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MD630-INT Series General-Purpose AC Drive

User Guide

Industrial Automation | Intelligent Elevator | New Energy Vehicle | Industrial Robot | Rail Transit

Data code PS00019852B00

Legal Information

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The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

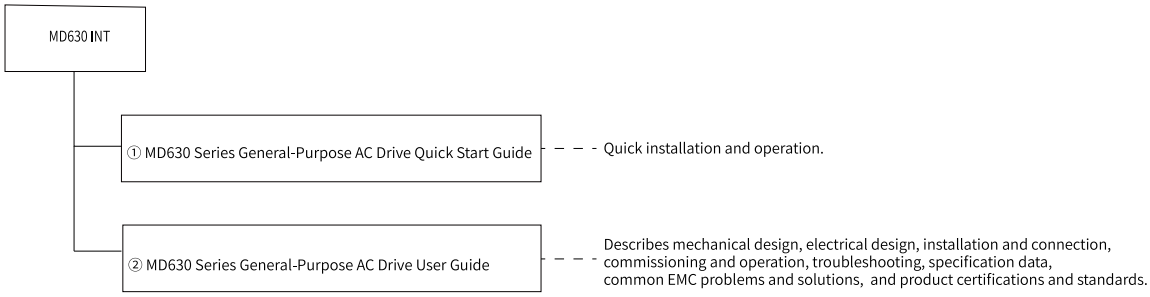
This product is a new generation of general-purpose AC drives from Inovance. The bus-type models come standard with a three-in-one high-speed bus communication interface. It is mainly used in silicon crystals, lithium batteries, 3C, semiconductor, ceramic, glass, rubber and plastics, cables, textile and other industries. The AC drives are designed to efficiently drive various types of loads, such as fans, water pump, roller and belt.

The AC drives range from 0.37 kW to 22 kW, with a total of five different frame structures.

Primarily intended for mechanical, electrical, and commissioning engineers, this manual focuses on mechanical design, electrical design, installation and wiring, commissioning, functional applications, and troubleshooting.

More Information

The following figure and table describe document codes and document introduction of the drive.



Data Name	Code	Description
MD630-INT Series General-Purpose AC Drive Quick Start Guide	PS00019537	Describes the quick installation and operation of the product.
MD630-INT Series General-Purpose AC Drive User Guide (This guide)	PS00019852	This guide describes mechanical design, electrical design, quick installation and connection, commissioning and operation, troubleshooting, technical data, common EMC problems and solutions, and product certifications and standards.

Revision History

Revision Date	Version	Description
August 2025	B00	**Added the following content:** • Added information about Modbus TCP. • Added information about fire mode. • Added information about expansion cards.
June 2025	A00	Initial release.

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version by the following methods:

- Do keyword search under Service and Support at *http://www.inovance.com*.

- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install **My Inovance** app, where you can search for and download user guides.

Warranty Disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. Maintenance will be charged after the warranty expires.

The warranty does not cover any defect caused by:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or unusual voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see Product Warranty Card.

Table of Contents

Legal Information 1
Preface 1
Safety Precautions 20
1 Product Information 26
1.1 Components 26
1.2 Nameplate and Model 27
1.3 Product Models 28
2 Mechanical Installation 31
2.1 Safety Precautions 31
2.2 Unpacking and Handling 31
2.3 Installation Instructions 33
2.3.1 Environment Requirements 33
2.3.1.1 Standard Environmental Resistance Requirements 34
2.3.1.2 Impact Under Special Environments and Countermeasures 35
2.3.2 Heat Dissipation 38
2.3.2.1 Installation Clearance 38
2.3.2.2 Air Duct Design and Cooling 41
2.3.2.3 Cooling Mode of AC Drive Cabinet 45
2.3.3 Installation Direction 46
2.3.4 Installation Tools 47
2.4 Checklist Before Installation 48
2.5 Backplate Mounting 49
2.6 Through-hole Mounting 50
2.7 Rail Mounting 53
2.8 Inspection After Installation 54
2.9 Mounting Accessories 54
2.9.1 Installing the Grounding Bracket of the Cable Shield 54
2.9.2 Installing Punch Vibration Damping Bracket 57
2.9.3 Installing the Junction Box Protector 58
3 Electrical Wiring 61
3.1 AC Drive and Peripheral Device 61
3.2 Electrical Connection 62

3.3 Requirements on Power Grid System Compatibility 63
3.4 Wiring Requirements and Cable Preparation 64
3.4.1 Cabinet design that meets EMC requirements 64
3.4.2 Cable routing 65
3.4.3 Cable Preparation 69
3.5 Main Circuit Connection 71
3.5.1 Descriptions of Main Circuit Terminals 71
3.5.2 Main Circuit Terminals Connected to Power Supply, Motor, and Braking Resistor 74
3.5.3 Built-in EMC Filter Connection 76
3.5.4 External EMC Filter Connection 77
3.5.5 Recommended Power Cables 78
3.5.6 Requirements on Grounding Cables 78
3.5.7 Power Cable Connection 80
3.6 Control Circuit Connection 81
3.6.1 Descriptions of Control Circuit Terminals 81
3.6.2 I/O Wiring 90
3.6.3 Electrical wiring of relay output 96
3.6.4 Wiring STO Terminals 96
3.6.5 Recommended Control Cables 97
3.6.6 Connecting Control Cable 97
3.7 Post-Wiring Check 98
4 Commissioning and Trial Run 99
4.1 Quick Commissioning Guide 99
4.2 Commissioning Tools 103
4.2.1 Operating Panel 103
4.2.1.1 Overview 103
4.2.1.2 Components 103
4.2.1.3 Display on the Operating Panel 105
4.2.1.4 Parameter View and Setting 106
4.2.1.5 Status Monitoring 107
4.2.2 Commissioning Software 112
4.2.2.1 Commissioning Software 112
4.2.2.2 Quick Start Guide 115
4.3 Commissioning Preparation 119
4.3.1 Motor Type 119
4.3.2 Select Motor Parameter Group 1 on Nameplate 120
4.3.3 Collect Data of AC Drive and Motor 120

4.3.4 Check the cables connecting the AC drive and the motor 121
4.3.5 Powering on the AC Drive 122
4.3.6 AC Drive Model Check 122
4.3.7 Software Version 122
4.4 Motor Parameter Setting.... 123
4.4.1 Setting Motor Parameters 123
4.4.2 Set the carrier frequency 125
4.5 Set Encoder Parameters 125
4.6 Motor Auto-tuning.... 131
4.6.1 Asynchronous Motor Parameter Auto-tuning 133
4.6.2 Synchronous Motor Parameter Auto-tuning 136
4.7 Running command setting 141
4.8 Frequency reference setting.... 143
4.9 Torque reference setting.... 146
4.10 Jog 148
4.10.1 Select Set Channel 148
4.10.2 Set Jog Frequency 148
4.10.3 Defines the terminal jog operation command 150
4.11 Commissioning with iFA Drive 152
4.12 Copy quickly after commissioning is completed 156
5 Functions 157
5.1 Functions 157
5.2 Common Function 157
5.2.1 Commands for Operation 157
5.2.1.1 Operation Command 157
5.2.2 Frequency Reference 169
5.2.2.1 Select Frequency Reference Source Channel 169
5.2.2.2 Selecting the Auxiliary Frequency Source....207
5.2.2.3 Selecting Source of Main Frequency and Auxiliary Frequency Superposition ...210
5.2.2.4 Setting Jog Frequency and Additional Frequency....211
5.2.2.5 Frequency Reference Limits....217
5.2.2.6 Define Running Mode in Case of a Frequency Below Minimum Limit 223
5.2.2.7 Set Frequency Through Terminal 224
5.2.2.8 Frequency Reference Source Selection 227
5.2.3 Torque Reference....228
5.2.3.1 Select Torque Reference Source Channel....228

5.2.3.2 Setting Additional Torque....238
5.2.3.3 Setting Torque Limit....243
5.2.4 Start/Stop Mode....246
5.2.4.1 Startup Mode....246
5.2.4.2 Stop Mode....254
5.2.4.3 Starting frequency....257
5.2.4.4 DC Braking....258
5.2.4.5 Timed Automatic Stop....262
5.2.4.6 Hibernation and Wakeup....263
5.2.4.7 Start safety protection....265
5.2.5 Jog....266
5.2.5.1 Jog....266
5.2.5.2 Jog Frequency Set Channel....274
5.2.6 Acceleration/Deceleration Time....275
5.2.6.1 Acceleration/Deceleration Time Setting....275
5.2.6.2 Acceleration/Deceleration Mode Setting....280
5.2.6.3 Low-speed gain....284
5.2.6.4 Automatic Switchover of Acceleration/Deceleration Time Based on Running Frequency....285
5.2.6.5 Ramp tracking enable....287
5.2.7 Motor Parameter Group....289
5.2.8 Modify Motor Direction....292
5.2.8.1 Motor Running Direction Limit....292
5.2.8.2 Change Motor Direction Without Changing Motor Wiring....294
5.2.8.3 Dead Zone Time of Forward/Reverse Run Switchover....294
5.2.9 Speed Control/Torque Control Switchover....295
5.2.10 Control Terminal....296
5.2.10.1 Control Terminals....296
5.2.10.2 Digital Input (DI) Terminal....297
5.2.10.3 Digital Output (DO) Terminal....307
5.2.10.4 Virtual Digital Input (VDI) Terminal....315
5.2.10.5 Virtual Digital Output Terminal (VDO) Functions....320
5.2.10.6 High-Speed Digital Input (HDI)....323
5.2.10.7 High-speed Digital Output (HDO)....329
5.2.10.8 Analog Input Terminal (AI)....334
5.2.10.9 Analog Output (AO) Terminals....350
5.2.10.10 DI Function Settings....357
5.2.10.11 DO Function Settings....363
5.2.10.12 I/O Expansion Card....371

5.2.11 Prediction on Critical Component Lifetime 381
5.2.12 Application Macro 386
5.2.12.1 Introduction to Applications 386
5.2.12.2 Interface Macro 390
5.2.12.3 Industry Macro 421
5.3 Motor Control 430
5.3.1 Vector Control 430
5.3.1.1 FVC control 431
5.3.1.2 SVC Control 435
5.3.1.3 Speed Control 439
5.3.1.4 Torque Control 461
5.3.1.5 Current Limit 471
5.3.1.6 Torque Limit 472
5.3.1.7 Power Limit 476
5.3.1.8 Overvoltage Suppression 478
5.3.1.9 Undervoltage Suppression (Vector) 480
5.3.1.10 Flux Control 484
5.3.1.11 Energy-saving control 487
5.3.1.12 Overexcitation 488
5.3.1.13 Current Loop 489
5.3.1.14 Droop control 491
5.3.2 Asynchronous Motor V/f Control 494
5.3.2.1 Control Mode 494
5.3.2.2 V/f curve selection 495
5.3.2.3 V/f Overvoltage Suppression 498
5.3.2.4 V/f Undervoltage Suppression 501
5.3.2.5 V/f Overcurrent Suppression 504
5.3.2.6 V/F Oscillation Suppression 506
5.3.2.7 V/f Torque Boost 506
5.3.2.8 V/f Slip Compensation 508
5.3.2.9 V/f Energy-Saving Control 509
5.3.2.10 V/f Droop Control 510
5.3.2.11 Overexcitation 513
5.3.3 Basic Control 513
5.3.3.1 Random PWM 513
5.3.3.2 Overmodulation 514
5.3.3.3 Braking Resistor Control 515
5.3.3.4 Parameter Calculation 517
5.3.3.5 Self-test 518

5.3.3.6 Shorting motor stator control 521
5.3.3.7 Carrier Frequency and Wave Generation 522
5.3.4 Encoder 525
5.3.4.1 Encoder Wiring and Basic Settings 525
5.3.4.2 Encoder Function 545
5.3.4.3 Encoder Parameter Configuration 561
5.4 Advanced Functions 566
5.4.1 Frequency Detection 566
5.4.1.1 Frequency Detection (FDT) 566
5.4.1.2 Detection Frequency Amplitude Value 568
5.4.1.3 Frequency Detection Value 569
5.4.1.4 Frequency Upper Limit Reached 571
5.4.1.5 Frequency lower limit reached 575
5.4.1.6 Target speed reached 577
5.4.1.7 Speed Comparison Reach 579
5.4.1.8 Jump Frequency 581
5.4.2 Current Detection 583
5.4.2.1 Zero Current Detection 583
5.4.2.2 Output Overcurrent Threshold 584
5.4.2.3 Current 2 reach 585
5.4.3 Fan Control 586
5.4.4 Setting Time Reached 589
5.4.4.1 Cumulative Power-on Time Reached 589
5.4.4.2 Accumulative Running Time Reached 590
5.4.4.3 Current Running Time Reached 591
5.4.5 Load Monitoring 592
5.4.6 Process Functions 598
5.4.6.1 Wobble Control Function 598
5.4.6.2 Process PID Control 601
5.4.6.3 Simple PLC Function 611
5.4.6.4 Motorized Potentiometer 616
5.4.6.5 Brake Control 622
5.4.7 Tension control 631
5.4.7.1 Tension control 631
5.4.7.2 Functions 634
5.4.7.3 Typical Applications 658
5.4.8 Free Function Module 662
5.4.8.1 Free Function Module 662
5.4.8.2 Word-bit Coversion Module 662

5.4.8.3 Data Conversion Module 667
5.4.8.4 Logic Operation 672
5.4.8.5 Arithmetic Operators 676
5.4.8.6 Switch Selection 682
5.4.8.7 Control Function 684
5.4.8.8 Multi-point curve A 689
5.4.8.9 Constant Value 692
5.4.9 Fire Mode 694
5.4.9.1 Fire mode 694
5.4.9.2 Operating Frequency and Direction 695
5.4.9.3 Troubleshooting in Fire Mode 700
5.4.9.4 Bypass 701
5.5 Fault and Protection 702
5.5.1 Startup Protection 702
5.5.2 Fault Reset and Restart 703
5.5.2.1 Fault Reset Mode 703
5.5.2.2 Manual Fault Reset 703
5.5.2.3 Automatic Fault Reset 705
5.5.2.4 Automatic fault reset/restart 709
5.5.3 Fault Protection Action Selection 711
5.5.3.1 Setting Actions to Faults 711
5.5.3.2 Set Protection Actions upon Faults 715
5.5.3.3 Action Modification of a Single Fault 751
5.5.4 Custom Faults and Alarms 755
5.6 Monitoring 761
5.6.1 Set Monitoring Parameters Displayed on Operating Panel 761
5.7 Additional Functions 769
5.7.1 Parameter interconnection 769
5.7.1.1 Connector Resource 769
5.7.1.2 Parameter Interconnection 807
5.7.2 Parameter Access Level 810
5.7.2.1 Parameter Access Level Introduction 810
5.7.2.2 Parameter Access Level Switchover 813
5.7.3 Parameter Protection 815
5.7.3.1 Parameter Lock 815
5.7.3.2 Parameter-write Protection 820
5.7.4 Restore Parameters to Default Settings 823
5.7.4.1 Restore Factory Parameters Except for Motor Parameters 823

5.7.4.2 Restoring Factory Parameters (Including Motor Parameters)....823
5.7.4.3 Back up current user parameters....823
5.7.4.4 Restore user backup parameters....824
5.7.4.5 Clear Records....824
5.7.4.6 Clear Issue Information....824
5.7.4.7 Restoring Factory Parameters (Including Motor Parameters) and Clearing the Records....824
5.7.5 User-defined Parameters....825
5.7.5.1 User-defined parameters....825
5.7.5.2 Address Mapping....827
5.7.5.3 Create Mapping Relationship....829
5.7.5.4 QUICK Menu....831
5.7.6 Black Box....832
5.7.7 Clear Records....833
5.7.7.1 Fault Log Clear....833
5.7.7.2 Record Clearance....834
5.7.8 Modified Parameter List....834
6 Communication....842
6.1 List of Terms....842
6.2 Communication System Connections....842
6.3 List of Communication Protocols....843
6.4 Communication Configuration Process....843
6.5 Parameter Communication Address....844
6.5.1 Special Communication Address....844
6.5.1.1 Communication control....844
6.5.1.2 Communication Setpoint....845
6.5.1.3 Other Special Addresses....847
6.5.1.4 Modbus Compatible Address....849
6.5.2 Control Word and Status Word....853
6.5.2.1 Control Word....853
6.5.2.2 Status Word....854
6.5.3 Mapping Table....854
6.6 Modbus RTU Drive Control....857
6.6.1 Overview....857
6.6.2 Communication Specifications....857
6.6.3 Communication System Connections....857
6.6.4 Message....858

6.6.4.1 Message Structure 858
6.6.4.2 Control Word and Status Word 861
6.6.4.3 Baud rate 861
6.6.4.4 Mapping table (AC drive data) 861
6.6.5 Communication Ports 862
6.6.6 Connect the AC drive to the bus system through the RS485 interface 863
6.6.7 Configure Communication Between AC Drive and Controller 864
6.6.8 Communication Parameters 865
6.6.9 Communication Fault Diagnosis 866
6.6.10 Communication Configuration Examples 866
6.6.10.1 Configuration for RS485 Communication Between AC Drive and H5U 866
6.7 EtherCAT Drive Control 873
6.7.1 Overview 873
6.7.2 Communication Specifications 873
6.7.3 Communication System Connections 874
6.7.4 Message 876
6.7.4.1 Diagnosis message structure 876
6.7.4.2 Process data 877
6.7.4.3 Message Instances 878
6.7.4.4 Control Word and Status Word 882
6.7.4.5 Mapping table (AC drive data) 882
6.7.5 Communication Terminals 882
6.7.6 Connect the AC drive to the bus system 884
6.7.7 Configure Communication Between AC Drive and Controller 884
6.7.8 Communication Parameters 885
6.7.9 Communication Fault Diagnosis 886
6.7.10 Communication Configuration Examples 889
6.7.10.1 Communication Instance When the MD630N-INT Is Controlled by the Inovance AC801 889
6.7.10.2 Communication Instance When the MD630-INT Is Controlled by the Beckhoff Controller 896
6.7.11 Replacing Faulty Device 906
6.8 EtherNet/IP Drive Control 906
6.8.1 Overview 906
6.8.2 Communication Specifications 906
6.8.3 Communication System Connections 907
6.8.4 Message 909
6.8.4.1 Diagnosis message structure 909
6.8.4.2 Process data 911

6.8.4.3 Instances 912
6.8.4.4 Control Word and Status Word 913
6.8.4.5 Mapping table (AC drive data) 913
6.8.5 Communication Terminals 913
6.8.6 Connect the AC drive to the bus system 914
6.8.7 Configure Communication Between AC Drive and Controller 914
6.8.8 Communication Parameters 915
6.8.9 Communication Fault Diagnosis 918
6.8.10 Communication Configuration Examples 919
6.8.10.1 Configuration for EtherNetIP Communication Between AC Drive and AC801 919
6.8.10.2 Configuration for EtherNet/IP Communication Between Drive and Rockwell Master 1756-L82 923
6.8.11 Replacing Faulty Device 939
6.9 PROFINET Drive Control 939
6.9.1 Overview 939
6.9.2 Communication Specifications 940
6.9.3 Communication System Connections 940
6.9.4 Message 942
6.9.4.1 Message Structure 942
6.9.4.2 Process data 943
6.9.4.3 Message Instances 944
6.9.5 Communication Terminals 945
6.9.6 Connect AC Drive to Bus System 946
6.9.7 Configure Communication Between AC Drive and Controller 947
6.9.8 Communication Parameters 948
6.9.9 Communication Fault Diagnosis 949
6.9.10 Communication Configuration Examples 950
6.9.10.1 Example for Communicating with TIA PORTAL 950
6.9.10.2 Communication Configuration Example for STEP7 970
6.9.11 Non-cyclic Read/Write Operation Example 986
6.9.11.1 Non-cyclic Reading and Writing in TIA Portal 986
6.9.11.2 Perform non-cyclic read/write in STEP7 989
6.9.12 Replacing Faulty Device 991
6.9.12.1 Selecting the **Support device replacement without exchangeable medium** option and setting the topology in TIA Portal 991
6.9.12.2 Selecting the **Support device replacement without exchangeable medium** option and setting the topology in STEP 7 994
6.9.13 Configuration of Ring Network Redundancy 996
6.9.13.1 Configure MRP in TIA Portal 996

6.9.13.2 Configuring the MRP function in STEP 7 999
6.9.14 Boot Priority 1001
6.9.14.1 Configure the Boot Priority in TIA Portal 1001
6.9.14.2 Configuring the Boot priority function in STEP 7 1002
6.10 Modbus TCP Drive Control 1003
6.10.1 Overview 1003
6.10.2 Communication Specifications 1004
6.10.3 Communication System Connections 1004
6.10.4 Message 1005
6.10.4.1 Message Structure 1005
6.10.4.2 Control Word and Status Word 1007
6.10.4.3 Mapping table (AC drive) 1007
6.10.5 Communication Terminals 1007
6.10.6 Connect AC Drive to Bus System Through Ethernet Port 1008
6.10.7 Configure Communication Between AC Drive and Controller 1009
6.10.8 Communication Parameters 1010
6.10.9 Communication Fault Diagnosis 1012
6.10.10 Communication Configuration Examples 1013
6.10.10.1 Configuration for Modbus TCP Communication Between AC Drive and H3U 1013
7 Troubleshooting 1021
7.1 Troubleshooting Procedure 1021
7.2 Fault Type and Level 1021
7.2.1 Fault Types 1021
7.2.2 Fault Level Description 1023
7.2.3 Correspondence Between Fault Types and Levels 1024
7.2.4 Issue Level Modification 1024
7.3 Fault Display 1026
7.4 Fault Record Query and Clearance 1028
7.5 Fault Reset 1030
7.6 Automatic Fault Reset 1031
7.7 Common Fault Troubleshooting 1035
7.8 Solutions to Common EMC Problems 1061
7.8.1 Harmonic suppression solution 1062
7.8.2 Residual Current Device Malfunction 1062
7.8.3 I/O Signal Interference 1064
7.8.3.1 High-Speed Pulse Interference 1064

7.8.3.2 Common I/O Signal Interference 1065
7.8.4 RS485 Communication Interference 1066
7.8.5 EtherCAT, EtherNet IP, and PROFINET communication interference 1066
7.9 Fault Code List 1067
8 Maintenance and Repair 1142
8.1 Safety Instructions for Maintenance and Repair 1142
8.2 Routine Maintenance 1142
8.2.1 Daily Maintenance Items 1142
8.2.1.1 Routine Checklist 1142
8.2.1.2 Routine Cleaning Items 1143
8.2.2 Regular Checklist 1143
8.2.3 Main circuit detection method 1143
8.2.4 Heat dissipation detection method 1146
8.3 Replace the AC drive 1147
8.3.1 Replace the AC drive (when data backup is available) 1147
8.3.2 Replace the AC Drive (when no data backup is available) 1149
8.4 Components Replacement 1151
8.4.1 Serviceable Components 1151
8.4.2 Maintenance Tools 1153
8.4.3 Replace the Fan 1153
8.4.4 Replace the control board. 1155
8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software) 1158
9 Technical Specifications 1162
9.1 Electrical Specifications 1162
9.2 General Specifications 1166
9.3 Product Dimensions 1172
9.4 Motor compatibility 1174
9.5 Overload capacity of the AC drive 1175
9.6 Electromagnetic Compatibility of AC Drive 1176
9.6.1 Electromagnetic compatibility 1176
9.6.2 Electromagnetic Compatibility of AC Drive 1177
9.7 Derating 1177
9.7.1 Carrier frequency-based derating 1177
9.7.2 Ambient derating 1179
9.8 Accessory Specifications 1180

9.8.1 List of Accessories 1180
9.8.2 Circuit Breaker and Fuse (CE) 1182
9.8.3 Circuit Breaker (UL) 1183
9.8.4 AC Input Reactor 1183
9.8.5 AC Output Reactor 1188
9.8.6 EMI Filter 1192
9.8.7 Braking Resistor 1197
9.8.8 EMC shield grounding bracket 1203
9.8.9 Through-hole mounting bracket 1205
9.8.10 Guide rail mounting options 1206
9.8.11 Punch vibration damping bracket 1208
9.8.12 Wiring protection box option 1209
9.8.13 Cables 1211
9.8.14 Expansion Card 1217
9.8.14.1 Outline dimensions 1217
9.8.14.2 Description of IO Expansion Card Interface 1218
9.8.14.3 MD-PG-AU1 Terminals Descriptions 1220
9.8.14.4 MD-PG-S1 Terminals Descriptions 1222
9.8.14.5 MD-PG-R1 Terminals Descriptions 1224
9.8.14.6 Installation 1225
10 Parameter 1227
10.1 Parameter Groups 1227
10.1.1 Parameter Group Introduction 1227
10.1.2 Common Parameter 1227
10.2 List of Parameters 1228
10.2.1 Common Parameters (F group) 1228
10.2.1.1 F0 Basic parameter settings 1228
10.2.1.2 F1 Basic parameters of motor 1 1231
10.2.1.3 F2 Control parameters of motor 1 1233
10.2.1.4 F3 Encoder parameters 1236
10.2.1.5 F4 I/O parameters 1237
10.2.1.6 Fd Basic Communication Parameters 1245
10.2.2 Group A System 1249
10.2.2.1 A0 Parameter Management 1249
10.2.2.2 A1: Active fault and alarm 1253
10.2.2.3 AF SN code 1254
10.2.2.4 A2: System Information 1257
10.2.2.5 A3: Model Information 1258

10.2.2.6 A4: Hardware Configuration 1260
10.2.2.7 A5: Carrier Frequency and Pulsing Configuration 1260
10.2.2.8 A6: Operating Panel and Display 1261
10.2.2.9 Ab Function commissioning 1264
10.2.2.10 Ad: Counting Function 1265
10.2.2.11 AE: User-Defined Parameters 1266
10.2.3 Group b Reference Channel 1268
10.2.3.1 b0: Instruction Channel Configuration 1268
10.2.3.2 b1 Main Command of Control Channel 1 1268
10.2.3.3 b2 Control Channel 1 Auxiliary Command 1269
10.2.3.4 b3: Main command of control channel 2 1270
10.2.3.5 b4: Control Channel 2 Auxiliary Command 1271
10.2.3.6 b5: Reference Channel 1 1272
10.2.3.7 b6: Reference Channel 2 1276
10.2.3.8 b7 Ramp (Acceleration/Deceleration) setting 1279
10.2.3.9 b8 Multi-reference 1282
10.2.3.10 b9 Terminal start/stop module 1284
10.2.4 Group C Motor Parameter 1286
10.2.4.1 C0 Encoder 1 parameters 1286
10.2.4.2 C2: Auto-tuning and Self-test 1289
10.2.4.3 C4 Basic parameters of motor 1 1290
10.2.4.4 C5 Expansion parameters of motor 1 1292
10.2.4.5 C7 Basic parameters of motor 2 1295
10.2.4.6 CA Basic parameters of motor 3 1296
10.2.4.7 Cd Basic parameters of motor 4 1297
10.2.5 Group d Control Parameters of Motor 1/2 1299
10.2.5.1 d0 Basic control parameters of motor 1 1299
10.2.5.2 d1 Limit and protection parameters of motor 1 1302
10.2.5.3 d2 Motor 1 control optimization 1307
10.2.5.4 d3 Speed control parameter of motor 1 1309
10.2.5.5 d4 Current control of motor 1 1311
10.2.5.6 d5 Excitation control of motor 1 1311
10.2.5.7 d7 Motor 1 control optimization 1312
10.2.5.8 d8 Basic control parameters of motor 2 1312
10.2.5.9 d9 Limit and protection parameters of motor 2 1315
10.2.5.10 Motor 1-V/f control 1320
10.2.5.11 db Speed control parameters of motor 2 1322
10.2.5.12 dC Current control parameters of motor 2 1324
10.2.5.13 Dd Excitation control parameters of motor 2 1324

10.2.5.14 dF Control optimization parametrs of motor 2 1325
10.2.6 Group y Control Parameters of Motor 1/2 1325
10.2.6.1 y0 Basic control parameters of motor 3 1325
10.2.6.2 y1 Limit and protection parameters of motor 3 1328
10.2.6.3 y2 Control parameters of motor 3 1333
10.2.6.4 y3 Speed control parameter of motor 3 1335
10.2.6.5 y4 Current control of motor 3 1337
10.2.6.6 y5 Excitation control of motor 3 1337
10.2.6.7 y7 Motor 3 control optimization 1337
10.2.6.8 y8 Basic control parameters of motor 4 1338
10.2.6.9 y9 Limit and protection parameters of motor 4 1341
10.2.6.10 yb Speed control parameters of motor 4 1345
10.2.6.11 yb Speed control parameters of motor 4 1347
10.2.6.12 yC Current control parameters of motor 4 1349
10.2.6.13 yd: Excitation control parameters of motor 4 1350
10.2.6.14 yF Control optimization parameters of motor 4 1350
10.2.7 Group E Input/Output 1351
10.2.7.1 E0 DI 1351
10.2.7.2 E1 DORO 1356
10.2.7.3 E2 AI 1358
10.2.7.4 E3 AO 1363
10.2.7.5 E4 HDI (DI7) 1364
10.2.7.6 E5: HDO (FM) 1366
10.2.7.7 EA Parameters of I/O Expansion Card 1 1367
10.2.7.8 Eb Parameters of I/O Expansion Card 2 1373
10.2.7.9 EE Input and output correction parameters 1378
10.2.8 Group H Protection and Auxiliary 1379
10.2.8.1 H1 Fault Level Settings 1379
10.2.8.2 H2: User-Defined Fault 1396
10.2.8.3 H3: Automatic Fault Reset/Restart 1397
10.2.8.4 H6 Historical Fault Record 1 1399
10.2.8.5 H7 Historical Fault Record 2 1403
10.2.8.6 H8 Historical Fault Record 3 1405
10.2.8.7 H9 Historical Fault Record 4 1409
10.2.8.8 HA Historical Fault Record 5 1413
10.2.8.9 Hb: Historical Fault Record 6 1415
10.2.9 Group J Industry-specific processes 1419
10.2.9.1 J6 Fire Mode 1419
10.2.10 n Communication Configuration 1421

10.2.10.1 n0 Communication General Configuration 1421
10.2.10.2 n1: Commissioning Communication 1422
10.2.10.3 n2 Modbus Communication 1422
10.2.10.4 n3: CAN Communication 1424
10.2.10.5 n4 EtherCAT parameters 1425
10.2.10.6 n5 EtherNet/IP Parameters 1426
10.2.10.7 n6 PROFINET parameter 1427
10.2.10.8 nd CIA402 parameters 1427
10.2.10.9 nE: Process Data Address Mapping 1428
10.2.11 Group o Free Function Block 1430
10.2.11.1 o1 Constant setpoint 1430
10.2.11.2 o2: Multi-point Curve Parameters 1431
10.2.11.3 o3 Word-to-bit Conversion Module 1433
10.2.11.4 o5 data conversion module 1442
10.2.11.5 o6: Logic Operation 1 1447
10.2.11.6 o7: Logic Operation 2 1452
10.2.11.7 o8 Arithmetic operation 1 1455
10.2.11.8 o9 Arithmetic operation 2 1466
10.2.11.9 oA Switch selection function 1471
10.2.11.10 ob Control function 1 1479
10.2.11.11 oC Control function 2 1481
10.2.12 Group P Application Function 1485
10.2.12.1 P0 Auxiliary Functions 1485
10.2.12.2 P1: Simple PLC 1489
10.2.12.3 P2 Process PID 1496
10.2.12.4 P3 Motorized potentiometer 1499
10.2.12.5 P4 Brake control 1501
10.2.12.6 Pd Basic Tension Control Parameters 1503
10.2.12.7 PE Tension Setting Parameters 1506
10.2.12.8 PF tension setting parameter + Taper setting parameter 1509
10.2.13 U Common Monitoring 1512
10.2.13.1 U0 Monitoring Parameters 0 1512
10.2.13.2 U1 Monitoring parameters 1 1516
10.2.13.3 U2 Monitoring parameters 2 1516
10.2.13.4 U3 Monitoring parameters 3 1519
10.2.13.5 U6 Monitoring parameters 6 1521
10.2.13.6 U8: General Monitoring Parameter 8 1522
10.2.13.7 U9: General Monitoring Parameter 9 1523
10.2.13.8 General monitoring parameter 11 1524

10.2.14 L Connector 1525
10.2.14.1 L00 Bit Connector 1 Parameters 1525
10.2.14.2 L01: Bit Connector 2 Parameters 1527
10.2.14.3 L02: Bit Connector 3 Parameters 1530
10.2.14.4 L03: Bit Connector 4 Parameters 1531
10.2.14.5 L04: Bit Connector 5 Parameters 1536
10.2.14.6 L06: Bit Connector 7 Parameters 1539
10.2.14.7 L07: Bit Connector 8 Parameters 1540
10.2.14.8 L10 Word Connector 1 1541
10.2.14.9 L11: Word Connector 2 Parameters 1559
10.2.14.10 L12 Word Connector 3 1559
10.2.14.11 L15: Word Connector 6 Parameters 1561
10.2.14.12 L20: Double-word connector 1..... 1562
10.2.14.13 L22 Floating-point connector 1 1562
10.2.14.14 L23 Floating-point connector 2 1563
10.2.14.15 L24 Floating-point connector 3 1565
10.2.14.16 L25 Floating-point connector 4 1567
10.2.14.17 L30 Floating-point connector 9 1568
10.2.14.18 L31 Floating-point connector 10 1569
10.2.14.19 L32 Floating-point connector 11 1570
10.2.14.20 L33 Floating-point connector 12 1571
10.2.14.21 L34 Floating-point connector 13 1571
11 Certification and Standard Compliance..... 1573
12 Appendix..... 1574
12.1 Service and Support 1574
12.2 List of Terms 1576
12.3 Data flow description.....1584

Safety Precautions

Safety Disclaimer

- This section describes the safety precautions that help you use this product correctly. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to observe the safety precautions may result in serious injuries or death of personnel or device damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this equipment based on the designated environment requirements. Any damage caused by improper usage are not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Categories and Definitions



Indicates that failure to comply with the notice will result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety precautions:

- Some drawings in this guide show the equipment without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- Product illustrations in this guide are for reference only. Actual products may vary.
- Personnel must take mechanical precautions to protect personal safety. Wear necessary protective safety gear, such as anti-smashing shoes, clothing, glasses, gloves, and sleeves.

Unpacking
 • Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking. • Do not install the equipment if you find water seepage or missing or damaged components upon unpacking. • Do not install the product if the packing list does not match the product you received.
 • Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation. • Unpack the package by following the unpacking sequence. Do not hit the package with force. • Check the surfaces of the equipment and accessories for any damage, rust, and scratches. • Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation
 • Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage. • Before hoisting the equipment, ensure the components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injury or equipment damage. • Never stand or stay below the equipment when the equipment is being hoisted. • When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in physical injuries or equipment damage.
 • Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage. • When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries. • Store and transport the equipment strictly based on the requirements. Failure to comply may result in equipment damage. • Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration. • Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection. • Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation. • Do not transport the equipment with other devices or materials that may harm or have negative impacts on the equipment.

Installation
DANGER • The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed to operate on the equipment.
WARNING • Read through the guide and safety instructions before installation. • Do not install the product in places with strong electric or magnetic fields. • Before installation, ensure that the installation position has sufficient mechanical strength to support the weight of the device. Failure to comply will result in a mechanical danger. • Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock. • When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire. • Do not retrofit the equipment. • Do not fiddle with the bolts used to fix equipment components or the bolts marked in red. • When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations. • Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction. • Install the equipment on metal or other incombustible objects. Keep the equipment away from combustible objects. Failure to comply will result in fire.
CAUTION • Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After the installation is completed, remove the protective guard. Failure to comply will block the vent and affect heat dissipation, causing overheat of the product. • Resonance may occur when a machine supposed to run at a constant speed is running at variable speeds. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring
 • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Before wiring, disconnect all the power supplies of the equipment, Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply will result in an electric shock. • Do not perform wiring, remove the equipment cover, or touch the circuit board with power on. Failure to comply can result in electric shock. • Ensure the equipment is grounded properly. Failure to comply can result in electric shock.
 • Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire. • When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. • Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at both ends. • Tighten the terminal screws with the tightening torque specified in the guide. Failure to comply may result in overheat, damage to the connection parts, or fire. • After wiring, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.
 • During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits. • Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-On
 • Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted. • Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire. • After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.
 • Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical injuries or equipment damage. • Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire. • Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in physical injuries or even death.

Operation
 • The equipment must be operated only by professionals. Failure to comply can result in death or personal injury. • Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply can result in an electric shock.
 • Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries. • Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

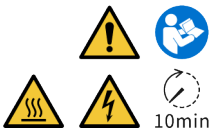
Maintenance
 • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not maintain the equipment with power on. Failure to comply can result in an electric shock. • Before maintenance, cut off all equipment power supplies and wait as specified on the product warning sign. • When a PM motor rotates, its terminals will produce induced voltage even if the motor is powered off. Failure to comply can result in electric shock.
 • Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.

Repair
 • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not maintain the equipment with power on. Failure to comply can result in electric shock. • Before inspection and repair, cut off all equipment power supplies and wait as specified on the product warning sign.
 • Require for repair services in accordance with the product warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries, or equipment damage. • When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly. • Replace quick-wear parts of the equipment in accordance with the replacement instructions. • Do not use damaged equipment. Failure to comply may result in further equipment damage, physical injuries, or even death. • After equipment replacement, check the wiring and set parameters again.

Disposal
 • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

To ensure safe operations, comply with safety signs on the device, and do not damage or remove the safety labels. The following table describes the safety labels.

Safety Sign	Description
	• Before using the product, read the user guide and safety precautions carefully. Failure to comply will result in personnel injuries or death or product damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.

1 Product Information

1.1 Components

The following figure shows the layout of the AC drive by using the example of T4 (11 kW to 15 kW) 15 kW model.

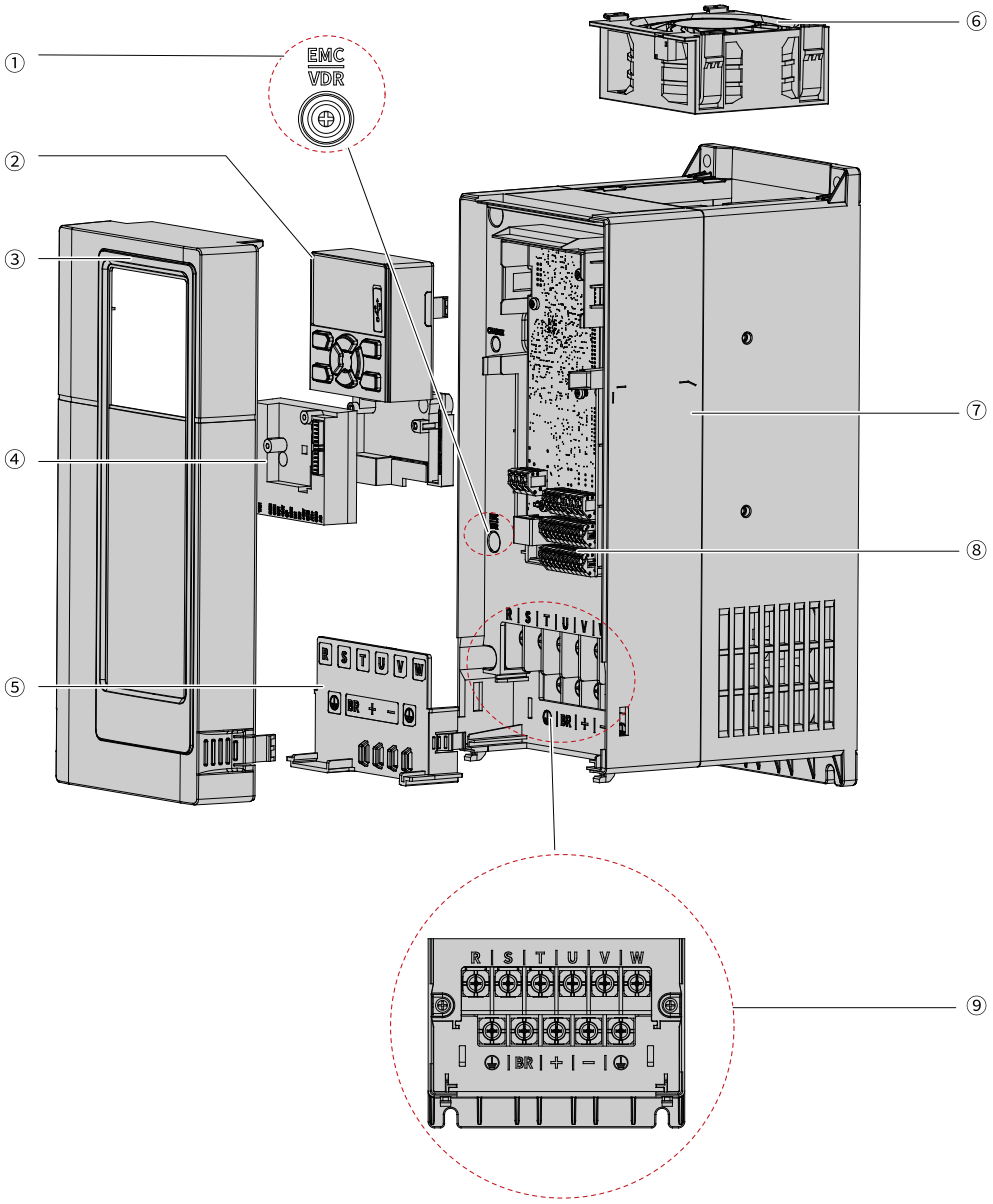


Figure 1-1 Product components

No.	Part Name	Description	Note
①	EMC/VDR grounding screw	Optional grounding screw	-
②	Operating panel display component	Operating panel display and key operation area	For details, see*6.1 Operator Panel*section.
③	Plastic upper cover	Used for protect the whole machine	-
④	Expansion card	Optional card assembly, not included as standard	(Reserved)

No.	Part Name	Description	Note
⑤	Terminal cover	Protection of the main circuit terminal	-
⑥	Fan	Used for heat dissipation.	For details, see the *"2.3.2.2 Air Duct Design and Cooling" on page 41*section.
⑦	Nameplate	Used to display the product information.	For details, see the *"1.2 Nameplate and Model" on page 27*section.
⑧	Control circuit terminals	Control signal transmission and feedback	For details, see the *" Descriptions of Control Circuit Terminals" on page 81*section.
⑨	Main circuit terminals	The main power circuit connection terminals, for input and output wires connection.	For details, see the *" Descriptions of Main Circuit Terminals" on page 71*section.

1.2 Nameplate and Model

Model

Note

Consisting of two-digit numbers and one-digit letters, the rated current in ④ is configured based on the heavy-load model. R represents the decimal point "."

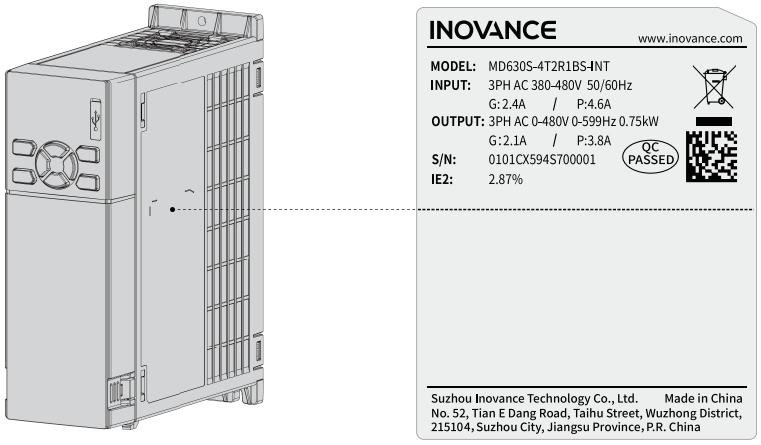
MD630 S - 4T 2R1 B S - INT
① ② ③ ④ ⑤ ⑥ ⑦

①	**Product name** MD630: AC drive series	②	**Type** S: Standard N: Bus type	③	**Voltage class (V)** 4T: Three-phase 380 V to 480 V
④	**Output Current (A)** 1R5: 1.5 2R1: 2.1 3R8: 3.8 ... 9R0: 9.0 ... 045: 45	⑤	**Braking unit** B: with the braking unit	⑥	**Safety function** S: with the STO function
				⑦	**Model configuration** INT: Global version

Nameplate description

Note

The following nameplate is used as an example. The actual nameplate is subject to the product.



Serial number descriptions

0101CJ14	4	S	7	00001
①	②	③	④	⑤

①	**Internal code** Product material code	②	**Manufacturer code** 4: Suzhou Inovance	③	**Year** S: 2024 T: 2025 U: 2026 V: 2027 W: 2028 X: 2029 Y: 2030 ... Note: I/L/O/Q is not used.
④	**Month** 1: January 2: February 3: March ... A: October C: December	⑤	**Lot number** 00001: First 00002: Second 00003: Third ... Range: 00001 to 99999	/	

1.3 Product Models

For product models of MD630, see the following table.

Table 1–1 Product models (three-phase 380 V to 480 V)

Appearance Structure	Type	Model	Product No.	G-type (supporting 1.5 times the rated load)					P-type (supporting 1.1 times the rated load)				
				Power (kW)	Output Current (A)	Input current (A)	Power capacity when grid-connected (KVA)		Power (kW)	Output Current (A)	Input current (A)	Power capacity when grid-connected (KVA)	
							400V	480 V				400 V	480 V
T1	Standard	MD630S-4T1R5BS-INT	0101CQ45	0.37	1.5	1.7	1.43	1.54	0.75	2.1	2.4	2.09	2.2
	Bus type	MD630N-4T1R5BS-INT	0101CQ43										
	Standard	MD630S-4T2R1BS-INT	0101CJ14	0.75	2.1	2.4	1.98	2.2	1.5	3.8	4.6	3.85	3.96
	Bus type	MD630N-4T2R1BS-INT	0101CJ26										
	Standard	MD630S-4T3R8BS-INT	0101CJ15	1.5	3.8	4.6	3.85	3.96	2.2	5.1	6.4	5.39	5.61
	Bus type	MD630N-4T3R8BS-INT	0101CJ27										
T2	Standard	MD630S-4T5R1BS-INT	0101CJ16	2.2	5.1	6.3	5.28	5.5	3	7.2	9	7.59	7.81
	Bus type	MD630N-4T5R1BS-INT	0101CJ28										
	Standard	MD630S-4T7R2BS-INT	0101CJ17	3	7.2	8.9	7.48	7.7	4	9	11.4	9.57	9.9
	Bus type	MD630N-4T7R2BS-INT	0101CJ29										
	Standard	MD630S-4T9R0BS-INT	0101CJ18	4	9	11.4	9.57	9.9	5.5	13	17	14.3	14.63
	Bus type	MD630N-4T9R0BS-INT	0101CJ30										
T3	Standard	MD630S-4T013BS-INT	0101CJ19	5.5	13	16.8	14.08	14.52	7.5	17	22.7	19.03	19.36
	Bus type	MD630N-4T013BS-INT	0101CJ31										
	Standard	MD630S-4T017BS-INT	0101CJ20	7.5	17	22	18.48	19.03	11	25	33.4	28.05	28.49
	Bus type	MD630N-4T017BS-INT	0101CJ32										

Appearance Structure	Type	Model	Product No.	G-type (supporting 1.5 times the rated load)					P-type (supporting 1.1 times the rated load)				
				Power (kW)	Output Current (A)	Input current (A)	Power capacity when grid-connected (KVA)		Power (kW)	Output Current (A)	Input current (A)	Power capacity when grid-connected (KVA)	
							400V	480 V				400 V	480 V
T4	Standard	MD630S-4T025BS-INT	0101CJ21	11	25	32.4	27.17	27.94	15	32	42.1	35.31	36.08
	Bus type	MD630N-4T025BS-INT	0101CJ33										
	Standard	MD630S-4T032BS-INT	0101CJ22	15	32	41.6	34.87	35.75	18.5	37	49.1	41.14	42.02
	Bus type	MD630N-4T032BS-INT	0101CJ34										
T5	Standard	MD630S-4T037BS-INT	0101CJ23	18.5	37	48.7	40.81	41.8	22	45	60.1	50.38	51.37
	Bus type	MD630N-4T037BS-INT	0101CJ35										
	Standard	MD630S-4T045BS-INT	0101CJ24	22	45	58.5	49.06	50.38	30	60	71.6	60.06	61.71
	Bus type	MD630N-4T045BS-INT	0101CJ36										

Note

The power supply capacity on the grid is calculated at 400 VAC and 480 VAC.

2 Mechanical Installation

2.1 Safety Precautions

The equipment can be operated only by professionals with electrical knowledge. Operations by others are prohibited.



- Thoroughly read the safety instructions and user guide before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply can result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not modify this equipment.
- Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- When the equipment is installed in a cabinet or a terminal device, an protective enclosure against file, electrical disturbance, and mechanical damage must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment on an incombustible object such as metal and do not touch or attach the equipment to combustibles. Failure to comply can result in fire.
- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on top of the equipment. Failure to comply can block ventilation holes, resulting in over-temperature caused by poor ventilation.
- Resonance may occur when the equipment operating at a constant speed switches to variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

2.2 Unpacking and Handling

Unpacking

1. Open the external box to take out the inner box, as shown in pictures ①, ②, and③.
2. Open the inner box, as shown in pictures ④ and ⑤.
3. Take out the expanded polyethylene foam and the AC drive, as shown in picture ⑤.

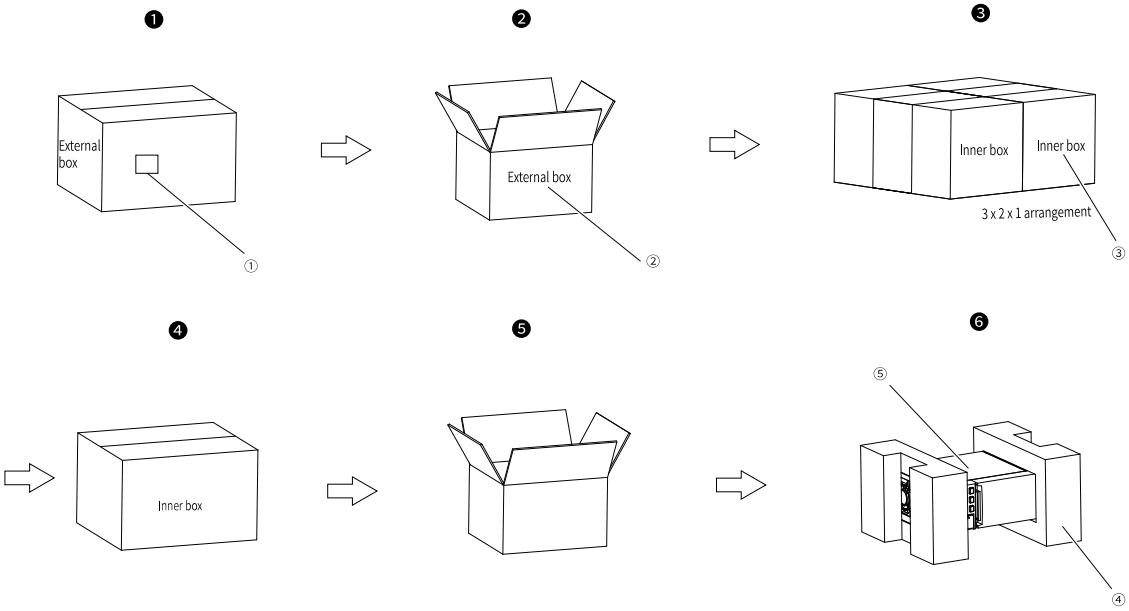


Figure 2-1 AC drive unpacking

Table 2–1 Unpacking list

No.	Name
①	Label
②	External box
③	Inner box
④	Expanded polyethylene foam
⑤	AC drive

Check

1. Open the package and check whether the AC drive is intact. If the AC drive or other accessories are damaged, do not operate or install the damaged device.
2. Check whether the drive model is consistent with that on the delivery order.
3. Record the model and serial No.

Storage

Caution

Store and transport the equipment as required to prevent damage.

- The AC drive must be stored in a clean and dry room, where the temperature ranges from -40°C and +60°C and temperature change rate is smaller than 1°C/min.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Do not expose the AC drive to the environment with moisture, high temperature, or strong sunlight for a long time.

- If the AC drive needs to be stored for a long period of time, cover it or take other appropriate measures to keep it from contamination and environmental influences.
- Pack the AC drive with the original packing box provided by Inovance as possible as you can.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the AC drive once for at least 5 hours every 6 months. Increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.
- Before transportation, ensure the product is packed securely. For long-distance shipping, use sealed box for packaging.
- Never transport the product with other equipment or materials that may harm or have negative impacts on the drive.

Transportation



- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the components such as the front cover and terminal block are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.

Note

Before wiring, check and ensure that the voltage of the mains power is compatible with the voltage of the AC drive power supply.

2.3 Installation Instructions

2.3.1 Environment Requirements

The G model (heavy-load) product has a 5-year life, which is estimated life based on the following conditions. It is not a guarantee because the service life of the actual device may be shortened due to the harsh installation environment and operating conditions.

- Ambient temperature: 40°C as annual average temperature
- Load rate: 100% rated for G-type machine
- Operating time: Continuous operation at 24h per day

- Other factors: Humidity less than 95% RH, non-condensing, non-conductive dust, oil pollution, Salt mist, halogen corrosive gases, etc. The three-phase grid voltage is balanced and no other capacitive load is switched under the same grid.

The internal temperature of the AC drive increases when the following more severe conditions exist, which may shorten the life of the AC drive:

- The operating ambient temperature is too high. The air duct is blocked due to dust or flocky objects. The ambient temperature of the air inlet of the AC drive is too high due to improper cooling design of the cabinet.
- The output current is too large, frequent overload or load fluctuation is frequent.
- If the service life of the product is too long, the service life of the product is naturally degraded, and parts need to be replaced.
- There are harsh environments such as conductive dust, oil, salt spray, and halogen corrosive gases. The device may fail prematurely. An imbalance in the mains voltage may lead to abnormal large bus voltage fluctuation.

To extend the service life of the AC drive, the following measures are recommended:

- Reduce the ambient temperature (for example, install an air conditioner in the machine room). Add a filter screen to clean the air ducts regularly. Improve the internal layout and heat dissipation design of the cabinet.
- In the case of heavy or even frequent overload in the actual application conditions, it is recommended to replace the AC drive with a larger specification and increase the margin with the general-purpose AC drive.
- For products that are used beyond the age limit, it is recommended to repair or replace the AC drive in advance to prevent unnecessary stop due to accidental damage. Contact Inovance technical agents or service personnel.
- Reinforce external environmental protection to reduce the impact of harsh environments on the AC drive. If there is a three-phase imbalance in the grid, the AC drive may be damaged in advance. It is recommended to add an AC reactor.

2.3.1.1 Standard Environmental Resistance Requirements

The standard environmental resistance requirements mainly include the standards and requirements during transportation of the AC drive with packaging, installation and running of the AC drive, and long-term storage with packaging. The following table describes the standard specifications of the setting environment of the AC drive. When the AC drive is used in an environment beyond this location, it may not only affect the equipment life, but may even cause a fault. Therefore, set the environment according to the following standards and requirements.

Property	Specification
Environmental conditions during transportation with packaging	
Ambient temperature	Temperature: -20°C to +60°C
	Humidity: ≤ 95% RH, without condensation Compliant with IEC60721-3-2 2K1 (GB/T 4798.2 2K1)

Property	Specification
Mechanical environmental requirements	Vibration resistance: 5 Hz to 100 Hz 0.01 g^2/Hz, 200 Hz 0.001 g 2/Hz Complies with EN 60721-3-2 class 2M3
	Shock: Half-sine wave; 15 g/11 ms: 3 times in each direction Compliant with IEC 60068-2-27 (GB/T 2423.5)
Protection Requirements	Protection against hazardous chemicals: 2C2 Compliant with: IEC60721-3-2 2C2 (GB/T 4798.2 2C2)
	Mechanical active substance: 2S2 Compliant with: IEC60721-3-2 2S2 (GB/T 4798.2 2S2)
The environmental conditions during installation	
Ambient temperature	Temperature: -20°C to +60°C (derating required at 50°C, derating by 2.5% for every 1°C increase)
	Humidity: ≤ 95% RH, without condensation
Installation altitude	For altitudes equal to or below 1000 m, derating is not required. For altitudes ranging from 1000 m to 3000 m, derate 1% for every additional 100 m. For altitude above 3000 m, contact Inovance.
Mechanical environmental requirements	Vibration resistance: 5.0 Hz to 8.4 Hz, 3.5 mmp; 8.4 Hz to 200.0 Hz, 1.0 g, 10 cycles/axes Compliant with: IEC60721-3-3 3M4 (GB/T 4798.3 3M4)
Grid overvoltage	OVC III
Protection Requirements	Protection against hazardous chemicals: 3C2 Compliant with: IEC60721-3-2 3C2 (GB/T 4798.2 3C2)
	Mechanical active substance: 3S2 Compliant with: IEC60721-3-2 3S2 (GB/T 4798.2 3S2)
Environmental conditions for long-term storage with packaging	
Ambient temperature	Temperature: -40°C to +60°C
	Relative humidity: ≤ 95% RH, without condensation Compliant with: IEC60721-1-1 1K4 (GB/T 4798.1 1K4)
Protection Requirements	Protection against hazardous chemicals: 1C2 The maximum relative humidity must not exceed 60% in the space where corrosive gases exist Compliant with: IEC60721-1-1 1C2 (GB/T 4798.1 1C2)
	Mechanical active substance: 1S2 Compliant with: IEC60721-1-1 1S2 (GB/T 4798.1 1S2)

2.3.1.2 Impact Under Special Environments and Countermeasures

Under special operating conditions, such as high temperature, low temperature, vibration, oil pollution, etc., there are special standards and requirements for the environment.

Temperature

Use the product within the specified temperature range according to *"2.3.1.1 Standard Environmental Resistance Requirements" on page 34*. When out of the temperature range, the life of the electronic components will be significantly shortened. Take the following countermeasures to control the AC drive temperature within the specified range.

For high temperatures:

- Install the AC drive in an electric cabinet with adjustable temperature.
- The electrical cabinet adopts forced ventilation.
- Avoid installing the AC drive above one another. If this installation method cannot be avoided, install according to *"2.3.2.1 Installation Clearance" on page 38*.

For low temperatures:

- Do not switch off the power supply of the AC drive to avoid starting the device after it has cooled down at low temperatures.
- Install the heater in the electrical cabinet.

For sharp temperature change:

- Install the AC drive in an electric cabinet with adjustable temperature.
- Keep away from the installation sources with high-power heating equipment in the vicinity.

Humidity (Condensation)

Use the product within the specified humidity range according to *"2.3.1.1 Standard Environmental Resistance Requirements" on page 34*. When the humidity is too high, corrosion and insulation degradation may occur.

For high humidity:

- Install the AC drive in an electric cabinet with adjustable temperature.
- Keep away from the installation source with water mist equipment.
- Seal the electrical cabinet and add hygroscopic agent.
- Install the heater in the electrical cabinet.

Condensation

Condensation may occur when the humidity in the control cabinet changes dramatically due to frequent start/stop or when the ambient temperature changes sharply. Condensation can result in poor insulation or rust.

Solutions:

- Take the above countermeasures for high humidity:
- Do not switch off the power supply of the AC drive to avoid starting the device after it has cooled down at low temperatures.
- For condensation and high humidity applications, the stop time is long. It is recommended that the heater be started for half an hour before power on to prevent condensation from causing faults such as engine failure during start-up.

Dust

Dust coats contacts and causes loose connections, soaks up moisture and lowers insulation resistance, as well as blocks the cabinet's air filter, cutting airflow and driving temperatures up. In addition, the floating of conductive powders can result in malfunction, insulation aging or short-circuit within a short period of time.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- Install the AC drive in a control cabinet of a sealed structure.
- Install the filter at the air inlet and replace it regularly.
- Minimize the frequency of opening and closing doors.
- Clean the surrounding air.

Corrosive liquid

Corrosive liquids, attached to high pressure, may cause creepage along the surface. Some alkaline liquids may cause PCBA (Printed Circuit Board Assembly) corrosion and stress cracking of non-metallic materials.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- Install the AC drive in a control cabinet of a sealed structure (Apply door sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- Minimize the frequency of opening and closing doors.
- Seal the door and the cable inlet and outlet holes.

Corrosive gas

Corrosive gases can easily cause corrosion to PCBA, connectors and metal structural parts, and may cause vulcanization corrosion to SMD resistor.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- Install the AC drive in a control cabinet of a sealed structure (Apply door sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- Install electrical products in an indoor environment with temperature and humidity control, and there is no air flow inside or outside the room.

Cotton

Cotton can block the AC drive ducting, causing overheating or shortening power device life.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- Install the AC drive in a control cabinet of a sealed structure (Apply door sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- Install the filter at the air inlet and clean it regularly.

Conductive filament

Conductive filaments may cause electrical short circuits in exposed high-voltage areas of the product.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- The cabinet uses air conditioning for cooling.
- Install the AC drive in a control cabinet of a sealed structure (Apply door sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- Install the filter at the air inlet and clean it regularly.
- Use the vacuum cleaner for daily maintenance of the cabinet instead of air blow guns.

Conductive powder

Conductive powder may accumulate in exposed high-voltage areas, causing electrical short circuits.

Solutions:

- Adopt high protection level AC drives. For details, contact Inovance.
- Install the AC drive in a control cabinet of a sealed structure (Apply door sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- The cabinet uses air conditioning for cooling.

Vibration / shock

Use the product within the specified vibration range according to *"2.3.1.1 Standard Environmental Resistance Requirements" on page 34*. If the vibration range is exceeded, it may cause problems such as loose structural parts, poor connector contact, and large devices falling off, especially in continuous repeated shock situtions.

Solutions:

Adopt high protection level AC drives equipped with the vibration damping bracket (*"9.8.11 Punch vibration damping bracket" on page 1208*). For details, contact Inovance.

- Install the AC drive in the floor type cabinet.
- Do not mount the product in a location with strong vibration.

2.3.2 Heat Dissipation

2.3.2.1 Installation Clearance

Note

- Before installing the AC drive in the cabinet, design the cabinet to ensure sufficient clearances for installation and heat dissipation. Take the following factors into consideration:
- When multiple AC drives are required to work together, install them side by side. Keep their tops level with each other, especially for those of different sizes.
- In applications requiring AC drives to be installed side by side, install an air guide plate to prevent overtemperature/overload fault that may occur due to heat dissipated from the lower row to the upper row.
- Reserve sufficient clearance according to the power rating of the AC drive. The recommended installation methods of the MD600 include single-layer installation and multi-layer installation.

Installation Clearance for A Single Device

When only a single device is installed, reserve sufficient clearance around the device. The following figure shows the minimum clearance.

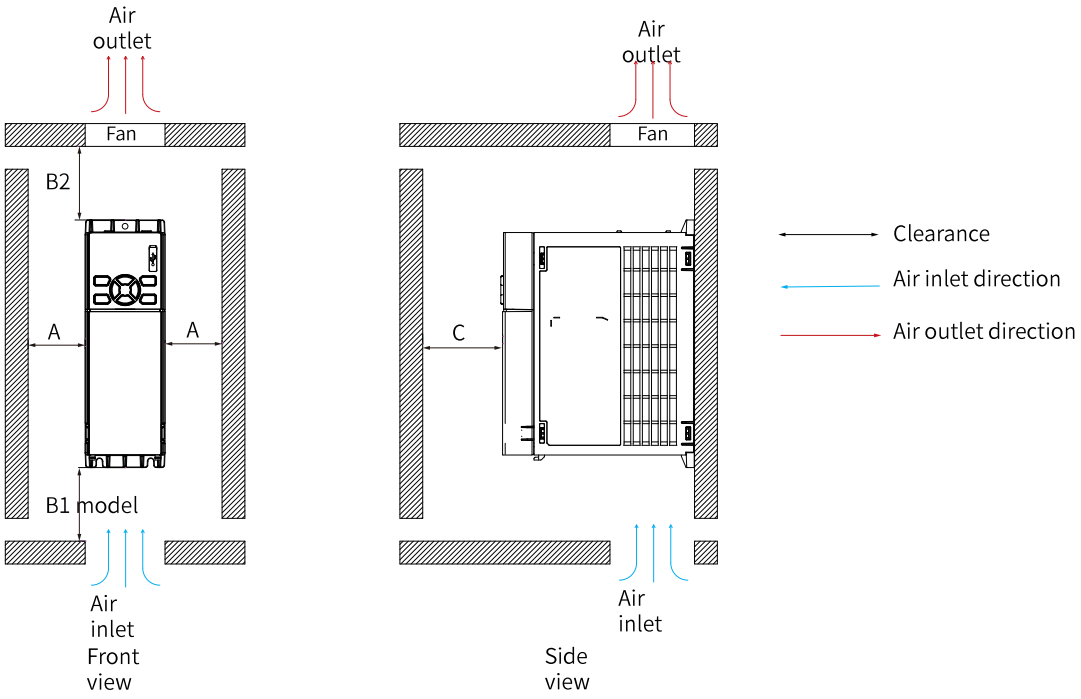


Figure 2-2 Clearance for installation of a single device

Table 2–2 Clearance for installation of a single device

Power Rating (kW)	Clearance mm (in.)			
	A	B1	B2	C
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)

Installation Clearance for Multiple Devices

When multiple devices are installed side by side, reserve sufficient clearance around the devices. The following figure shows the minimum clearance.

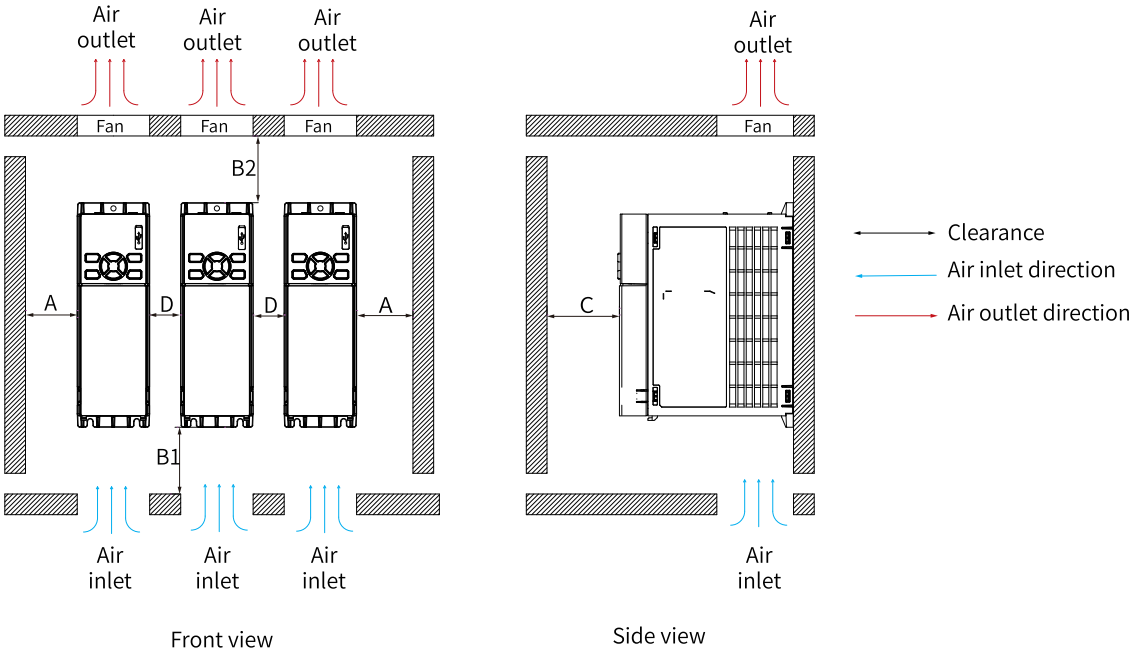


Table 2–3 Clearance for installation of multiple devices

Power Rating (kW)	Clearance mm (in.)				
	A	B1	B2	C	D
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)	30 (ambient temp. 50℃)
					0 (ambient temp. 40℃)
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)	30 (ambient temp. 50℃)
					0 (ambient temp. 40℃)
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)	30 (ambient temp. 50℃)
					0 (ambient temp. 40℃)
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)	30 (ambient temp. 50℃)
					0 (ambient temp. 40℃)

When multiple devices are installed at multiple layers, reserve sufficient clearance around the device. The following figure shows the minimum clearance.

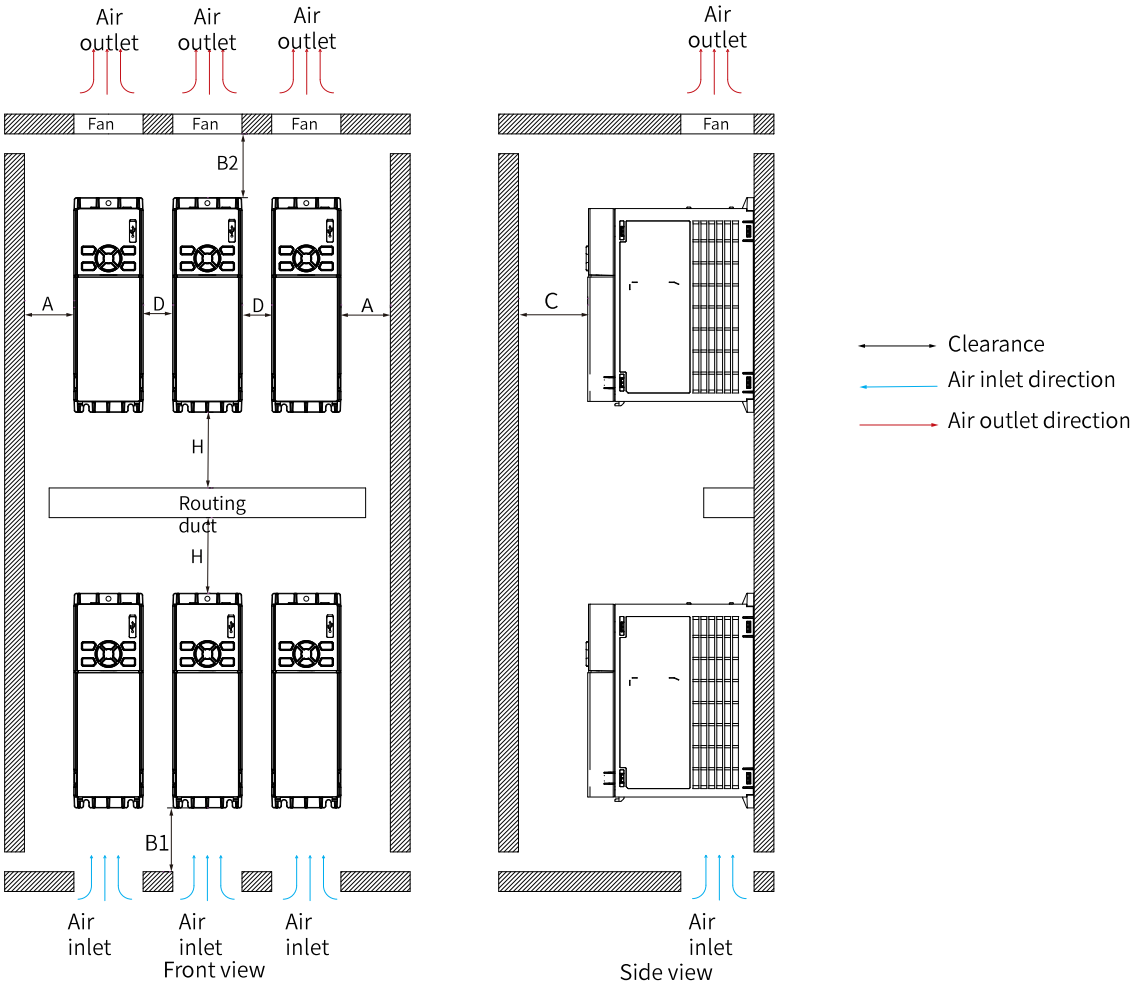


Figure 2-3 Clearance for installation of multiple devices at different layers

Table 2–4 Clearance for installation of multiple devices at different layers

Power Rating (kW)	Clearance mm (in.)					
	A	B1	B2	C	D	H
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)	30 (ambient temp. 50℃)	125
					0 (ambient temp. 40℃)	
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)	30 (ambient temp. 50℃)	125
					0 (ambient temp. 40℃)	
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)	30 (ambient temp. 50℃)	150
					0 (ambient temp. 40℃)	
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)	30 (ambient temp. 50℃)	150
					0 (ambient temp. 40℃)	

2.3.2.2 Air Duct Design and Cooling

Air duct design of naturally ventilated cabinet

- Air inlet requirements:
  - The air inlet of the cabinet must be at least 50 mm (1.97 in.) lower than that of the AC drive.

- If multiple AC drives of different sizes are installed in the cabinet, the air inlet of the cabinet must be lower than the air inlet of the lowermost AC drive.

The diagram of naturally ventilated air inlet duct is shown below.

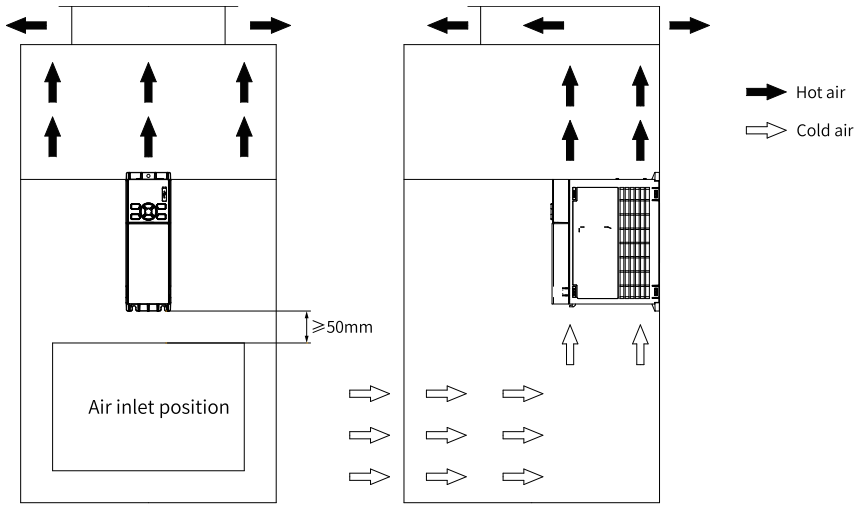


Figure 2-4 Naturally ventilated air inlet duct

- Air outlet requirements
  - The hot air flows upward. Therefore, open the air outlet at the top of the cabinet and make the outlet face the air outlet of the drive, so that hot air can be discharged from the cabinet.
  - If exhaust ducts are used, the air outlet can be located around the cabinet, but must be higher than the air outlet of the AC drive.

The diagram of naturally ventilated air outlet duct is shown below.

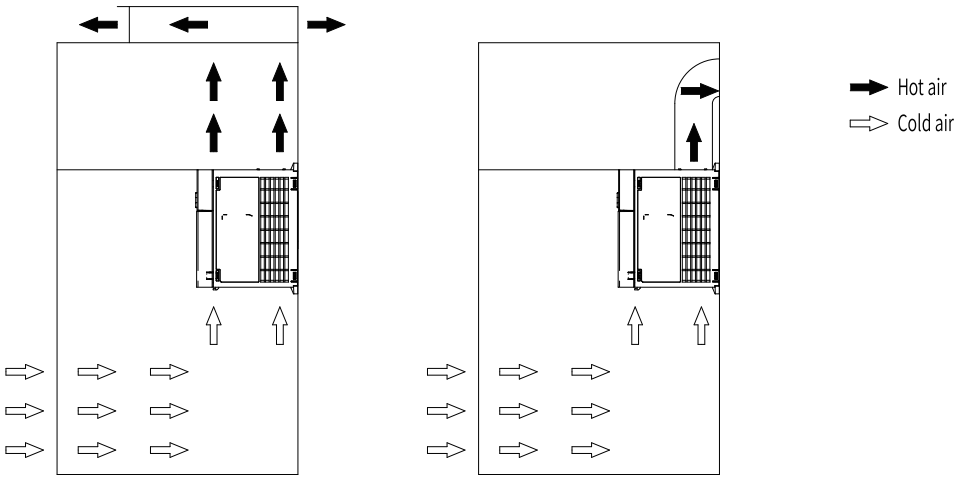


Figure 2-5 Naturally ventilated air outlet duct

Air duct design of forced air cooling cabinet

- Air inlet requirements:
  - The air inlet of the cabinet must be at least 50 mm (1.97 in.) lower than that of the AC drive.
  - If multiple AC drives of different sizes are installed in the cabinet, the air inlet of the cabinet must be lower than the air inlet of the lowermost AC drive.

- In most cases, if fans are installed at the air inlet, the fans will blow air into the cabinet, which causes abnormal air volume distribution of drives in the cabinet. Therefore, it is not recommended to install a fan at the air inlet to blow air into the cabinet.

The diagram of forced air cooling inlet duct is shown below.

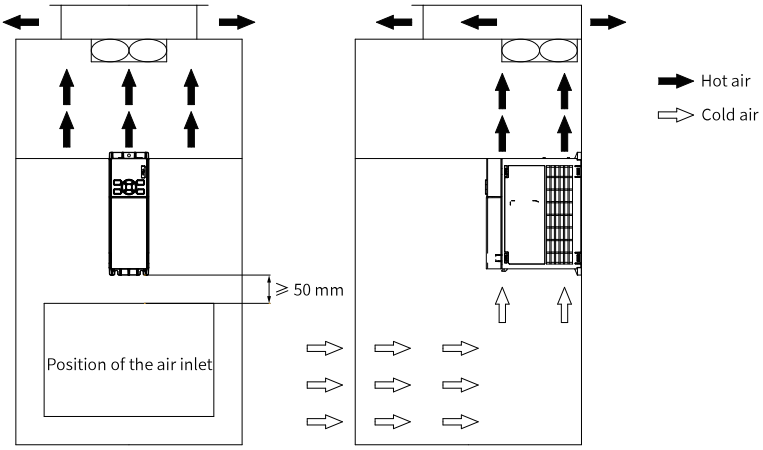


Figure 2-6 Forced air cooling inlet duct

- Air outlet requirements:
  Install the exhaust fan at the top of the cabinet or on the side near the top of the cabinet, and make the fan face the air outlet of the drive, as shown in the following figure.

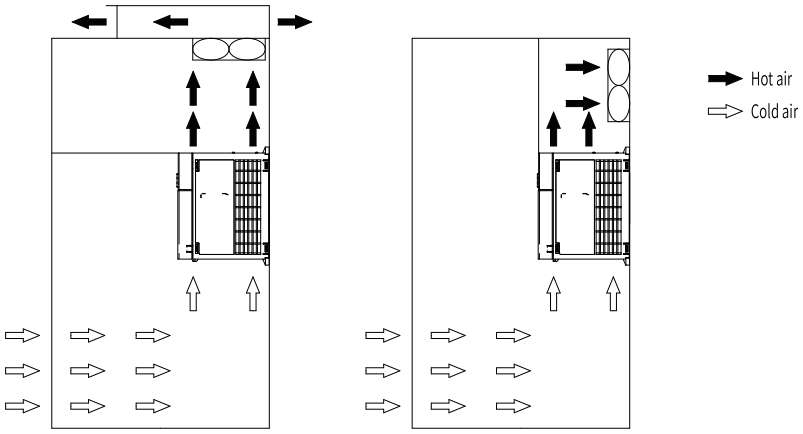


Figure 2-7 Forced air cooling outlet duct (1)

If the air outlet top cover of the cabinet is too close to the air outlet of the exhaust fan, the performance of the fan will be degraded, resulting in significant increase in resistance and decrease in air volume. In this case, the air volume of the drive will be decreased and the drive will be heated up. Therefore, ensure that the air outlet top cover is at least 200 mm (7.87 in.) away from the air outlet of the exhaust fan, as shown in .

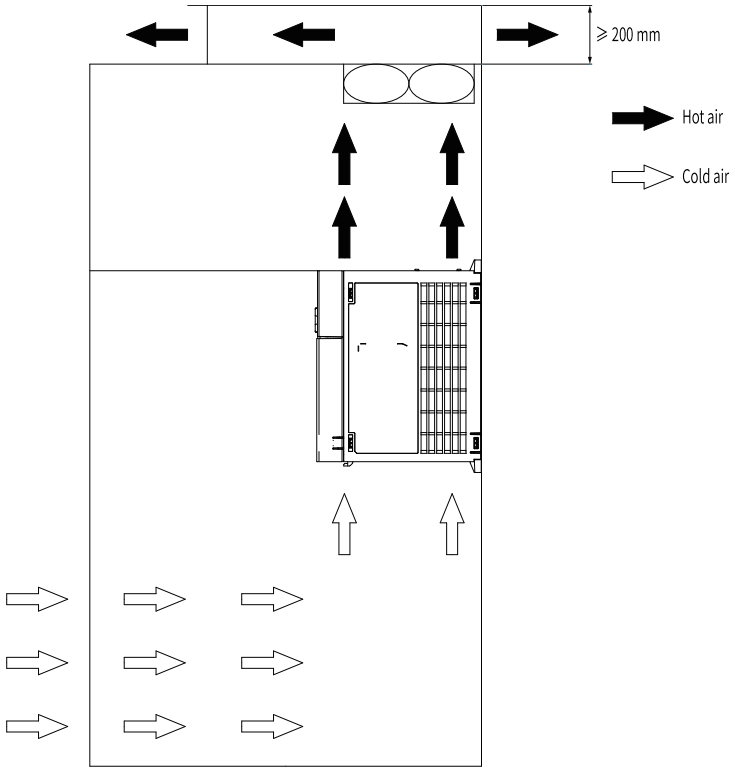


Figure 2-8 Forced air cooling outlet duct (2)

Thermal specifications:

Power (kW)	Ventilation volume		G-model rated output heat dissipation (W)	P-model rated output heat dissipation (BTU/hr)	Effective area of the cabinet air inlet (cm^2)	Effective area of the cabinet air outlet (cm^2)	Minimum selection requirements for the nominal air volume of the cabinet fan (CFM)
	(CFM)	(m^3/hr)					
0.37	-	-	31.6	107.7	24	32	22.7
0.75	-	-	37.2	126.8	24	32	22.7
1.5	12.6	21.42	60.3	205.71	24	32	22.7
2.2	23	39.1	75.4	257.3	37.5	50	41.4
3	17	28.9	101.3	345.7	37.5	50	30.6
4	17	28.9	116.0	395.8	37.5	50	30.6
5.5	31	52.7	175.0	596.9	54	72	55.8
7.5	31	52.7	211.1	720.1	54	72	55.8
11	55.7	94.7	348.2	1187.9	96	128	100.3
15	57.5	97.8	390.4	1332.1	96	128	103.5
18.5	91.8	156.1	511.3	1744.6	127	170	165.2
22	85	144.5	853.9	2913.6	127	170	153

For example, on the plate shown in the following figure, the size of each hole is C x C, and there are 9 holes. Therefore, the ventilation area of the air inlet is 9 x C x C.

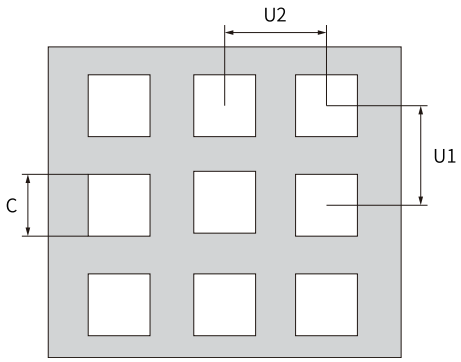


Figure 2-9 Plate with air inlet holes

The preceding table applies to only a single product. For a cabinet containing multiple products, calculate the total ventilation area by adding the ventilation area of each product. For the air outlet installed with a filtering net, the air outlet resistance increases substantially. In this case, the minimum ventilation area of the air outlet must be increased to 1.2 to 1.5 times the value listed in the preceding table. The ventilation area in the preceding tables refers to the actual through-hole area of the opening. The ventilation area is calculated by the following: opening area x opening rate.

If multiple AC drives are installed in the same cabinet, the ventilation area calculation is to add air inlet or outlet area of each AC drive. For example, if a 22kW and 11kW AC drives are installed in the cabinet, the air inlet area requirement of the cabinet is 126.96+96=222.96 cm^2. The air outlet area is 128 + 169.28 = 297.28cm^2.

In the active air ventilation mode, a fan is installed at the top of the cabinet to draw hot air out of the cabinet. This is a commonly used ventilation mode. To ensure that the hot air can be discharged out of the cabinet, the total air volume of the fan cannot be smaller than that of all AC drives in the cabinet. For example, a 22 kW and a 11 kW AC drives are installed in the cabinet. The cabinet fan selection requirements specify a nominal airflow of 100.3 + 153 = 253.3 CFM, meaning that the nominal airflow of the fan installed in the cabinet must not be less than 253.3 CFM.

2.3.2.3 Cooling Mode of AC Drive Cabinet

Hot air back flow is the most common problem in the drive control cabinet. The mechanism of hot air back flow is as follows:

- Due to the suction of the fan, the air pressure at the control cabinet inlet is lowered down. However, the hot air discharged from the drive accumulates at the top of the control cabinet, causing the air pressure to rise.
- Due to the pressure difference between the inlet and outlet of the control cabinet, the air in the cabinet flows from the high pressure area to the low pressure area. The air speed is related to the area of the air inlet and outlet of the control cabinet and the air flow volume.
- If the hot air is not isolated from the cold air, the hot air discharged by the drive will again be drawn into the drive by the fan, heating the drive significantly.

The main function of the air deflector or exhaust duct is to isolate the hot air discharged by the drive from the cold air at the drive inlet to ensure that the inlet air temperature of the drive is within the allowed range.

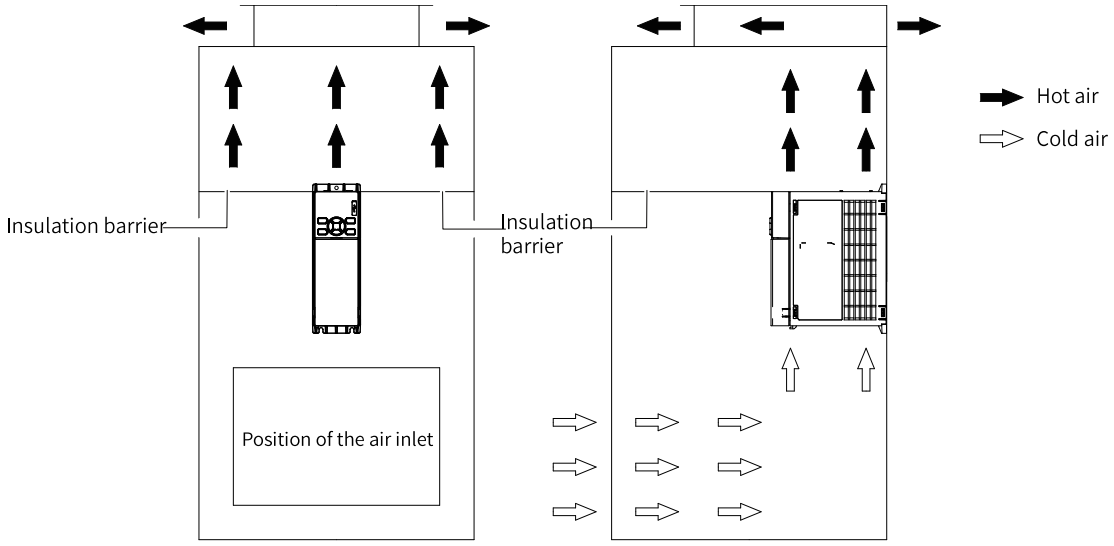


Figure 2-10 Using air deflector to prevent hot air recirculation

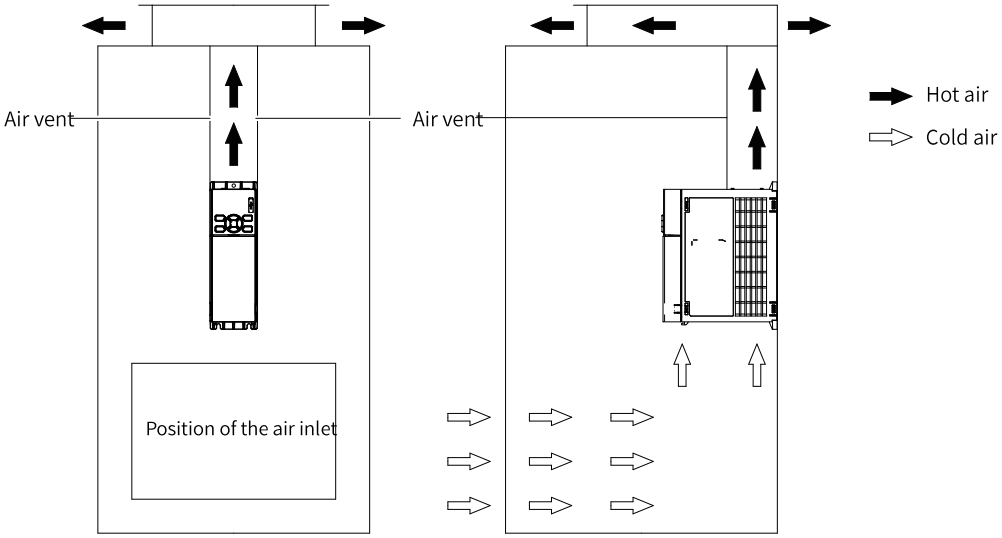


Figure 2-11 Using exhaust duct to prevent hot air recirculation

2.3.3 Installation Direction

Warning

- Incorrect installation direction may cause overtemperature alarm or damage.
- Install the AC drive upright, as shown in the following figure. Do not lie the AC drive on its back or side, or install it in the upside-down direction.

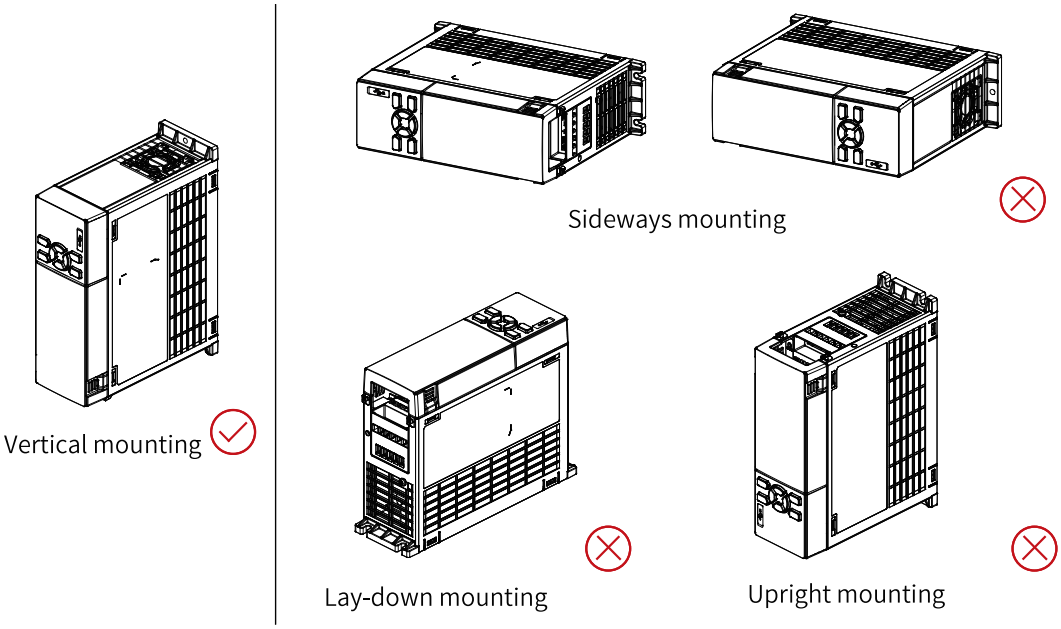


Figure 2-12 Installation direction

2.3.4 Installation Tools

Table 2–5 Mechanical Installation Tools

Tool	Remarks	Appearance
Electric drill and drilling bit	It is used to drill mounting holes on the mounting surface.	
Phillips screwdriver	It is used to tighten or loosen screws See Table 2-4 Screw & Screwdriver Specifications for the screwdriver models.	
Straight screwdriver	Remove the upper cover and knock-out hole.	
Tape measure	It is used to measure the installation dimensions of the equipment.	
Gloves	They are used to prevent static electricity during mechanical installation.	
Torque wrench	Used to calibrate the torque during installation.	

Tool	Remarks	Appearance
Socket wrench	It is suitable for different bolt models.	
Extension bar	Use a torque wrench in narrow areas.	

The following table describes the screw specifications required for the wall-mounted installation method, that is, the screws used to install the AC drive.

Table 2–6 Screw & screwdriver specifications

Drive Structure	Power Rating (kW)	Screwdriver model	Screw specification & quantity	Tightening torque (N·m)
T1	0.37 to 1.5	Cross slot PH2	Three M4 combination screws	1.2
T2	2.2 to 4	Cross slot PH2	Three M4 combination screws	1.2
T3 models	5.5 to 7.5	Cross slot PH2	Four M4 combination screws	1.2
T4	11 to 15	Cross slot PH2	Four M5 combination screws	2.8
T5	18.5 to 22	Cross slot PH2	Four M5 combination screws	2.8

2.4 Checklist Before Installation

Check the following items before installation:

- Check the installation environment, installation clearance, and Installation orientation.
- Prepare the installation tools and accessories.
- Packaging confirmation, unpacking inspection and handling to meet the installation requirements.
- Check the following items before installation.

Table 2–7 Checklist before installation

No.	Item	Checked
1	The mechanical strength of the mounting position can bear the weight of the device.	□
2	The environment and load-bearing capacity of the mounting position fulfill the installation requirements.	□
3	Sufficient clearance is reserved for heat dissipation, including for heat dissipation of other devices in the cabinet.	□
4	The mounting bracket (if needed) is made of incombustible materials.	□
5	If the application site is exposed to metal dust, install the device in an enclosed cabinet to isolate the device from the metal dust. In this case, the space inside the cabinet needs to be as large as possible.	□
6	Before installing the AC drive, install the bottom mounting bracket in the cabinet and guide rails (optional), and prepare mounting beams with holes reserved to fix the AC drive.	□
7	Keep flammables or explosives away from the drive.	□

2.5 Backplate Mounting

Supported model

T1 to T5 models support backplate mounting.

Installation

1. For T1 to T2 models, install the AC drive as the following measures:
   a. Use a Phillips screwdriver to secure the M4 cross recessed pan head SEMS screw on the upper side of the AC drive, as shown in figure ①.
   b. Repeat the previous step to fix the M4 cross recessed pan head SEMS screws on the lower left and lower right side of the AC drive, as shown in ② and③.

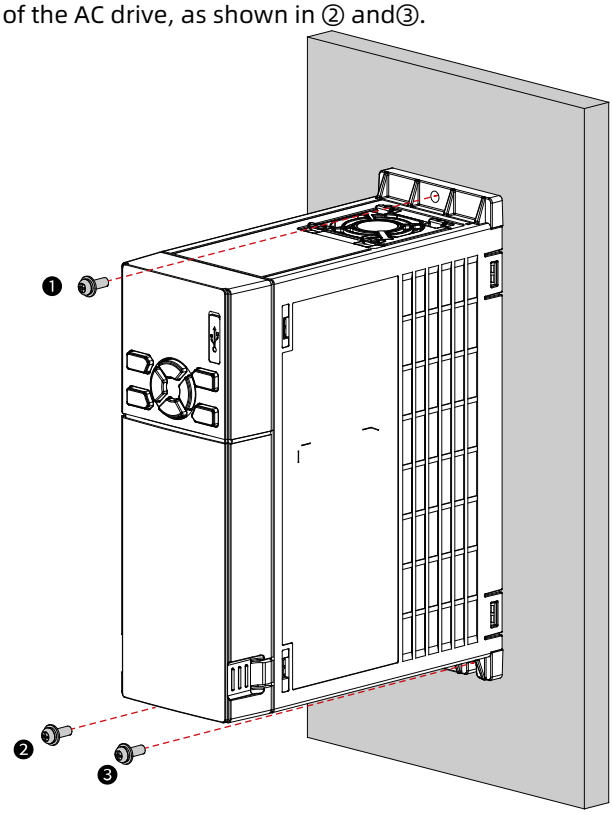


Figure 2-13 Installing through screws

2. For T3 to T5 models, install the AC drive as the following measures:
   a. Use a Phillips screwdriver to secure the screws on the upper right and upper left side of the AC drive, as shown in ① and ②. T3 screw: M4 cross recessed pan head SEMS screw; T4/T5 screw: M5 cross recessed hexagon head SEMS screw.
   b. Repeat the previous step to fix the screws on the lower left and lower right side of the AC drive, as shown in ③ and④. T3 screw: M4 cross recessed pan head SEMS screw; T4/T5 screw: M5 cross recessed hexagon head SEMS screw.

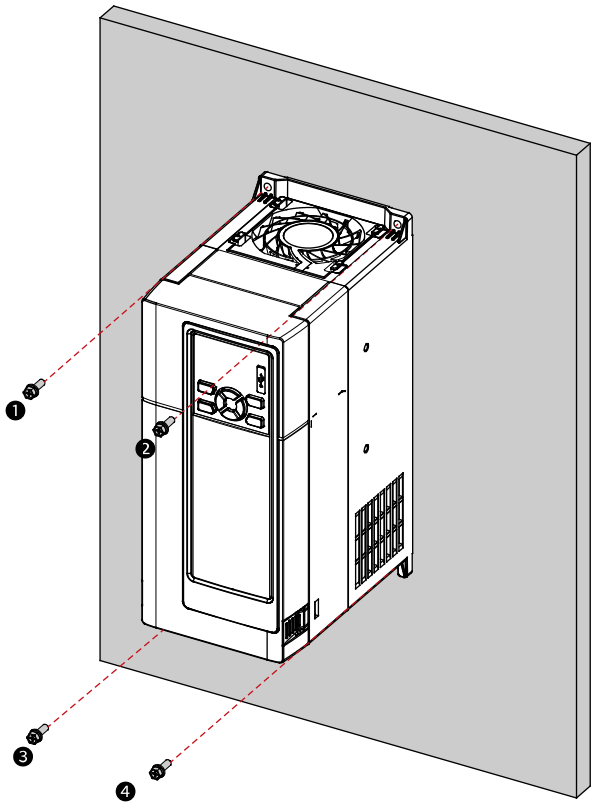


Figure 2-14 Installing through screws (T3 to T5)

For related torque, see the following table.

Drive Structure	Power Rating (kW)	Type of Screwdriver	Screw Specifications & Quantity	Tightening Torque (N·m)
T1	0.37 to 1.5	Phillips type (PH2)	M4 SEMS screw x 3	1.2
T2	2.2 to 4	Phillips type (PH2)	M4 SEMS screw x 3	1.2
T3 models	5.5 to 7.5	Phillips type (PH2)	M4 SEMS screw x 4	1.2
T4	11 to 15	Phillips type (PH2)	M5 SEMS screw x 4	2.8
T5	18.5 to 22	Phillips type (PH2)	M5 SEMS screw x 4	2.8

2.6 Through-hole Mounting

Supported model

Through-hole mounting supports T4 to T5 models, and the IP rating of the cabinet for this installation method can reach IP20.

Recommended bracket model

Recommended bracket model for T4 model: MD630-AZJ-A1T4.

Recommended bracket model for T5 model: MD630-AZJ-A1T5.

Installation

For T4 to T5 models, install the through-hole mounting bracket as the following measures:

Procedure

1. Remove the M4 screws provided with the bracket to divide the bracket into two parts, and install the left bracket into the AC drive, as shown figure 1 in Figure (1).
2. Tighten the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for T5 model) on the left side of the machine with a Phillips screwdriver, as shown in Figure 2 in Figure(1).
3. Insert the right bracket into the AC drive, ensuring it is correctly aligned with the left side bracket using locating pegs.Tighten the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for T5 model) on the left side of the machine with a Phillips screwdriver. Fasten the left and right brackets with two M4×10 cross recessed pan head SEMS screws. See Figure (2).
4. Insert the AC drive with the bracket tilted into the fixed hole of the control cabinet, as shown in the figure (3).
5. Push the AC drive up so that the bracket is flat against the mounting surface of the control cabinet. Tighten the four M5×20 cross recessed hexagon head SEMS screws around the bracket with a Phillips screwdriver, as shown in figure (4).

Note

- Discard the removed M4×10 screws and replace them with the supplied M4×10 screws.
- Screw torque: M4: 1.2 N·m, M5: 2.8 N·m.

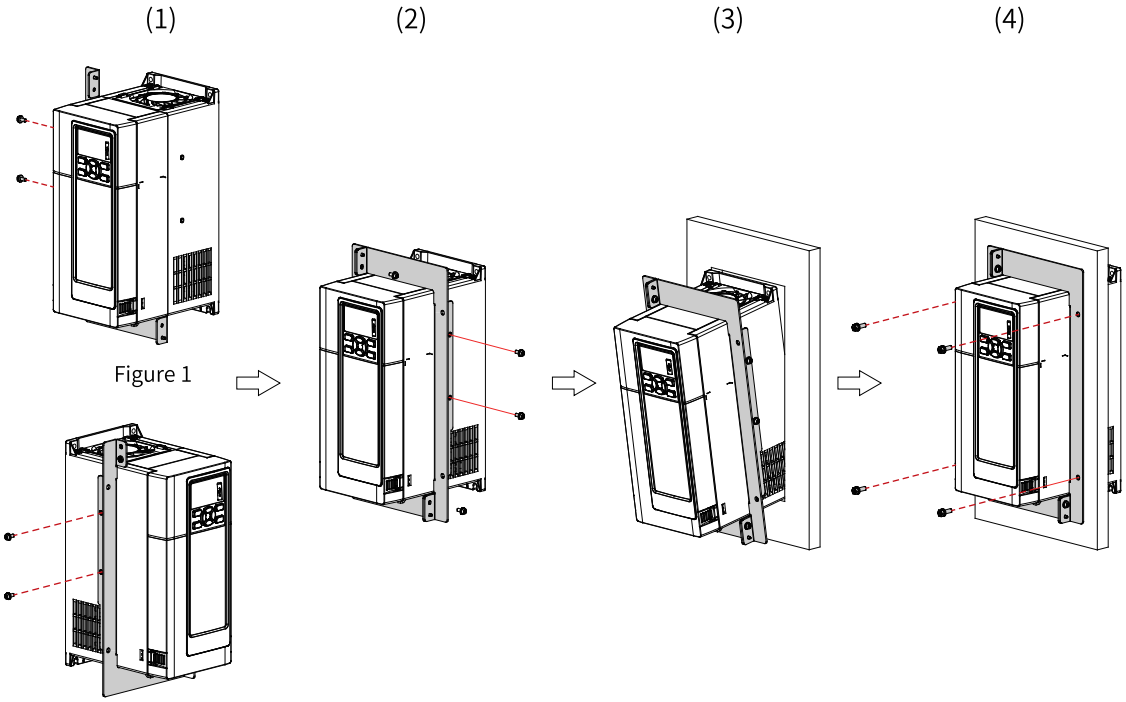
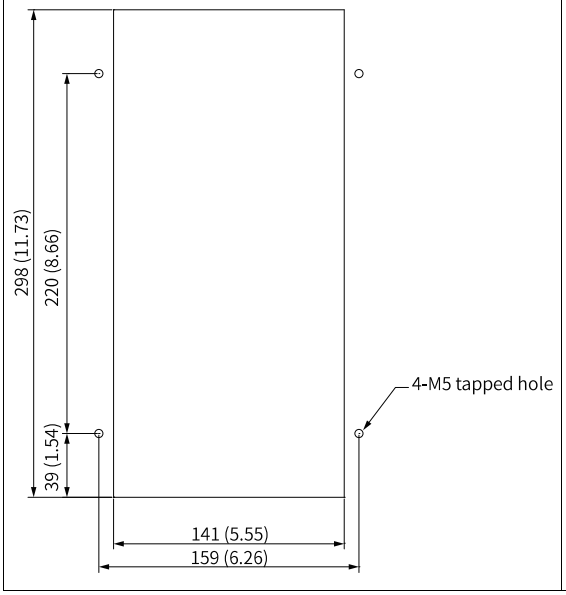
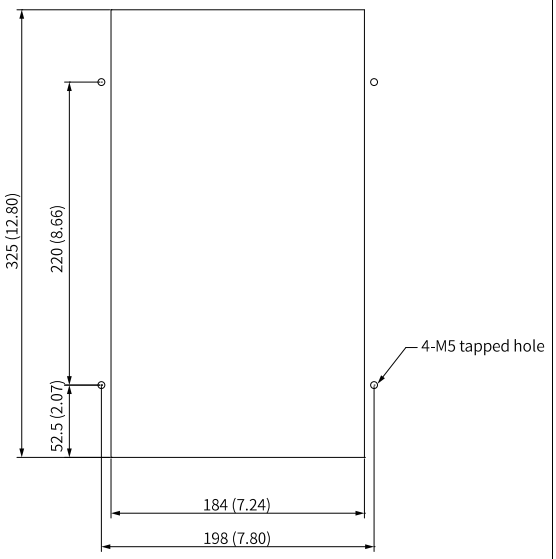


Figure 2-15 Through-hole mounting (T4 to T5 models)

Table 2–8 Recommended mounting hole dimensions for T4 to T5 models cabinet (mm)

Recommended mounting hole dimensions for T4 model cabinet mm (in.)	Recommended mounting hole dimensions for T5 model cabinet mm (in.)
	

2.7 Rail Mounting

Supported model

T1 to T2 models support rail mounting.

Recommended Model

Recommended guide rail models: MD630-AZJ-A4T1

Installation

For T1 to T1 models, install the DIN rail as the following measures:

Procedure

1. Install the optional plastic base plate of the DIN rail into the bottom of the product with PA4×12 self-tapping screws, as shown in Figure ①.
2. Snap the upper snap-fit joint of the plastic base plate into the guide rail, and then tap the bottom of the product with your hand in the direction of the arrow. Then, snap the lower snap-fit joint of the plastic base plate into the guide rail, as shown in Figure ②.

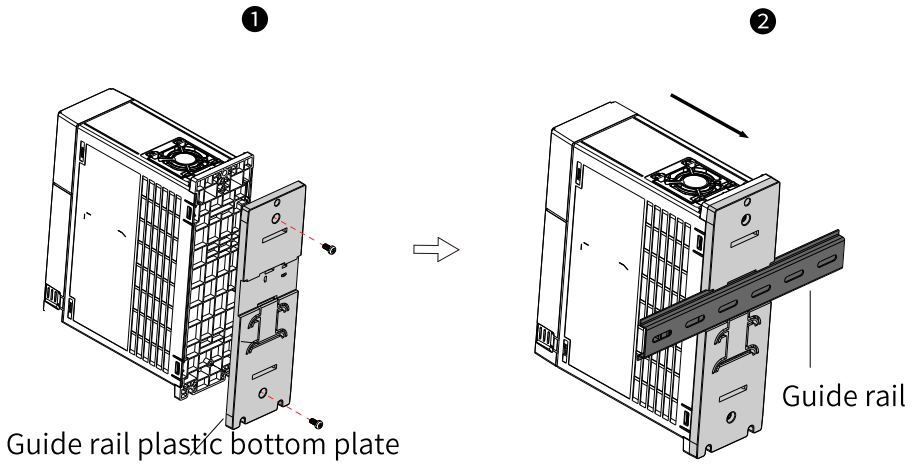


Figure 2-16 Guide rail mounting

Note

- Self-tapping screws are shipped with the rail brackets.
- Screw torque: 1.2 N·m.

2.8 Inspection After Installation

After the installation is done, check the following items.

Table 2–9 Post-installation checklist

No.	Item	Checked
1	The ceiling height meets the minimum requirements for smooth ventilation. The air inlet and air outlet are free of obstruction and have sufficient space. Sufficient space is reserved for safe passing when the cabinet door is opened.	☐
2	All contact protection devices (such as the guard plate) inside and outside the cabinet are installed.	☐

2.9 Mounting Accessories

2.9.1 Installing the Grounding Bracket of the Cable Shield

1. For T1 to T3 models, install the grounding bracket of the cable shield as follows:
   a. Press the snap-fit joints on both sides of the front plastic cover. After the snap-fit joints loosen, flip the cover upwards to remove it. Pull the main power terminal protection plate upwards to remove it, as shown in figure (1).
   b. Check the product without the front plastic cover or main power terminal protection plate in figure (2).
   c. Use a Phillips screwdriver to loosen the ground terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the grounding bracket into the two ground

terminals of the terminal block. Re-install the ground terminal bolts, and secure the bracket to the drive with two PT4 x 8 self-tapping screws at the bottom of the bracket, as shown in figure (3).

d. Connect the main power cable and connect the PE cable to the grounding mark of the grounding bracket. Use a suitable pipe to tighten the power cable shield and the grounding bracket at the jaw to ground the cable 360°. Re-install the protective plate of the main power terminal, as shown in figure (4).

e. Connect the control cable to the control terminal. Press the loose cable with stainless steel spring and fasten the stainless steel spring with an M4 screw. The cable is grounded at 360°, as shown in figure (5).

f. Re-install the plastic upper cover of the product, as shown in figure (6).

Note

The torque of the above self-tapping screws is 1.2 N·m. The terminal block screws follow the recommended torque of the terminals.

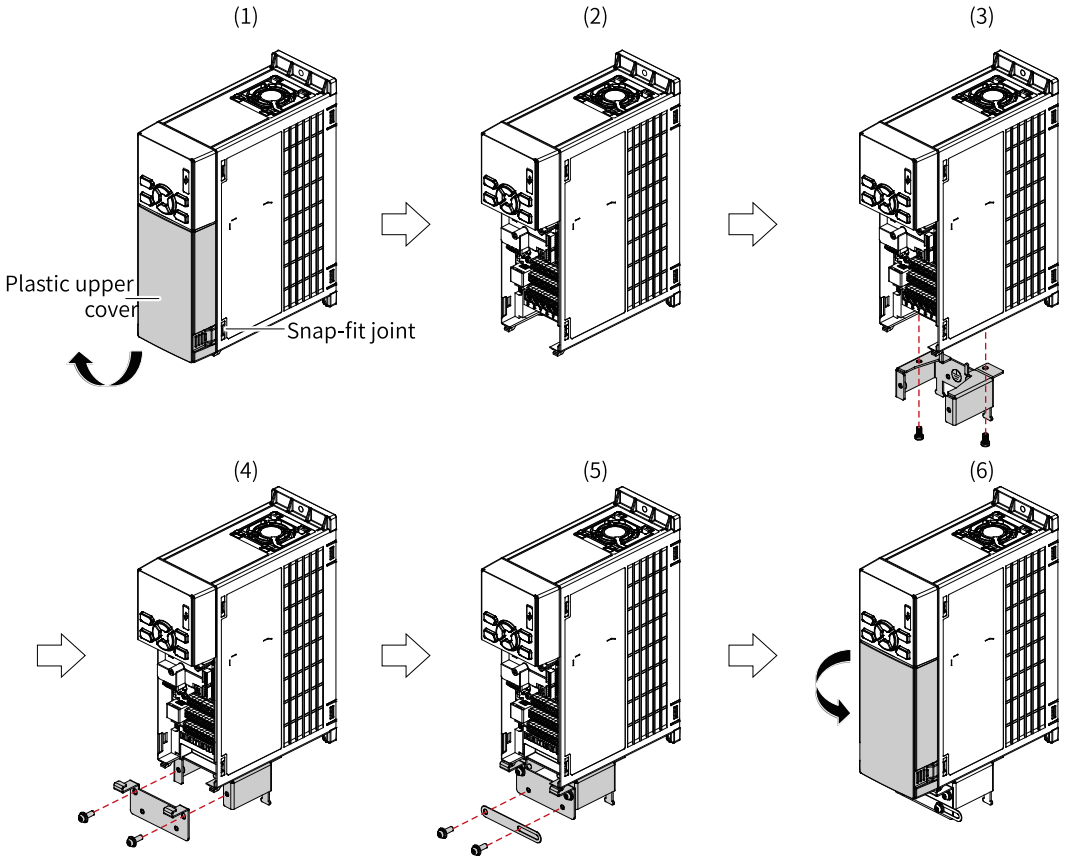


Figure 2-17 Installing the grounding bracket of the cable shield (T1 to T3)

2. For T4to T5 models, install the grounding bracket of the cable shield as follows:

a. Press the snap-fit joints on both sides of the front plastic cover. After the snap-fit joints loosen, flip the cover upwards to remove it. Pull the main power terminal protection plate upwards to remove it, as shown in figure (1).

b. Check the product without the front plastic cover or main power terminal protection plate in figure (2).

c. Use a Phillips screwdriver to loosen the ground terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the grounding bracket into the two ground terminals of the terminal block. Re-install the ground terminal bolts, and secure the bracket to the drive with two PT4 x 8 self-tapping screws at the bottom of the bracket, as shown in figure (3) and (4).

d. Connect the main power cable and connect the PE cable to the grounding mark of the grounding bracket. Use a suitable pipe to tighten the power cable shield and the grounding bracket at the jaw to ground the cable 360°. Re-install the protective plate of the main power terminal. Connect the control cable to the control terminal. Press the loose cable with stainless steel spring and fasten the stainless steel spring with an M4 screw. The cable is grounded at 360°, as shown in figure (5).

e. Re-install the plastic upper cover of the product, as shown in figure (6).

Note

The torque of the above self-tapping screws is 1.2 N·m. The terminal block screws follow the recommended torque of the terminals.

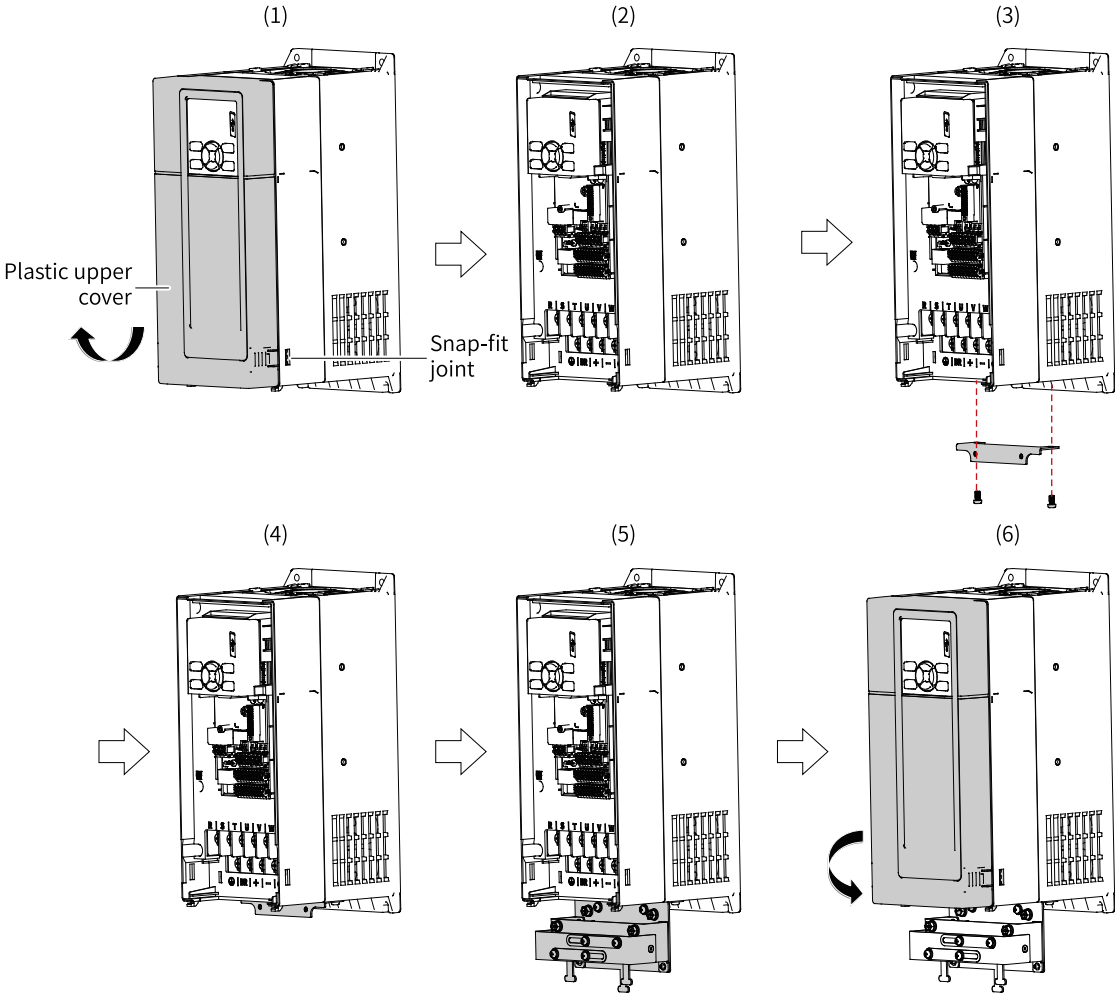


Figure 2-18 Installing the grounding bracket of the cable shield (T4 to T5)

Note

For wiring, see *"3.5.3 Built-in EMC Filter Connection" on page 76*.

2.9.2 Installing Punch Vibration Damping Bracket

Scenario

The vibration damping bracket is suitable for the punch working conditions.

Installation

Follow the steps below to install the punch vibration damping bracket for T1 to T5 models.

Use a Phillips screwdriver to secure the drive to the punch vibration damping bracket. The screw specifications are as follows:

- The T1 to T2 models are secured with three M4 × 16 cross pan head combination bolts, as shown in Figure (1).
- The T3 model is secured with four M4 x 16 cross pan head combination bolts, as shown in Figure (2).
- The T4 to T5 models are secured with four M5 x 25 cross-recess hexagon head combination bolts, as shown in Figure (2).

Note

The torque of the above screws is M4-1.2 N.m and M5-2.8 N.m.

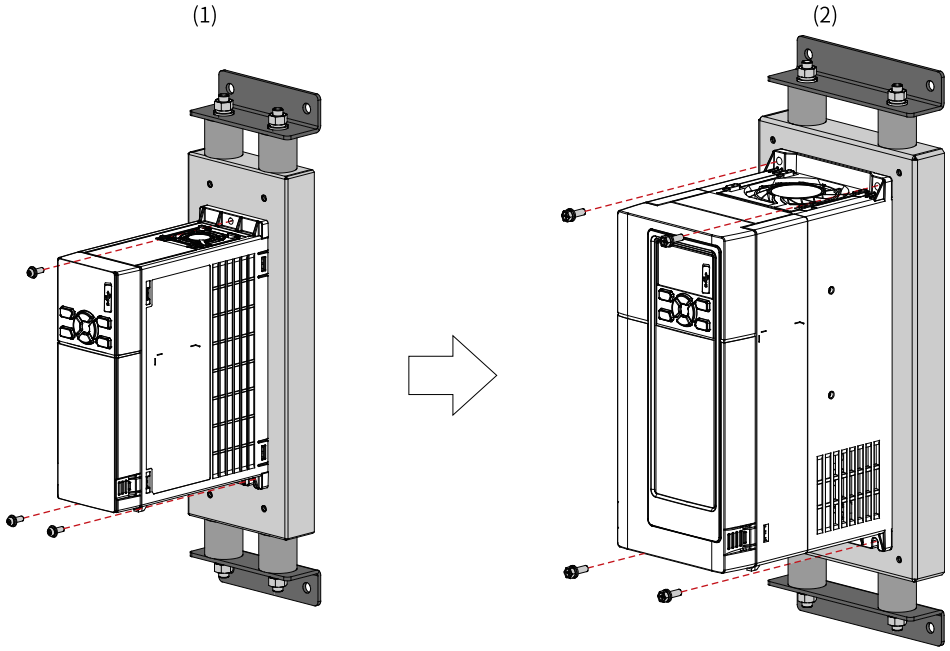


Figure 2-19 Installing the punch vibration damping bracket

2.9.3 Installing the Junction Box Protector

Scenario

The junction box protector prevents foreign objects from entering the cable terminal. After the junction box protector is installed, the cabinet protection level can be IP20.

Installation procedure

1. Follow the following steps to install the junction box protector for T1 to T3 models.
   a. Press the snap-fit joints on both sides of the front plastic cover. After the snap-fit joints loosen, flip the cover upwards to remove it, as shown in figure (1).
   b. Check the product without the front plastic cover or main power terminal protection plate in figure (2).
   c. Remove the four M4 screws to detach the bottom bracket and upper cover from the junction box protector.
   d. Use a Phillips screwdriver to loosen the ground terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the junction box protector into the two ground terminals of the terminal block. Re-install the ground terminal bolts, and secure the bracket to the drive with two PT4 x 8 self-tapping screws at the bottom of the bracket, as shown in figure (3).
   e. After the junction box protector bracket is fitted into the hanging lug in the middle of the plastic cover, secure the junction box protector to the bottom bracket of the junction box protector with the provided M4 screw. Pass the main power cable and control cable through the grommet, mount the grommet to the cable inlet board of the junction box protector, and then fit the board into the bracket according to four peg holes, as shown in figure (4) .
   f. After the main power cable is connected to the terminal block (connect the PE cable to the ground tag of the junction box protector), re-install the main power terminal protection plate. Connect the control cable to the terminal of the control board and re-install the front plastic cover, as shown in figure (5).
   g. Use the provided M4 screw to secure the upper cover of the junction box protector, as shown in figure (6) .

Note

- Discard the screws removed in step 4 and replace them with the M4×10 screws provided with the shipment.
- The screw torque is 1.2 N·m, and the terminal block screw specifications are based on the recommended torque of the terminal.

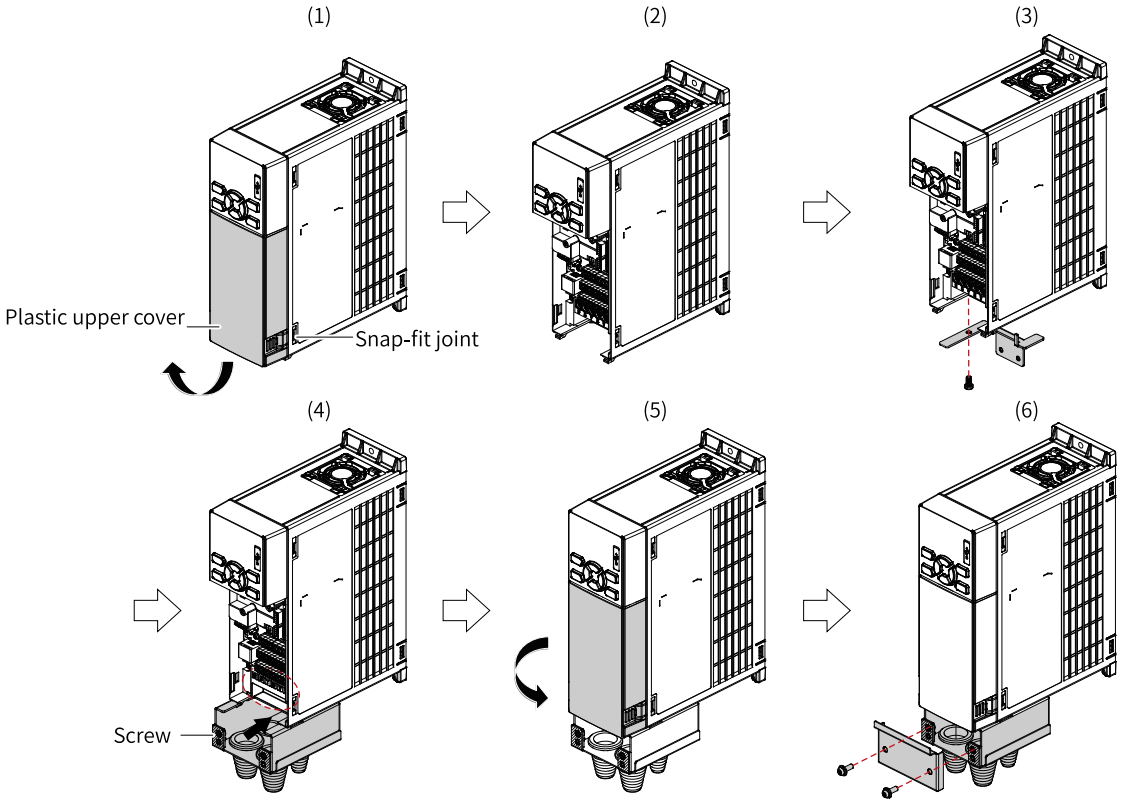


Figure 2-20 Installing the junction box protector (T1 to T3)

2. Follow the following steps to install the junction box protector for T4 to T5 models.
   a. Press the snap-fit joints on both sides of the front plastic cover. After the snap-fit joints loosen, flip the cover upwards to remove it, as shown in figure (1).
   b. Check the product without the front plastic cover or main power terminal protection plate in figure (2).
   c. Remove the four M4 screws to detach the bottom bracket and upper cover from the junction box protector.
   d. Use a Phillips screwdriver to loosen the ground terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the junction box protector into the two ground terminals of the terminal block. Re-install the ground terminal bolts, and secure the bracket to the drive with two PT4 x 8 self-tapping screws at the bottom of the bracket, as shown in figure (3).
   e. After the junction box protector is fitted into the hanging lug in the middle of the plastic cover, secure the junction box protector to the bottom bracket of the junction box protector with the provided M4 screw, as shown in figure (4).
   f. After the main power cable passes through the grommet, mount the grommet to the junction box protector, secure the cable to the terminal block (connect the PE cable to the ground tag of the junction box protector), and re-install the main power terminal protection plate. After the control cable passes through the grommet, mount the grommet to the junction box protector, connect the cable to the control board terminal, and re-install the front plastic cover, as shown in figure (5).
   g. Use the provided M4 screw to secure the upper cover of the junction box protector, as shown in figure (6).

Note

- Discard the screws removed in step 4 and replace them with the M4×10 screws provided with the shipment.
- The screw torque is 1.2 N·m, and the terminal block screw specifications are based on the recommended torque of the terminal.

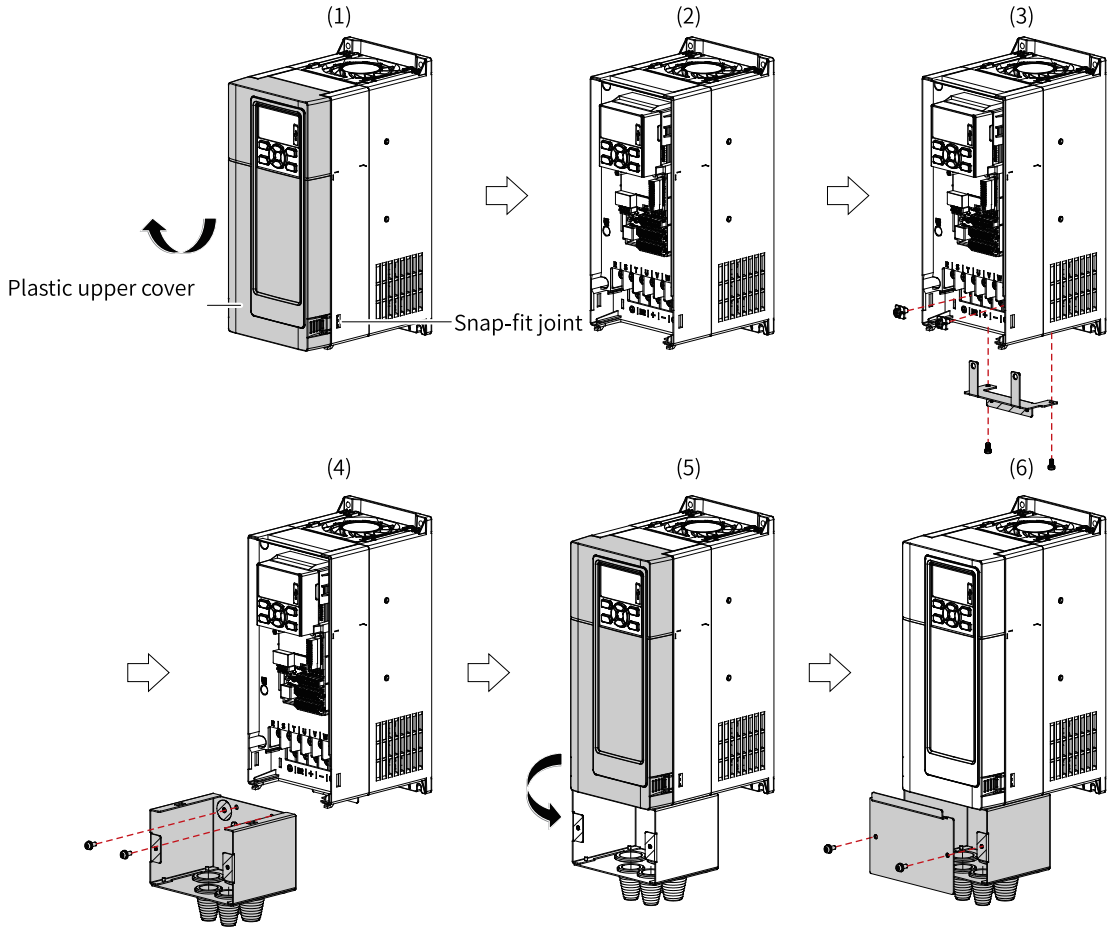


Figure 2-21 Installing the junction box protector (T4 to T5)

3 Electrical Wiring

3.1 AC Drive and Peripheral Device

When the AC drive is used to control motors, you must install a variety of electrical devices on the input and output sides of the AC drive to ensure system safety and stability. The following figure shows the system composition.

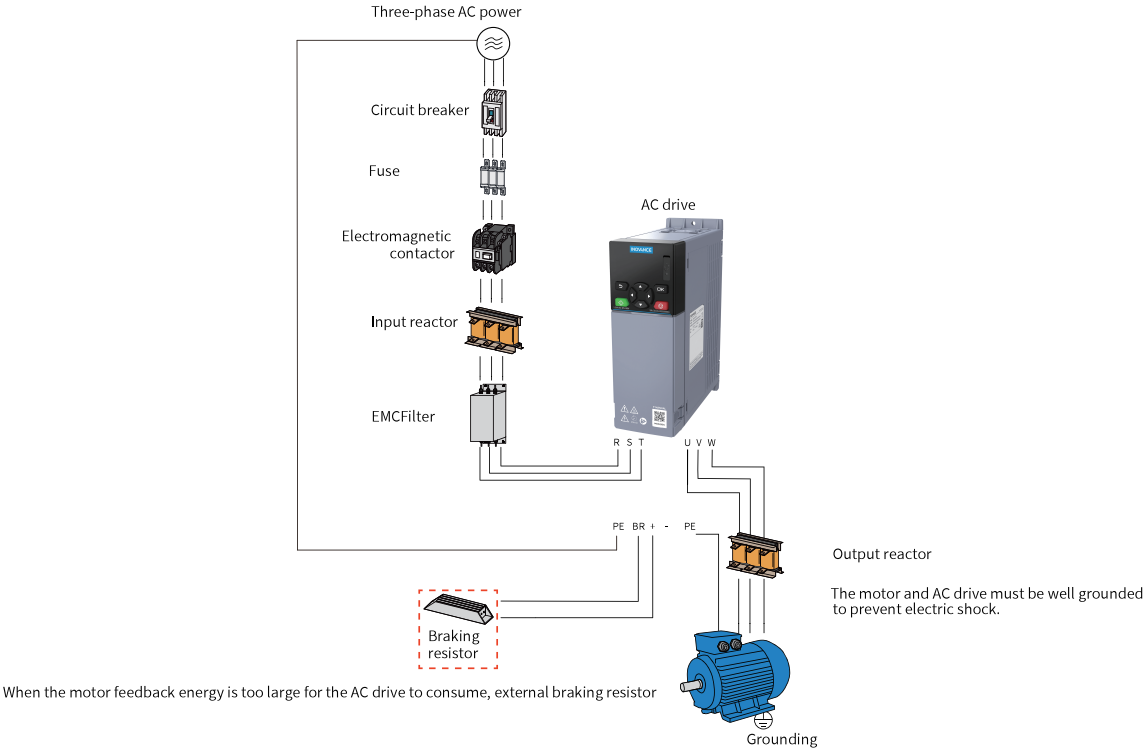


Figure 3-1 System Composition Diagram

Table 3–1 Descriptions of peripheral electrical components

Name	Installation Position	Function Description:
Breaker	AC drive input side	It is installed between the power supply and the AC drive input side. Circuit breaker: When overcurrent occurs on downstream devices, it cuts off the power supply to prevent accidents. Earth leakage circuit breaker (ELCB): Provides protection against potential high leakage current generated during the operation of the AC drive, which can prevent an electric shock or even a fire. Install a proper ELCB based on actual conditions.
Fuse	AC drive input side	Provide protection against short circuit.
Electromagnetic contactor	AC drive input side	It is used to connect to or cut off the power supply of the AC drive. Do not power on and power off the AC drive frequently by switching the contactor on and off (at least 1-hour interval).
AC Input Reactor	AC drive input side	It provides the following functions: Improves the power factor on the input side. Eliminates harmonics on the input side and prevents other devices from being damaged due to voltage waveform distortion and input current imbalance due to phase imbalance of the power supply.

Name	Installation Position	Function Description:
EMC Filter	AC drive input side	Reduce the conduction and radiation interference that affect the AC drive and power source, and increase the anti-interference performance of the AC drive.
Braking Resistor	AC drive input side	For an AC drive model containing letter B, it has the built-in braking unit. After the braking resistor is connected to the braking unit, the braking resistor consumes regenerative energy during motor deceleration.
Output reactor	AC drive output side	Generally, the AC drive generates much high-order harmonics on the output side. When a motor is far away from the AC drive, much distributed capacitance exists in the circuit. Certain harmonics may cause resonance in the circuit, which brings the following adverse effects: • Degrades the motor insulation performance and damages the motor in the long time. • Generates large leakage current and causes frequent AC drive protection trips., The output reactor can protect motor insulation and reduce bearing current.
Motor	AC drive output side	Select an applicable motor.
Note: For selection of peripheral electrical devices, see *" Accessory Specifications" on page 1180*.		

3.2 Electrical Connection

Wiring diagram of MD630S-INT standard AC drive

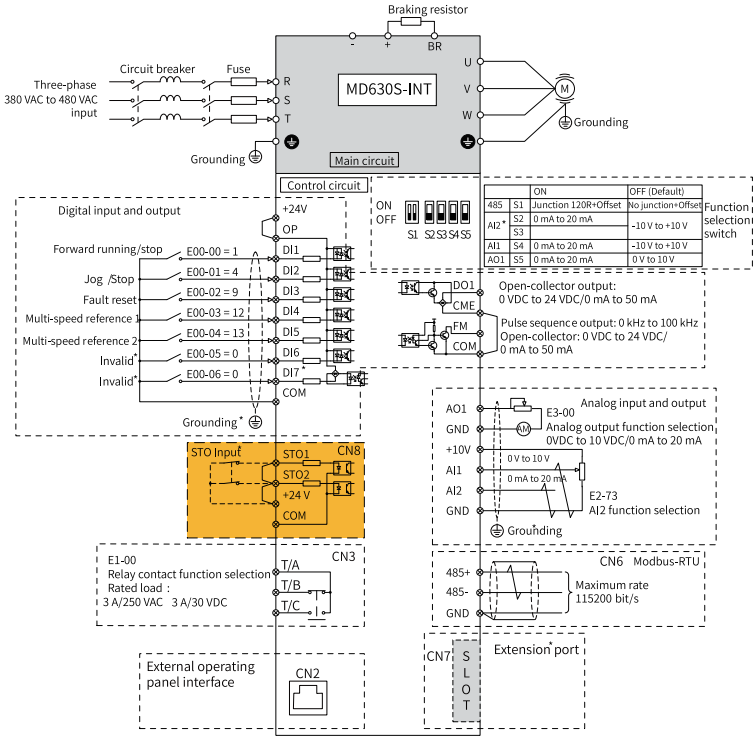


Figure 3-2 Wiring diagram of MD630S-INT standard AC drive

Note

- DI7*: DI7 supports 20 kHz high-speed pulse input.
- Grounding*: Connect the cable shield to the grounding bracket when the signal cable is too long or interfered.
- STO input *: STO models +24V/STO1/STO2 are shorted by default. If external function safety wiring is required, remove the shorting wiring.
- AI2*: S2 and S3 DIP switch ON status are mutually exclusive. Do not switch to the ON status at the same time. The temperature sampling supports PT100/PT1000/KTY84-130/PTC130.
- Expansion interface *: Reserved interface.
- No function *: No other functions are preset by default. The function of each terminal is determined by the parameters of the related function code.

Wiring diagram for MD630N-INT bus-type AC drive

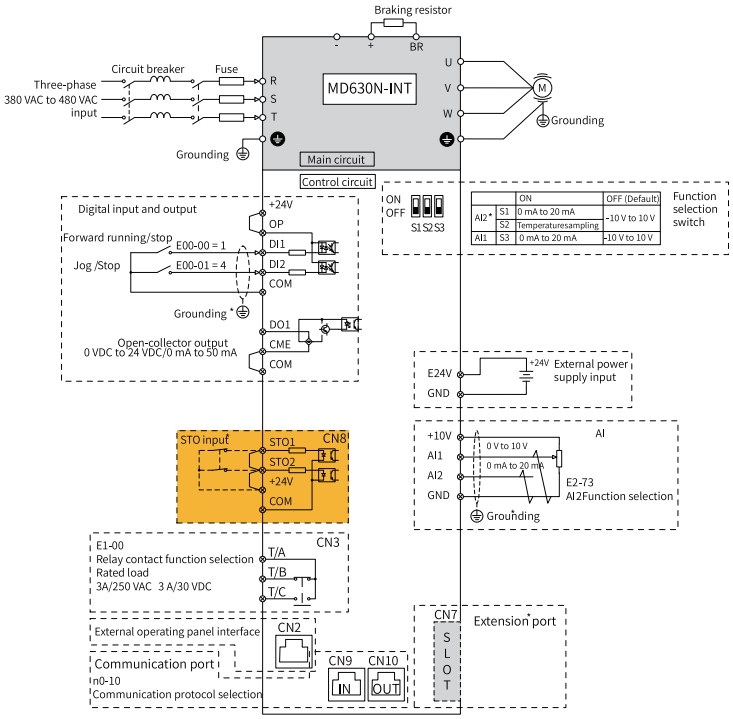


Figure 3-3 Wiring diagram for MD630N-INT bus-type AC drive

Note

- Grounding*: Connect the cable shield to the grounding bracket when the signal cable is too long or interfered.
- STO input *: STO models +24V/STO1/STO2 are shorted by default. If external function safety wiring is required, remove the shorting wiring.
- AI2*: S2 and S3 DIP switch ON status are mutually exclusive. Do not switch to the ON status at the same time. The temperature sampling supports PT100/PT1000/KTY84-130/PTC130.
- Expansion interface *: Reserved interface.

3.3 Requirements on Power Grid System Compatibility

MD630-INT support TN, TT and IT power distribution systems. Delta (corner-grounded) systems are not supported.

Note

As the AC drive contains a grounded Y capacitor and a voltage resistor to ground, if the AC drive is installed in an IT system (floating ground system) or angle-grounded TN system (asymmetric grounding system), the voltage of any PE may exceed the withstand voltage of the internal grounding device. In this case, disconnect the EMC/VDR grounding screw of the ground Y capacitor and ground voltage resistor. Failure to comply may result in damage to the drive.

3.4 Wiring Requirements and Cable Preparation

3.4.1 Cabinet design that meets EMC requirements

Installation precautions

- The fewer and smaller the holes in the cabinet, the better the interference attenuation. The maximum diameter of a hole on the galvanic metal contact surface in the cabinet is 100 mm. Pay special attention to the size of the grid holes at the cold air inlet and air outlet.
- Weld the steel panels together without holes to achieve the optimal electrical connection. If welding is not possible, do not paint the gap between panels. In this case, install special conductive EMC bars to realize galvanic connection. Generally, reliable conductive strips are made of flexible silicon mass covered with a metal mesh. Additional conductive gaskets are needed between metal surfaces to enhance the contact between them. The maximum distance between assembly screws is 100 mm.
- Sufficient high-frequency grounding network must be constructed in the cabinet to avoid voltage differences and forming of high-impedance radiator structures. Use short and flat low-inductance copper braids to improve the performance of high-frequency grounding system. High-frequency single-point grounding cannot be used due to the long distance in the cabinet.
- Use of only conductive EMC shield gaskets is not enough to achieve protective grounding. To ensure electrical safety of the parts, a low-frequency grounding system is required. Follow local regulations to design protective grounding.

Recommended wiring for the cabinet system

- Install the control devices and drive devices into two separate cabinets.
- If multiple cabinets are used, connect the cabinets by using a PE cable with a cross-sectional area of at least 16 mm2 for equipotentiality between the cabinets.
- In a cabinet, establish different parts based on interference intensity differences of sources.
- Devices in different parts of the cabinet should be equipotentially connected.
- Shield all communication (for example, RS485) and signal cables leading from the electrical cabinet.
- Install the power supply input filter inside the cabinet to a place near the input interface of the cabinet.
- All grounding points in the cabinet should be well coated for protection.

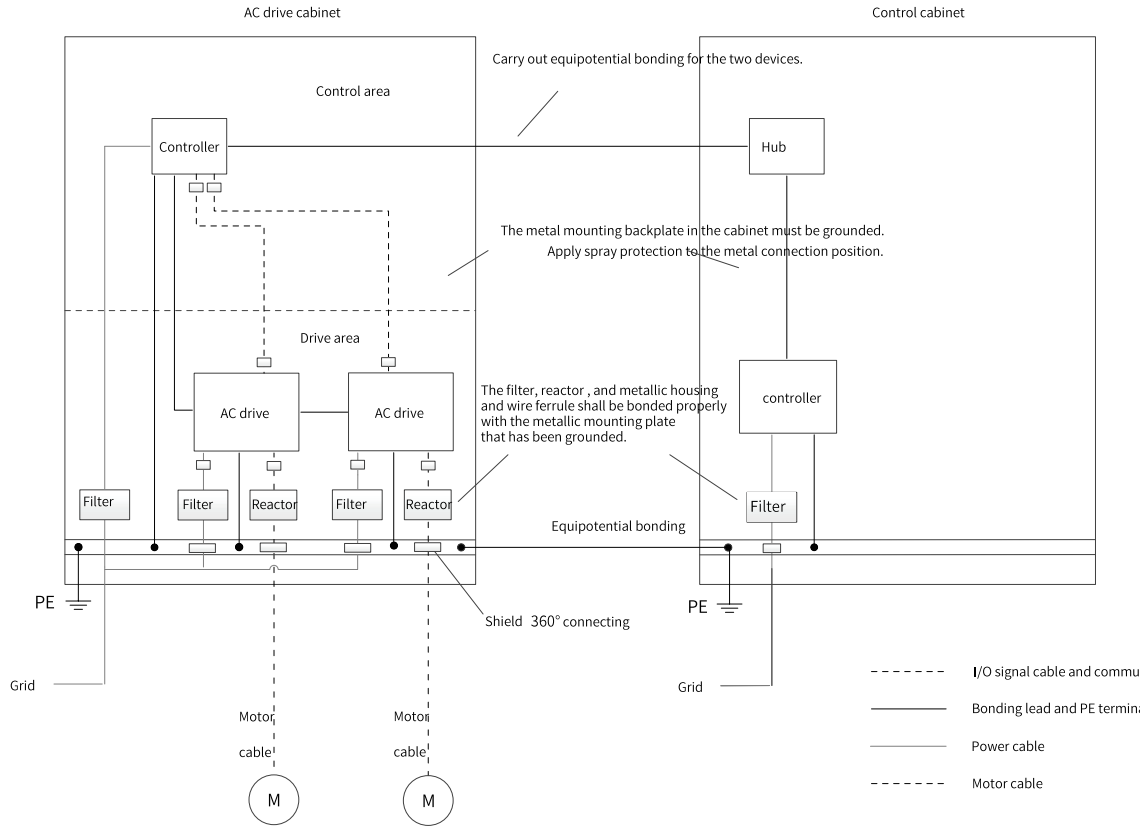


Figure 3-4 Recommended wiring of the cabinet system

3.4.2 Cable routing

The following four types of cables are used with the AC drive:

- Input/Output cable
- Bus cable
- Braking cable
- Signal Cables

For details on cable selection *" Cables" on page 1211*, see section.

Cabling Requirements

- Signal Cables and Power Cables Routed Separately
  When analog signals are used for remote control on the cabinet module, separate signal cables from high-voltage circuits (power supply input, inverter output, and braking resistor cables) by a distance of above 50 cm. This can reduce interference from the AC drive and other equipment to analog signals. Even in the control cabinet, the above wiring requirements must be followed.
- Requirements on the Analog Signal Cables
  Use shielded twisted pair cables for the analog control signal cables. Minimize the length of the stripped part of the cable (about 5-7 mm) and wrap the shield with the insulation tape to prevent the shield from coming into contact with other equipment and incurring interference.
- Requirements on the Motor Cables

Use shielded cables for motor cables. Minimize the distance between the cabinet module and the motor, and route the motor cables separately from other cables. Also, avoid long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the AC drive.

- Requirements on the Control Cables and Power Cables
  If the control cable and power cable are interchanged during field wiring, make them cross vertically as possible to avoid interference introduced by parallel routing.

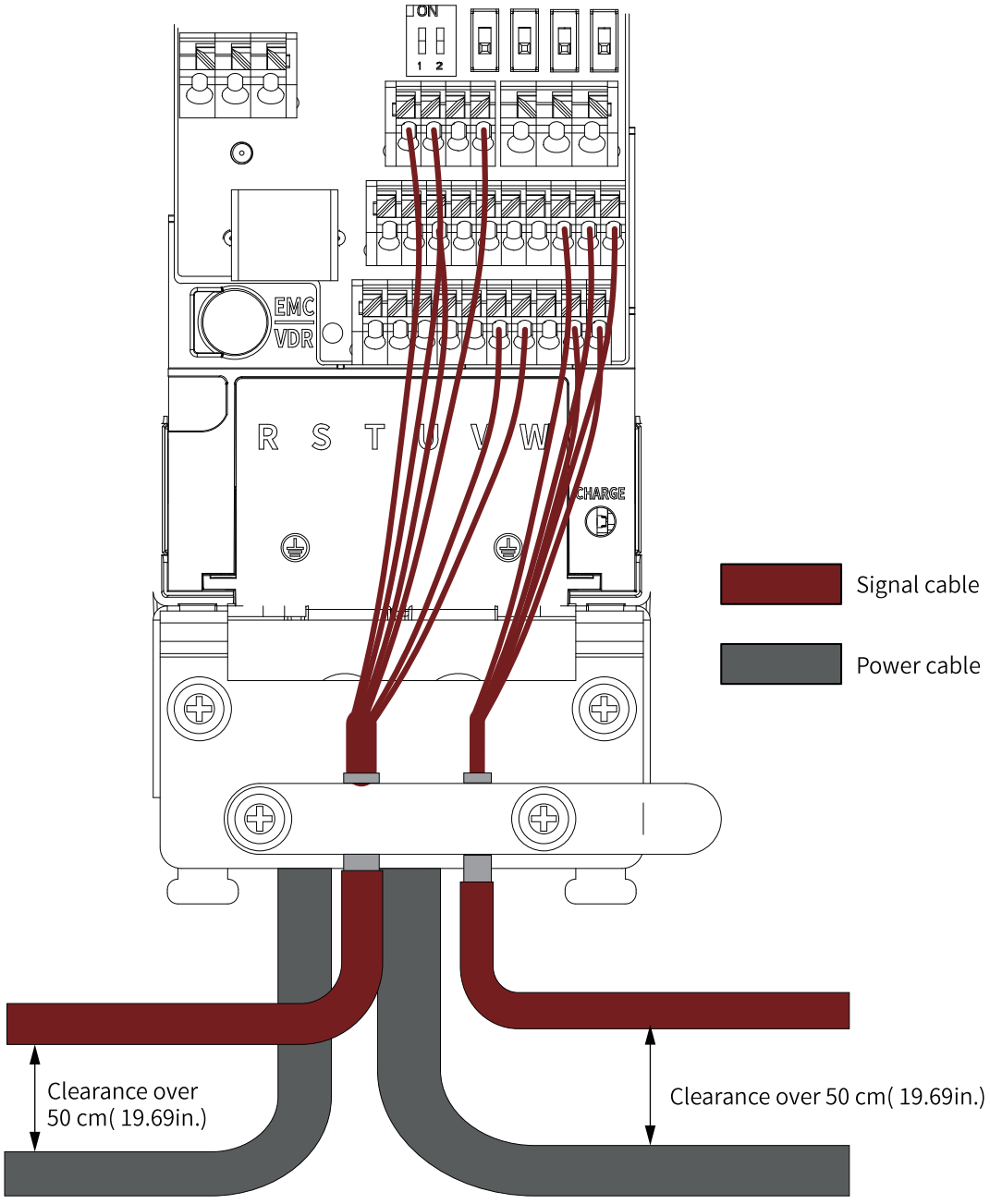


Figure 3-5 Wiring Diagram

Cable Routing

- **Routing disturbing cables and sensitive cables**

Route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables by a distance of at least 20 cm. When two types of cables must be intersected, the intersection angle must be 90 degrees to avoid interference, as shown in the following figure.

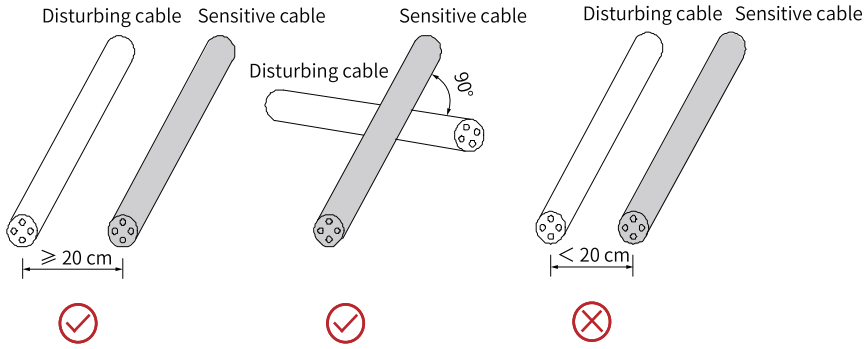


Figure 3-6 Routing disturbing cables and sensitive cables

- **Routing cables that transmit different types of signals**

  Route cables that transmit different types of signals through different routes and separate different types of signals with equipotential signals. When routing cables that transmit the same type of signals, lay equipotential signal cables to the outer layers and lay equipotential bondings as many as possible in the middle if possible, as shown in the following figure.

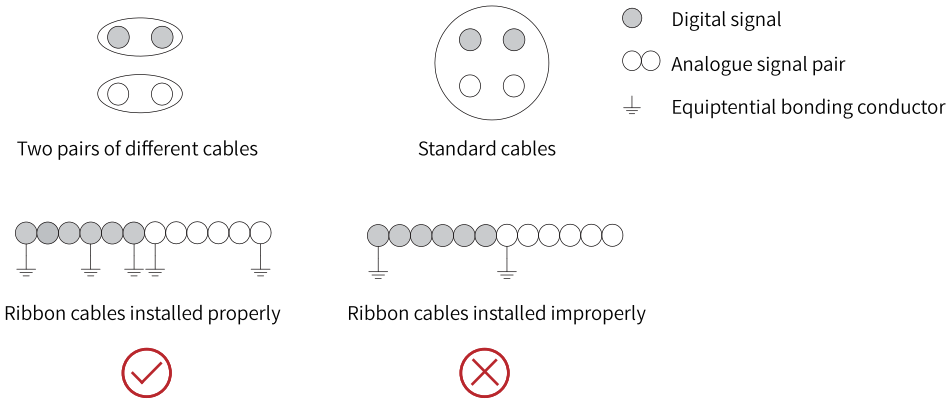


Figure 3-7 Routing cables that transmit different types of signals

- **Routing multi-conductor cables**

  For multi-conductor cables, use one cable to transmit one type of signals. To use one cable to transmit multiple types of signals, use a cable with internal conductor shields, as shown in the following figure.

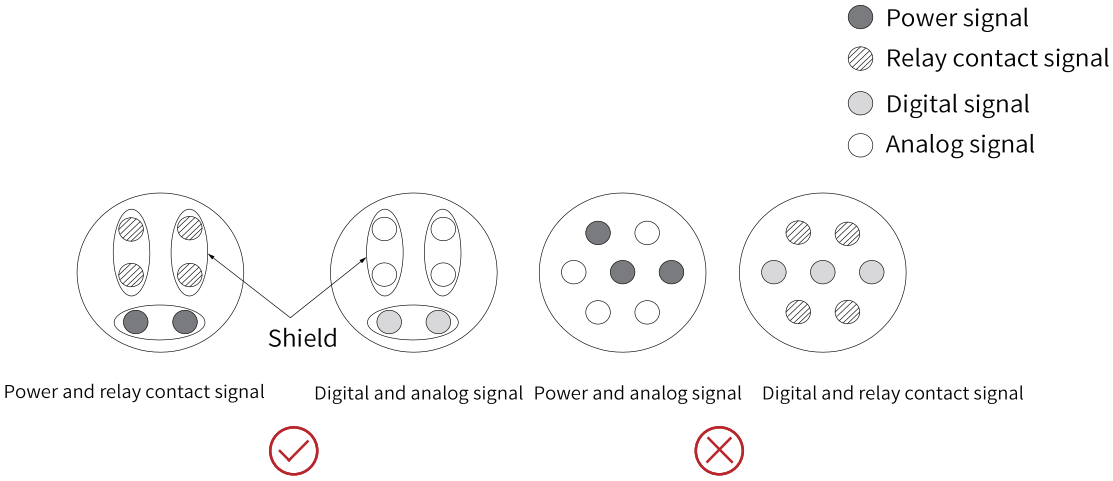


Figure 3-8 Routing multi-conductor cables

If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bondings, as shown below.

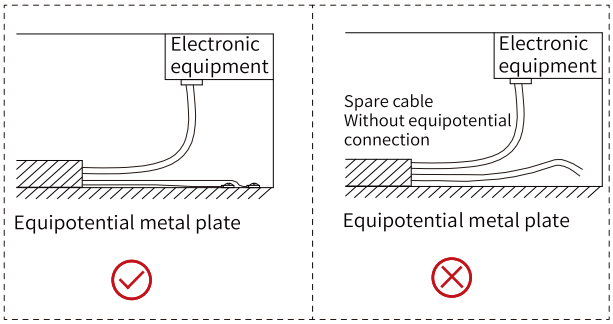


Figure 3-9 Handling reserved or unused conductors of multi-conductor cables

- **Requirements on the wiring loop area**
  For cables that transmit low-level sensor signals and shared cables that transmit relay signals, lay them close to each other to avoid the large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other.

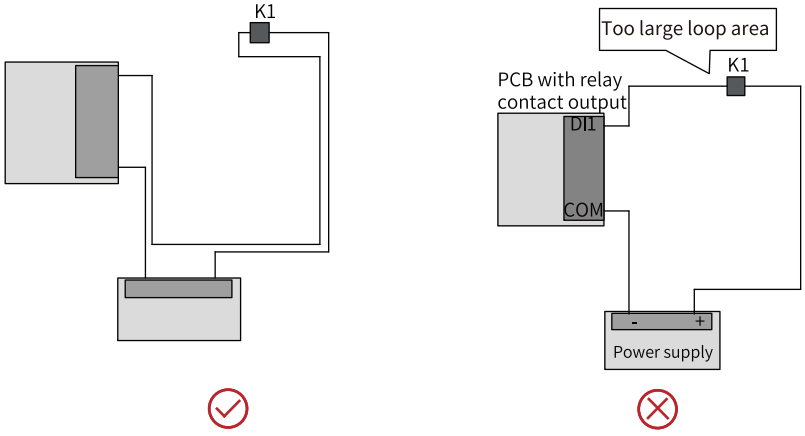


Figure 3-10 Recommended wiring loop area

- **Laying multiple types of cables**

For cables of different types, route the cables along the equipotential metal plate. To enhance the internal EMC performance, separate different types of cables or separate cables with metal separators (recommended) in the same metal (zinc-iron or stainless steel) duct.

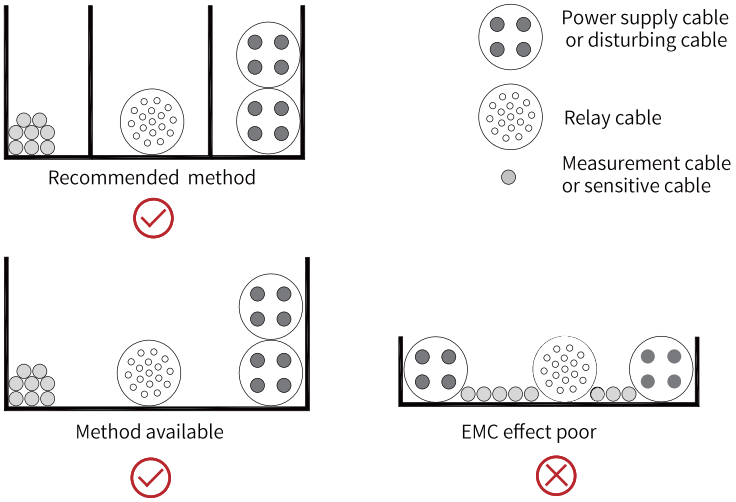


Figure 3-11 Laying multiple types of cables

- **Requirements on handing of shielded cables**
  Minimize the length of the unshielded part of a shielded cable, and connect the shield to the nearest PE terminal. If the unshielded part is too long, the cable conductor is prone to signal interference. There is no dedicated PE terminal on the MD600 enclosure. In this case, connect the shield to an external PE terminal.

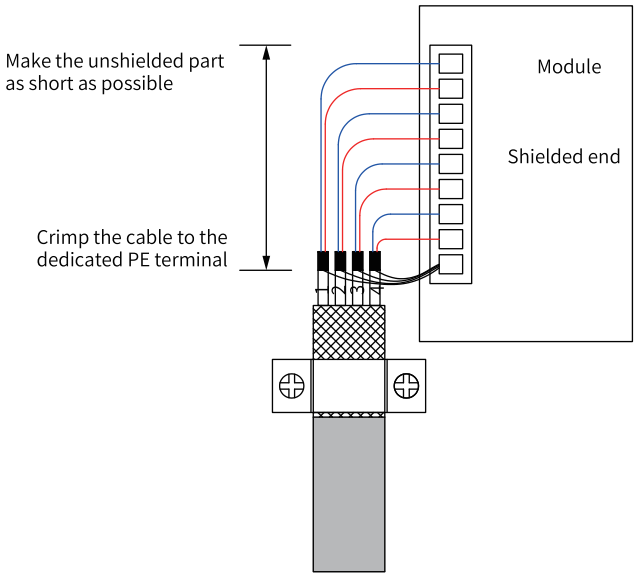


Figure 3-12 Requirements on handing of shielded cables

3.4.3 Cable Preparation

Cables for T1 to T3 series

- Input/Output cable

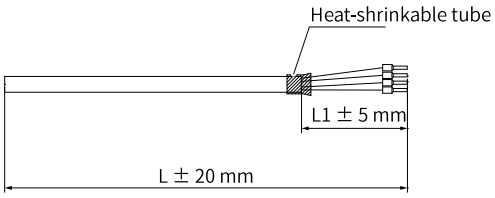


Figure 3-13 T1 to T3 input and output cables

- DC bus input cables

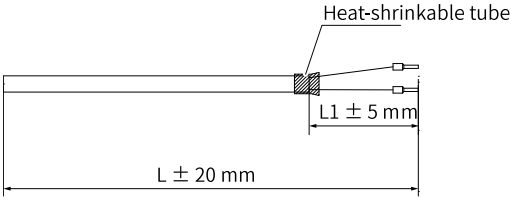


Figure 3-14 DC bus input cables

- Braking cable

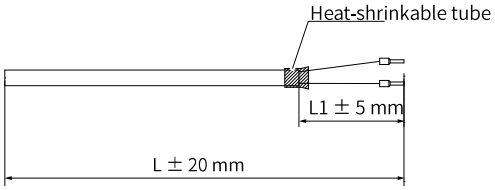


Figure 3-15 Braking cable

Cables for T4 to T5 series

- Input/Output cable

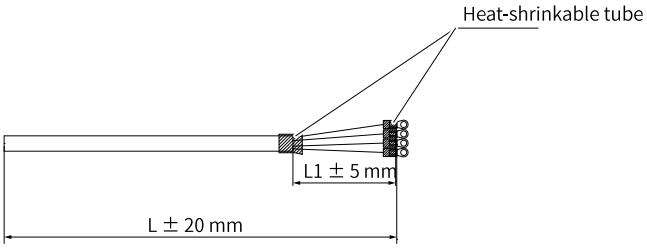


Figure 3-16 T4 to T5 input and output cables

- DC bus input cables

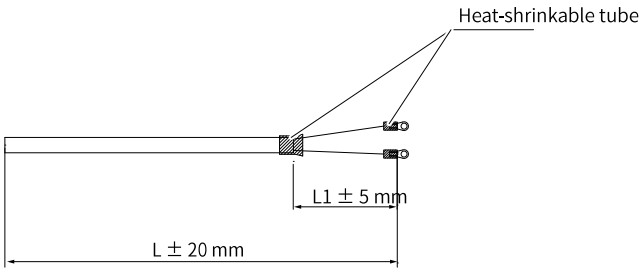


Figure 3-17 DC bus input cables

- Braking cable

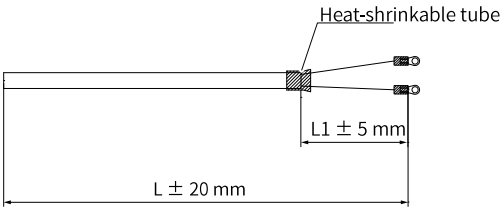


Figure 3-18 Braking cable

Note

- The total power cable length (L) and stripping length (L1) are adjusted according to the actual working conditions on site.
- The power ring tongue terminals are heat-shrink tubing with suitable heat-shrink sleeves.
- The control cables can be customized according to actual demand.

3.5 Main Circuit Connection

3.5.1 Descriptions of Main Circuit Terminals

The main circuit terminals of the AC drive are in a double-row layout. The layout of main circuit terminals of each model are as shown below.

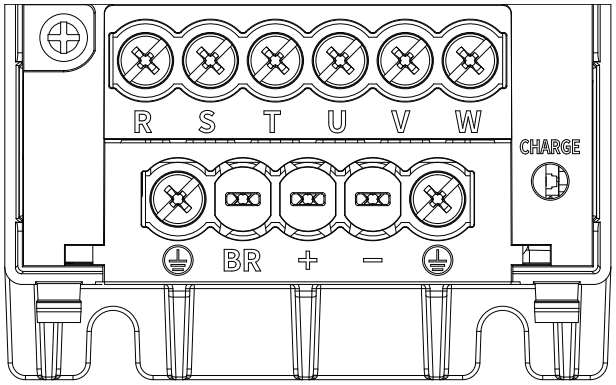


Figure 3-19 Layout of main circuit terminals for T1 to T2 models

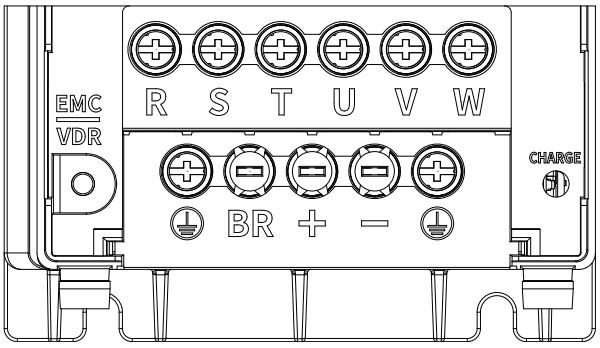


Figure 3-20 Layout of main circuit terminals for T3 models

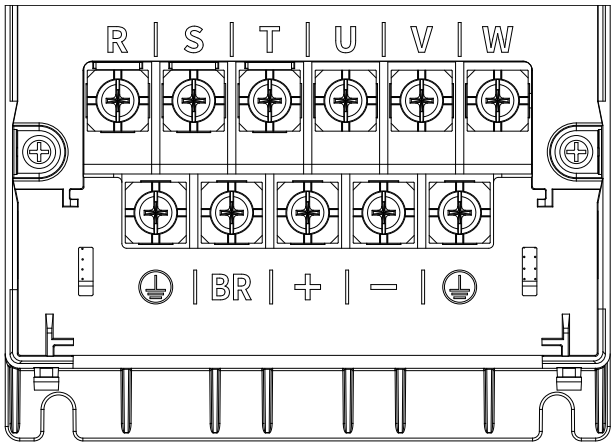


Figure 3-21 Layout of main circuit terminals for T4 to T5 models

Table 3–2 Descriptions of main circuit terminals for T1 to T5 models

Terminal Mark	Name	Function
R, S, T	Three-phase power input terminals	Used to connect the three-phase AC input power supply.
BR, +	Braking resistor connection terminals	Used for braking resistor connection.
+, -	Positive and negative terminals of the DC bus	Used to connect the common DC bus.
U, V, W	Output terminals	Used to connect to a three-phase motor.
⏚	Grounding terminal (PE)	Used for protective grounding.

Note

Install the main circuit terminals in T4 to T5 models carefully since the screws are falling easily.

The following diagram shows the dimensions of the main circuit terminals of each structure.

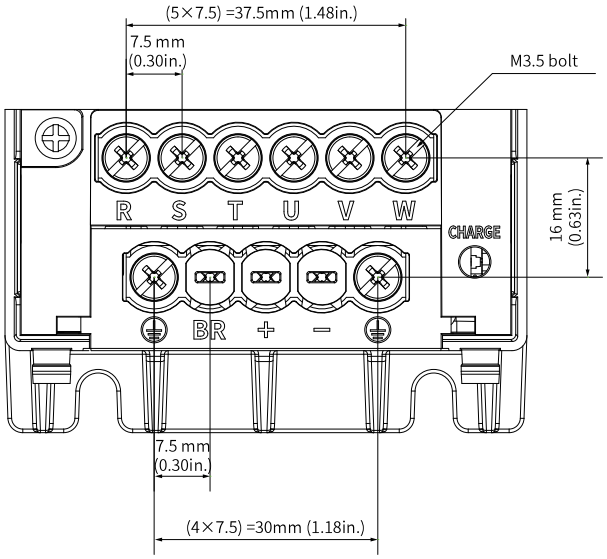


Figure 3-22 Dimensions of main circuit terminals in T1 to T2

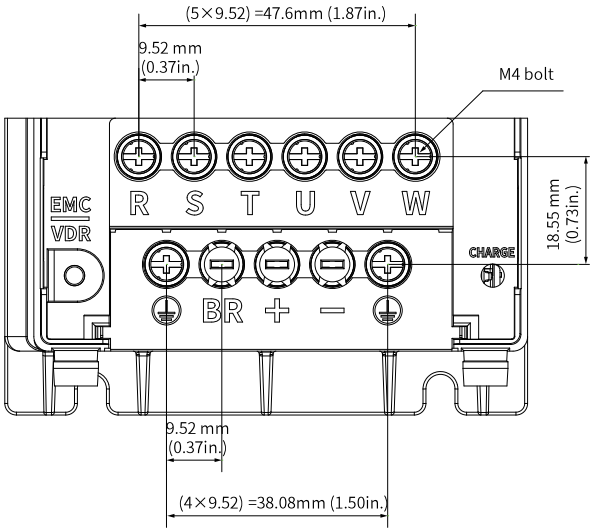


Figure 3-23 Dimensions of main circuit terminals in T3

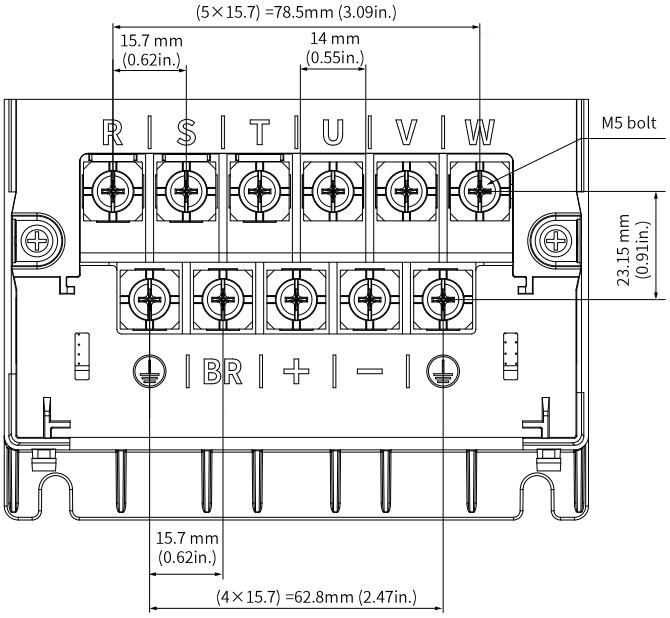


Figure 3-24 Dimensions of main circuit terminals in T4

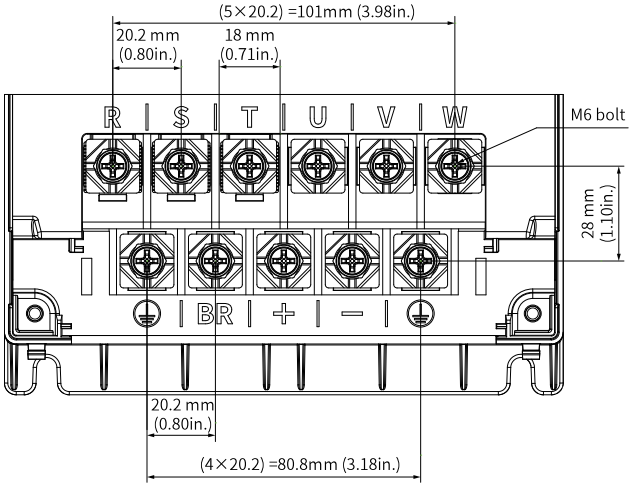


Figure 3-25 Dimensions of main circuit terminals in T5

3.5.2 Main Circuit Terminals Connected to Power Supply, Motor, and Braking Resistor

Wiring of main circuit terminals

- The AC drive input power cables and output motor cables will generate strong electromagnetic interference. In particular, when these power cables with strong electromagnetic interference and control circuit cables are routed over a long distance, the electromagnetic coupling can easily affect the normal operation of the AC drive. Therefore, it is recommended that the distance between the main circuit cable and the signal cable be greater than 30 cm.
- Common main circuit cables include input RST cables, output UVW cables, DC positive and negative bus cables, and braking cables. The signal cables include I/O signal cables. Communication cable. Cable ducts must be in good connection and well grounded. The aluminum cable duct ensures equipotential of the equipment. The filter, AC drive, and motor must be connected properly to the system (mechanical or device). All conductive metal contact parts of these lap joints must be in full contact, and the installation parts must be protected by spraying.

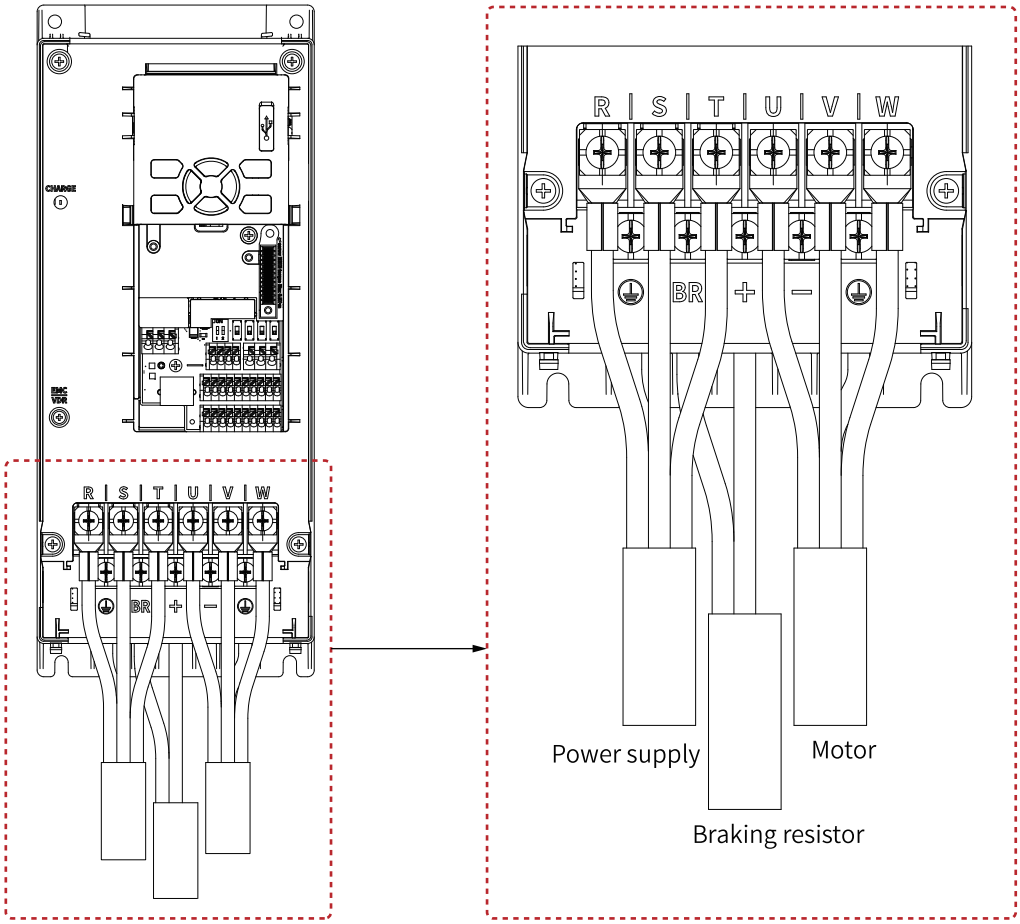


Figure 3-26 Wiring diagram of main circuit terminal block

Wiring in the IT power grid

In the IT grid system, disconnect the EMC/VDR optional grounding screw. Failure to comply will result in damage to the AC drive, as shown in the following figure.

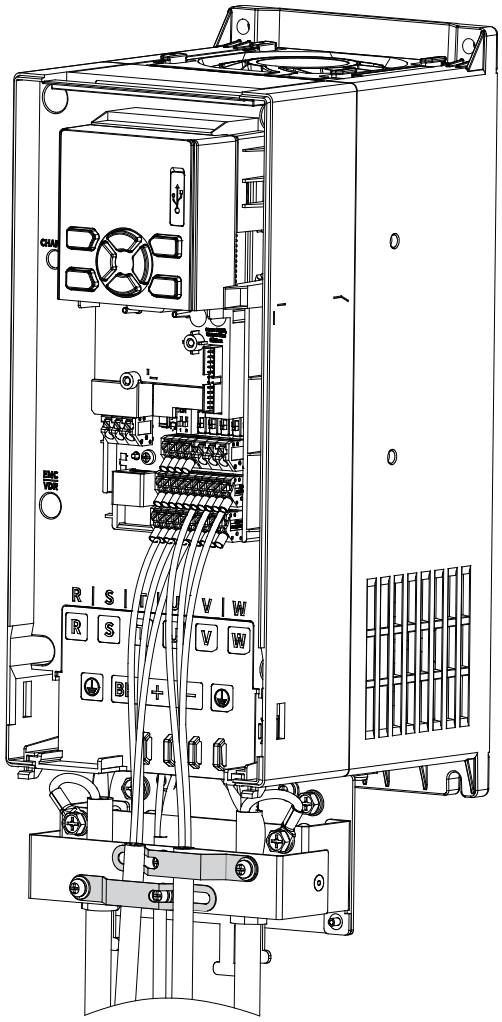


Figure 3-27 Disconnecting the optional EMC grounding screw

Length of motor cables

When the AC drive is working, the quick on-off of its power switch triode can lead to excessively large dU/dt at the output side. If the motor cable is too long, the motor winding will experience excessive voltage stress that may cause insulation breakdown. It is recommended to use a motor that complies with IEC60034-25 IVIC B specifications or a motor with high insulation voltage resistance. In addition, when the cable length increases, the distributed capacitance of the cable increases linearly, resulting in high harmonic current.

When the motor cable length is longer than the recommended length in the following table, install an output reactor on the output side of the product or use a motor that complies with IEC60034-25 IVIC B. The output reactor can reduce the voltage stress on the motor winding.

Rated AC drive power	Cable length of ordinary asynchronous motor (Unshielded cable in V/f control mode)	
	No output reactor is installed	Install an output reactor
0.37 kW	≤ 200 m (carrier frequency reduced to 1 kHz)	≥ 200 m
0.75 kW	≤ 300 m (carrier frequency reduced to 1 kHz)	≥ 300 m

Rated AC drive power	Cable length of ordinary asynchronous motor (Unshielded cable in V/f control mode)	
	No output reactor is installed	Install an output reactor
1.5 kW	≤ 500 m (carrier frequency reduced to 1 kHz)	≥ 500 m
≥ 2.2 kW	≤ 500 m (default carrier frequency)	≥ 500 m

Note

- In SVC control mode, the maximum length of ordinary asynchronous motor cables without an reactor is 100 m.
- The length of the shielded cable is 2/3 of the length of the shielded cable.

Motor cable shield requirements

It is recommended to use the shielded cable as the motor output cable. Perform a 360° connection on the shield structure by using the shield grounding bracket, and crimp the drain wire of the shield to the PE terminal. For details on the grounding bracket *"9.8.8 EMC shield grounding bracket" on page 1203*of the power cable shield, see section.

Keep the lead wire of the motor cable shield as short as possible, with its width (b in the following figure) not shorter than 1/5 of its length (a in the following figure).

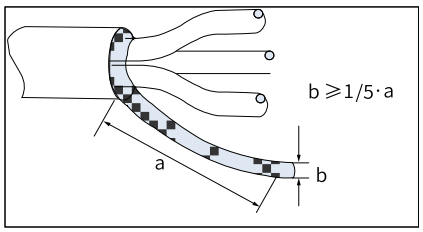


Figure 3-28 Lead-out of the motor cable shield

3.5.3 Built-in EMC Filter Connection

This product has an EMC filter that meets the class C3 limit. To meet the standard requirements, use shielded cables with a maximum length of 10 m for motor cables and use the shielded bracket on the AC drive side for 360° reliable connection

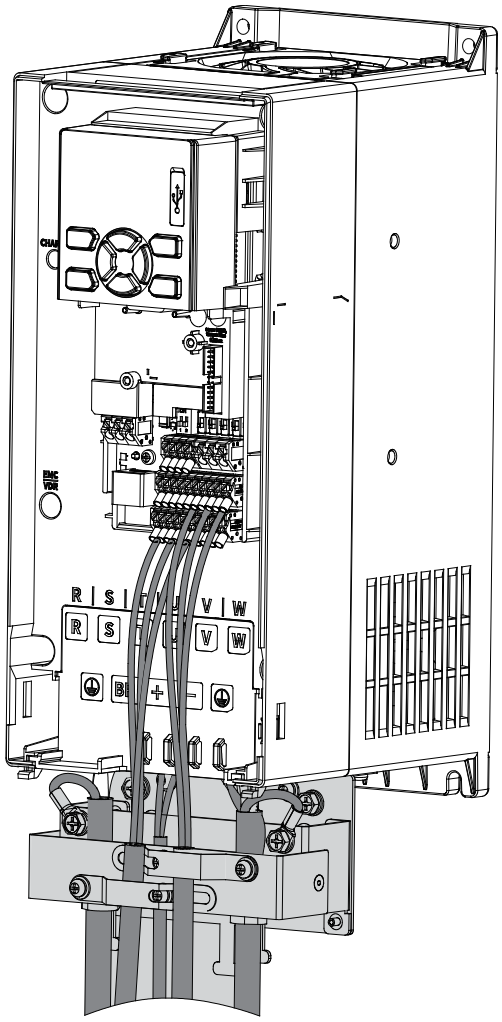


Figure 3-29 Connection of the shielding bracket

3.5.4 External EMC Filter Connection

Install the filter close to the input side of the AC drive. The cable between the filter and the drive must be shorter than 30 cm. Connect the grounding terminals of the filter and the grounding terminal of the AC drive together, and install the filter and AC drive on the same conductive surface that is connected to the main grounding terminal of the cabinet.

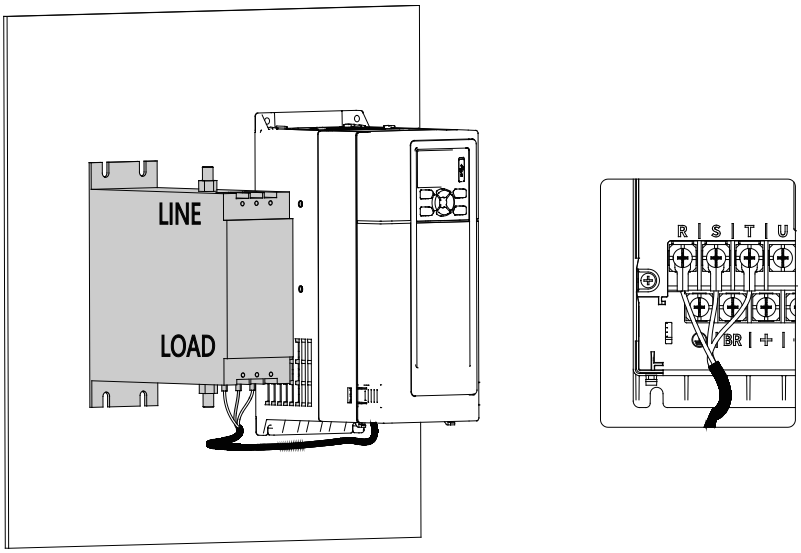


Figure 3-30 EMC filter installation

3.5.5 Recommended Power Cables

For power cable selection and specifications, see *" Power cable selection requirements" on page 1211*.

3.5.6 Requirements on Grounding Cables

To properly ground the module, observe the following requirements.

Caution

- To prevent an electric shock: Ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shock, ensure the protective grounding conductor complies with technical specifications and local safety standards. Keep the grounding cable as short as possible. As the leakage current of the drive may exceed 3.5 mA, use a copper protective grounding conductor with a cross-sectional area of at least 10 mm^2 according to IEC/EN 61800-5-1, or two protective grounding conductors with the same cross-sectional area.
- To comply with EMC standards, ground the neutral point of the power supply. When the neutral grounding is not conducted or the large resistance is grounded, if the optional grounding screw of the EMC filter is not removed, there is a risk of electric shock.
- When using multiple devices, follow the instructions for grounding all devices. Incorrect grounding will cause misoperation of devices.
- For drives equipped with optional VDR grounding screws, remove the grounding screw before voltage resistance test. Failure to comply may cause the drive to fail the test.
- The dimensions of the grounding cable must comply with the electrical device technical standards. Keep the length of the grounding cable as short as possible. Failure to comply will lead to unstable potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.
- Do not share the same grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device will lead to AC drive or device faults caused by electrical interference.
- For use of multiple AC drives, observe all the grounding instructions for the AC drive. Improper grounding of the device will lead to malfunction of the drive and the device.

Grounding purpose

Normally, the circuit can be insulated by an insulating object and stored in the housing. However, as insulation objects that can totally cut off the leakage current cannot be created, a small amount of current will still leak into the housing. The purpose of grounding is to prevent an electric shock caused by leakage current when personnel come into contact with the enclosure of electrical equipment.

In addition, the AC drive is a strong interference device. Grounding the AC drive is also necessary to reduce external interference.

Grounding requirement

- Use a yellow-green cable with copper conductors for protective grounding. Do not connect the protective grounding conductor to switching devices such as circuit breakers in series.
- Ground the grounding terminal properly. Improper grounding will lead to device malfunction or damage.
- Do not connect the grounding terminal to the N terminal of the neutral wire of the power supply.
- Install the drive on a conductive metal mounting surface. Ensure that the whole conductive bottom of the drive is attached properly to the mounting surface.
- Tighten the grounding screws to the correct tightening torque so that the PE conductor will not come loose or too tight.

Grounding mode

There are three grounding modes.

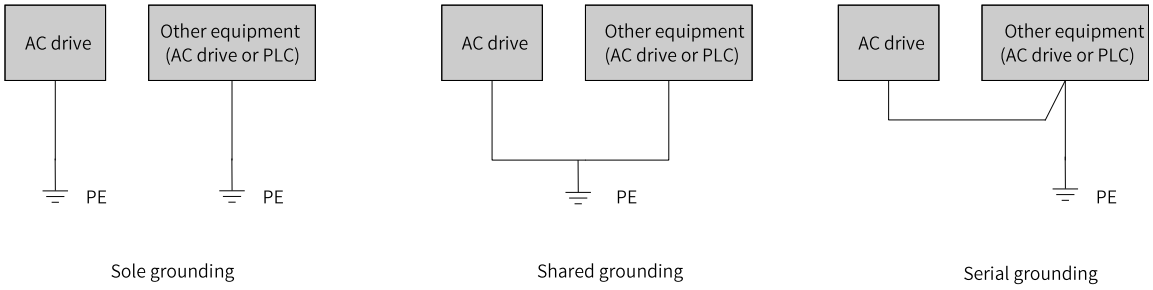


Figure 3-31 Grounding

- Separate grounding: Connect the AC drive and other devices to the protective grounding separately. This is the optimal and recommended grounding method.
- Shared grounding: Connect the AC drive and other equipments to the same protective grounding. This is a recommended grounding method.
- Grounding in series: Connect the grounding cable of other equipment to the grounding point of the AC drive. Or connect the grounding cable of the AC drive to the grounding point of other equipment. This method is highly susceptible to common ground impedance interference and not recommended.

The AC drive in the electrical cabinet is recommended to use grounding in parallel, as shown in the following figure.

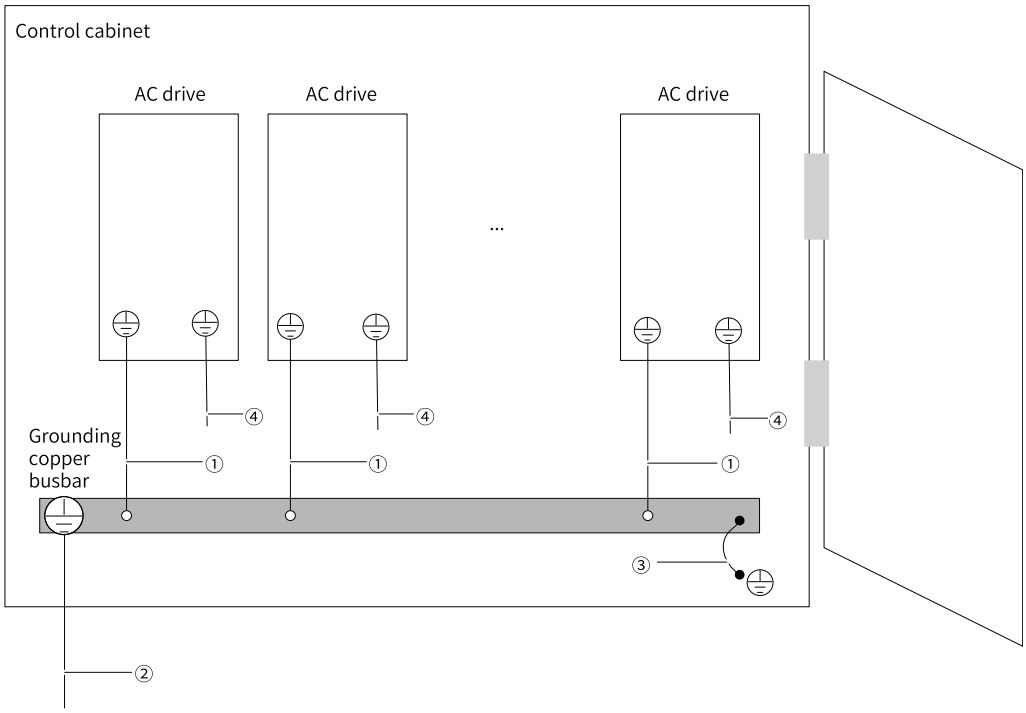


Figure 3-32 Grounding multiple AC drives installed in parallel

Description for grounding of multiple AC drives installed in parallel	
No.	Description
①	Connect the main circuit input PE terminal to the grounding copper busbar of the control cabinet through the protective grounding conductor.
②	Connect the PE cable on the input power supply end to the grounding copper busbar of the control cabinet.
③	Connect the grounding copper busbar of the control cabinet to the metal enclosure of the control cabinet through the protective grounding conductor.
④	Connect the motor output cable shield to the output PE terminal of the drive.

3.5.7 Power Cable Connection

Pre-wiring check

Check the following items before wiring.

Table 3–3 Pre-wiring checklist

No.	Item	Pass
1	Cables used during wiring comply with the requirements on the cross sectional area and the shield.	☐
2	The device and the AC drive are grounded properly.	☐
3	Proper electrostatic discharge (ESD) procedures are followed and antistatic wrist straps are worn.	☐

Wiring procedure:

Before connecting power cables, disable the power supply input. Take the following steps.

1. Remove upper access cover of the AC drive in the direction indicated by the arrow, as shown in figure ①.
2. Remove the power terminal protection board in the direction indicated by the arrow, as shown in figure ②.
3. Connect the cables to the input terminals (R, S, T) and output terminals (U, V, W) of AC drive. If an external braking resistor is required, connect the cables to the BR and + terminals of the AC drive. Secure the cables with the recommended torque in *" Power Cable Specifications" on page 1212*.

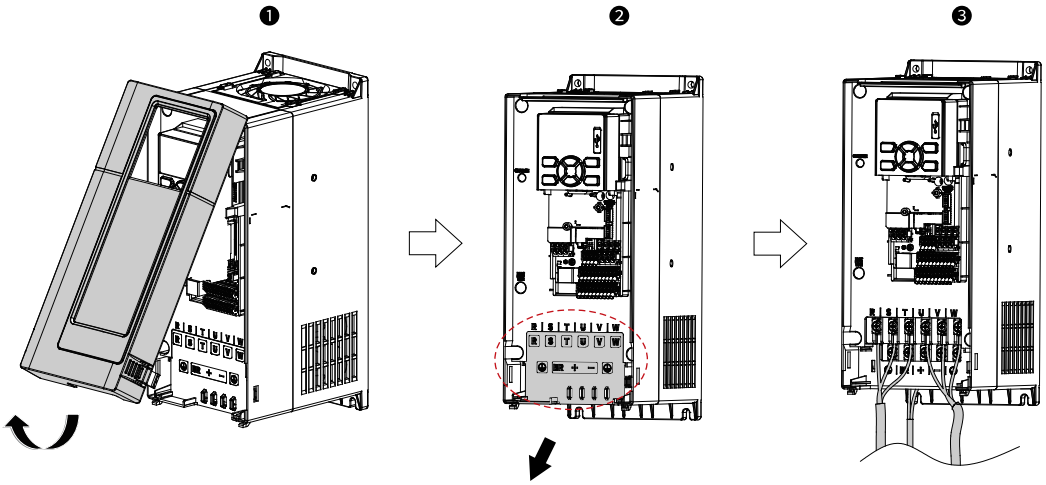


Figure 3-33 Connecting the power cables

3.6 Control Circuit Connection

3.6.1 Descriptions of Control Circuit Terminals

Terminal layout of standard models

The following section takes the MD630-INT model with standard STO function as an example.

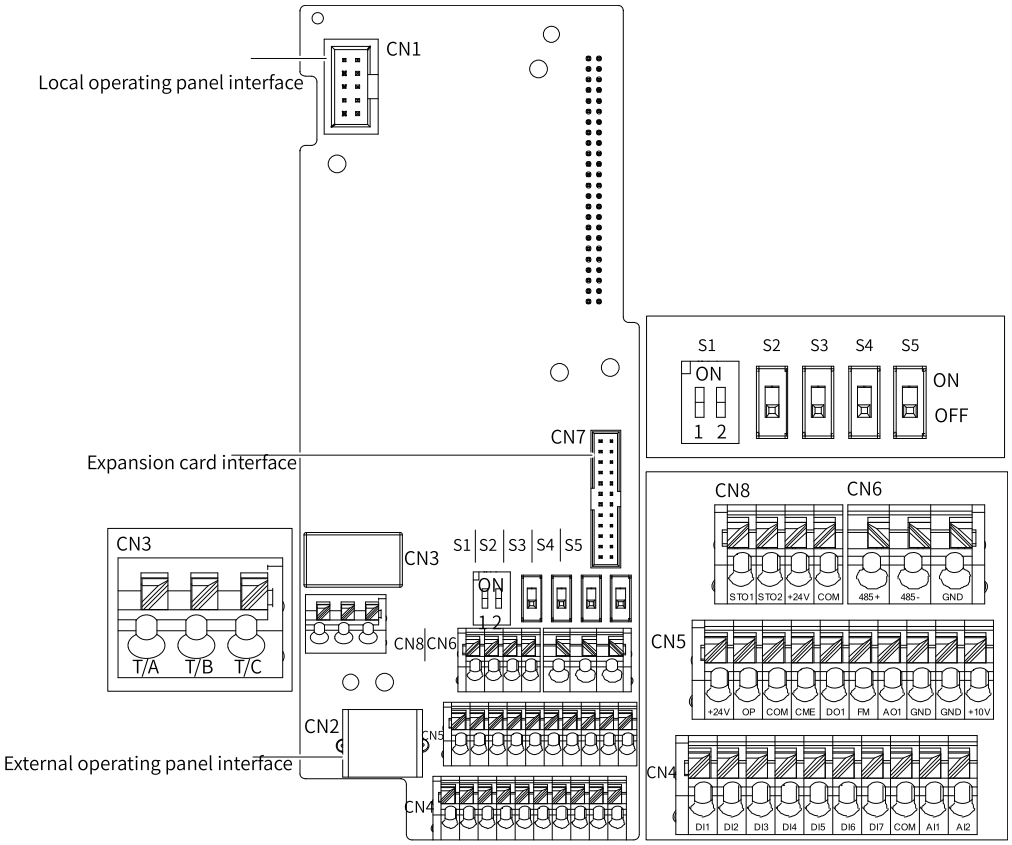


Figure 3-34 Layout of control circuit terminals of standard models

Table 3–4 Descriptions of control circuit terminals of standard models

External Terminal	Type	Transmission Information Type	Mark	Terminal Name	Function
CN1	2x5P economy header connector	Local operating panel interface	-	-	-
CN2	RJ45 terminal	External operating panel interface	-	-	The LCD keyboard (SOP20) can be connected through this terminal.
CN3	Crimping terminal block with three terminals, 3.5 mm	Relay output	T/A	Common terminal	Contact drive capacity (T/A to T/B, or T/A to T/C): 3 A/250 V AC, COS Ø = 0.4 3 A/30 VDC
			T/B	Normally closed (NC) terminal	
			T/C	Normally open terminal	

External Terminal	Type	Transmission Information Type	Mark	Terminal Name	Function
CN4	Crimping terminal block with ten terminals, 3.5 mm	DI/AI	DI1	DI 1	Photocoupler isolation; compatible with dual-polarity input. • Input impedance: 3.5 kΩ • Maximum input frequency: 100 Hz • The working voltage ranges from 15 V to 30 V. The voltage lower than 5 V is invalid and the voltage higher than 15 V is valid.
			DI2	DI 2	
			DI3	DI 3	
			DI4	DI 4	
			DI5	DI 5	
			DI6	DI 6	
			DI7	DI 7	Besides features of DI1 to DI6, it can also be used for high-speed pulse input. • Input impedance: 1.49 kΩ • Maximum input frequency: 20 kHz • The working voltage ranges from 15 V to 30 V. The voltage lower than 5 V is invalid and the voltage higher than 15 V is valid.
			COM	DI reference ground	Internally isolated from GND
			AI1	Analog input 1	The input signal type is selected through the DIP switch S4: • S4 = OFF: -10 V to +10 V (default) • S4 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after correction: 0.3%; response time: < 2 ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
			AI2	Analog input 2	The input signal type is selected through switch S2 and S3: • S2&S3=OFF: -10V to +10V (default); • S2=ON & S3=OFF: 0 mA to 20 mA; • S2=OFF & S3=ON: Temperature sampling; • PT100 (-25℃ to +200℃, ±8℃) • PT1000 (-25℃ to +200℃, ±8℃) • KTY84-130 (-40℃ to 260℃, ±15℃) • PTC130 (-20℃ to 180℃, ±15℃) The voltage/current input specification is the same as AI1. When switching to temperature sampling input, the corresponding thermistor type must be selected through E2-73:

External Terminal	Type	Transmission Information Type	Mark	Terminal Name	Function
CN5	Crimping terminal block with ten terminals, 3.5 mm	Power supply/ DO/AO	+24V	24 V digital power supply output	Provides external 24 V power supply for DI/DO and external sensors. The maximum output current is 200 mA [Note 1].
			OP	Digital input common terminal	Shorted to +24 V through a jumper by default. When the DI is powered up by an external power supply, the jumper must be removed.
			COM	24 V digital power supply reference ground	Internally isolated from GND
			CME	Digital output common terminal	Shorted to COM through a jumper by default. When the DO is powered up by an external power supply, the jumper must be removed.
			DO1	Digital output 1	Photocoupler isolation; unipolar open collector output; maximum output frequency: 100 Hz. Direct connection of DO to the power supply is prohibited and it must be used in series with a load. Output voltage range: 0 to 24 V Output current range: 0 mA to 50 mA
			FM	High-speed pulse output	Set by the parameter E5-00. The default setting is HDO pulse output (E5-00 = 0), with a maximum frequency of 100 kHz. When E5-00 = 1, it is used as normal DO. The specification is the same as DO1.
			AO1	Analog output 1	The output signal type is selected through the DIP switch S5: • S5 = OFF: 0 V to 10 V (default) • S5 = ON: 0 mA to 20 mA 12-bit resolution; correction accuracy: 0.5%; maximum load output current in voltage mode: 2 mA; load impedance in voltage mode: > 5 kΩ; load impedance in current mode: < 500 Ω
			GND	Analog reference ground	Internally isolated from COM
			GND	Analog reference ground	Internally isolated from COM
			+10V	10 V analog power supply output	Provides 10 V analog power supply for external potentiometer with the resistance ranging from 1 kΩ to 5 kΩ.

External Terminal	Type	Transmission Information Type	Mark	Terminal Name	Function
CN6	Crimping terminal block with three terminals, 3.5 mm	RS485 communication	485+	RS485 differential signal (+)	Maximum baud rate: 115200 bps Maximum communication distance: 1 km Maximum number of nodes: 247
			485-	RS485 differential signal (-)	
			GND	RS485 differential pair reference ground	
CN7	2x512P economy header connector	Extension port	-	-	(Reserved)
CN8	Crimping terminal block with four terminals, 3.5 mm	STO functional safety	STO1	STO input 1	By default, STO1/STO2/+24 V is shorted. If you need to use external function safety wiring, remove the jumper and connect the STO terminal correctly.
			STO2	STO input 2	
			+24V	STO power supply	
			COM	STO reference ground	

Note

Note 1: The +24 V power supply on the control board and I/O expansion card (reserved function) is the same. When using the +24 V power supply of the AC drive, note that the total load current cannot exceed 200 mA.

Table 3–5 Descriptions of control circuit DIP switch of standard models

Name	Description
S1	DIP switch for RS485 termination and bias resistor selection • When both are ON, the 485 ± signal is terminated and offset. • When both are OFF (default), the 485 ± signal is not terminated or offset. **Note: S1 is a two-position DIP switch, which must be both ON or OFF at the same time.**
S2/S3	The DIP switch for AI2 input mode selection. • When S2=OFF/S3=OFF (default), AI2 is the voltage input mode, and the input range is -10 V to +10 V. • When S2=ON/S3=OFF, AI2 is the current input mode and the input range is 0 mA to 20 mA. • When S2=OFF/S3=ON, AI2 is the temperature sampling mode, supporting PT100/PT1000/KTY84-130/PTC130 and other thermistors. Select the corresponding thermistor type through parameter E2-73. **Note: Do not turn S2/S3 to ON at the same time. Failure to comply will result in abnormal AI2 function.**

Name	Description
S4	The DIP switch for AI1 input mode selection. • When S4=OFF (default), AI1 is the voltage input mode, and the input range is -10V to +10V. • When S4=ON, AI1 is the current input mode and the input range is 0 mA to 20 mA.
S5	The DIP switch for AO1 input mode selection. • When S5=OFF (default), AO1 is the voltage output mode, with an output range of 0 V to 10 V. • When S5=ON, AO1 is the current output mode, with an output range of 0 mA to 20 mA.

Terminal layout of bus type models

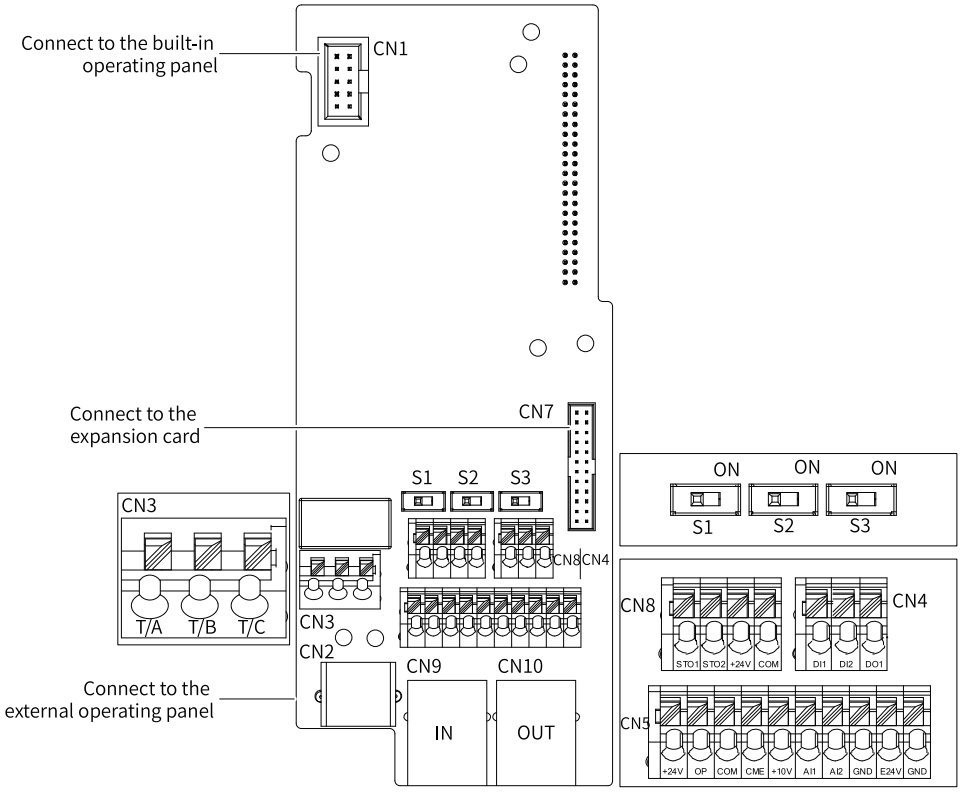


Figure 3-35 Layout of control circuit terminals of bus type models

Table 3–6 Descriptions of bus-type control circuit terminals

External Terminal	Type	Transmission Information Type	Mark	Name	Function
CN1	2x5P economy header connector	Local operating panel interface	-	-	-
CN2	RJ45 terminal	External operating panel interface	-	-	The LCD operating panel can be connected through this terminal (reserved function)

External Terminal	Type	Transmission Information Type	Mark	Name	Function
CN3	Crimping terminal block with three terminals, 5 mm	Relay output	T/A	Common terminal	Contact drive capacity (T/A to T/B, or T/A to T/C): 3A/250 VAC, COSØ = 0.4 3 A/30 VDC
			T/B	Normally closed (NC) terminal	
			T/C	Normally open (NO) terminal	
CN4	Crimping terminal block with three terminals, 3.5 mm	DI/DO	DI1	DI 1	Photocoupler isolation, compatible with dual-polarity input: • Input impedance: 3.5 kΩ • Maximum input frequency: 100 Hz • The working voltage ranges from 15 V to 30 V. The voltage lower than 5 V is invalid and the voltage higher than 15 V is valid.
			DI2	DI 2	
			DO1	Digital output 1	Photocoupler isolation; dual-polarity open collector output; maximum output frequency: 100 Hz; It is forbidden to connect the DO directly to the power supply, and a load must be connected in series for use. • Output voltage range: 0 to 24 V • Output current range: 0 mA to 50 mA

External Terminal	Type	Transmission Information Type	Mark	Name	Function
CN5	Crimping terminal block with ten terminals, 3.5 mm	Power supply/ AI	+24V	24 V digital voltage output	Provides external 24 V power supply for DI/DO and external sensors. The maximum output current is 200 mA [Note 1].
			OP	Digital input common terminal	Shorted to +24 V through a jumper by default. When the DI is powered up by an external power supply, the jumper must be removed.
			COM	24 V digital power supply reference ground	Internally isolated from GND
			CME	Digital output common terminal	Shorted to COM through a jumper by default. When the DO is powered up by an external power supply, the jumper must be removed.
			E24V	External 24 V power supply input	Provides an internal 24 V-GND power supply to provide power to the control board when the power supply is not connected to the drive. Specification of external power converter: 24 V ±10%/>1 A
			AI1	Analog input 1	The input signal type is selected by the DIP switch S3: • S3 = OFF: -10 V to +10 V (default) • S3 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after correction: 0.3%; response time: < 2ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
			AI2	Analog input 2	The input signal type is selected through the DIP switch S1 and S2: • S1 & S2 = OFF: -10 V to +10 V (default) • S1 = ON & S2 = OFF: 0 mA to 20 mA • S1 = OFF & S2 = ON: Temperature sampling The voltage/current input specification is the same as AI1. When switching to temperature sampling input, the corresponding thermistor type must be selected through parameter E2-73: • PT100: -25°C to +200°C, ±8°C • PT1000: -25°C to +200°C, ±8°C • KTY84-130: -40°C to +260°C, ±15°C • PTC130: -20°C to +180°C, ±15°C
			GND	Analog reference ground	Internally isolated from COM
			GND	E24V reference ground	Internally isolated from COM
			+10 V	10 V analog power supply output	Provides 10 V analog power supply for external potentiometers, ranging from 1 kΩ to 5 kΩ Maximum output current: 10 mA

External Terminal	Type	Transmission Information Type	Mark	Name	Function
CN7	2 x 12P simple ejector header	Extension port	-	-	(Reserved)
CN8	Crimping terminal block with four terminals, 3.5 mm	STO functional safety	STO1	STO input 1	By default, STO1/STO2/+24 V is shorted. If you need to use external function safety wiring, remove the jumper and connect the STO terminal correctly.
			STO2	STO input 2	
			+24V	STO power supply	
			COM	STO reference ground	
CN9	RJ45 terminal	100M bus	IN	100 M bus cascaded terminal	EtherCAT, EtherNet/IP, and PROFINET communication protocols are supported. Select the protocol type through N0-10. When EtherCAT is selected, the IN terminal is used. Direction is not distinguished for EtherNet/IP and PROFINET communication protocols.
CN10	RJ45 terminal	100M bus	OUT	100 M bus cascaded terminal	EtherCAT, EtherNet/IP, and PROFINET communication protocols are supported. Select the protocol type through N0-10. When EtherCAT is selected, the OUT terminal is used. Direction is not distinguished for EtherNet/IP and PROFINET communication protocols.

Note

Note 1: The +24 V power supply on the control board and I/O expansion card (reserved function) is the same. When using the +24 V power supply of the AC drive, note that the total load current cannot exceed 200 mA.

Table 3–7 Description of the bus-type control circuit DIP switch

Name	Description
S1/S2	AI2 input mode selection DIP switch • When S1 = OFF/S2 = OFF (default), AI2 is the voltage input mode, and the input range is -10 V to +10 V. • When S1 = ON/S2 = OFF, AI2 is the current input mode and the input range is 0 mA to 20 mA. • When S1 = OFF/S2 = ON, AI2 is the temperature sampling mode. It supports PT100/PT1000/KTY84-130/PTC130 and other thermistors. Select the corresponding thermistor type through parameter E2-73. **Note: It is forbidden to set S1/S2 to ON at the same time. Failure to do so will result in abnormal AI2 function.**
S3	AI1 input mode selection DIP switch • When S3 = OFF (default), AI1 is the voltage input mode, and the input range is -10 V to +10 V. • When S3 = ON, AI1 is the current input mode and the input range is 0 mA to 20 mA.

3.6.2 I/O Wiring

DIP switches for different functions

Model	Voltage/Current Mode for AI1	Voltage/Current Mode for AI2	Temperature Mode for AI2
MD630S-INT	S4	S2	S3
MD630N-INT	S3	S1	S2

AI1 terminal wiring

S4	Mode	Description
OFF	Wiring in voltage mode for AI1	AI1 is normally used as an external potentiometer input.
ON	Wiring in current mode for AI1	AI1 input terminal features an input impedance of 500 Ω and supports 0 mA to 20 mA current input.

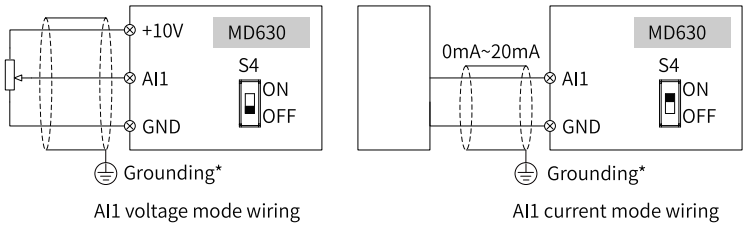


Figure 3-36 Wiring diagram for AI1 terminal (MD630S-INT as an example)

AI2 terminal wiring

S2	S3	Mode	Description
OFF	OFF	Wiring in voltage mode for AI2	-
ON	OFF	Wiring in current mode for AI2	-
OFF	ON	Wiring in temperature mode for AI2	AI2 terminal supports external temperature sensor input based on the steps below: 1 .Connect two-wire temperature sensors (PT100/PT100/KTY84-130/PTC130) to terminals AI2 and GND. 2 .Select the DIP switch position as required. 3 .Set the correct temperature sensor type in parameter E2-73.

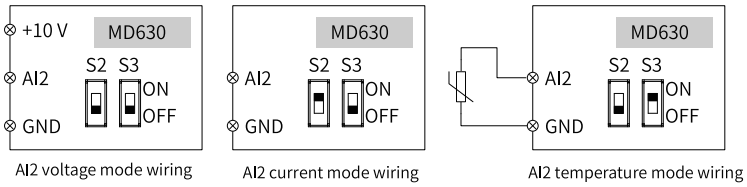


Figure 3-37 Wiring diagram for AI2 terminal (MD630S-INT as an example)

CAUTION

The type of AI1/AI2 input signal must correspond to the DIP switches. Failure to comply can result in analog input exception.

AO terminal wiring

S5	Mode
OFF	Wiring in voltage mode for AO
ON	Wiring in current mode for AO

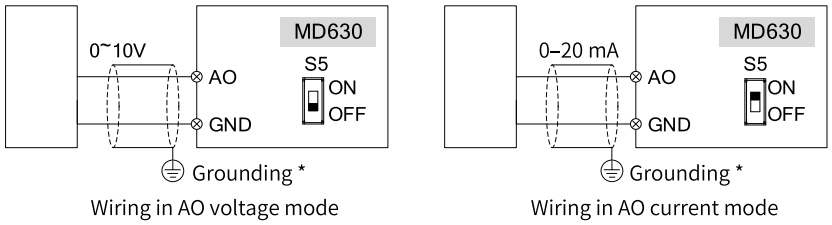


Figure 3-38 Wiring diagram for AO terminal

Anti-interference processing for analog signals

Analog signals are prone to external interference. Therefore, a shielded cable is recommended, and the wiring distance must be as short as possible (no longer than 20 m). Crimp the lead wire to the grounding bracket, as shown below.

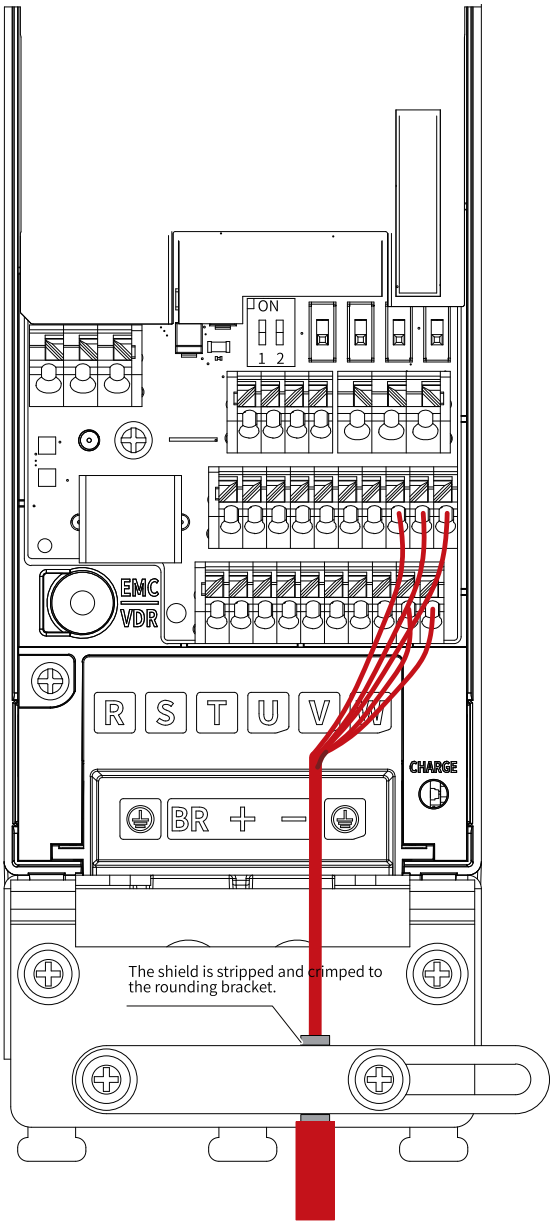


Figure 3-39 Grounding the shielded analog input cable

In applications where the analog signal is severely interfered, it is necessary to install a filter capacitor or ferrite magnetic core at the analog signal cable on the AC drive side.

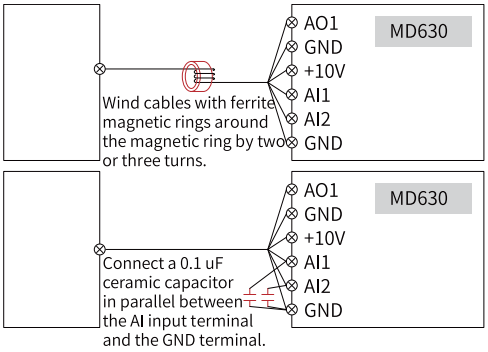


Figure 3-40 Filtering of the analog signal cable

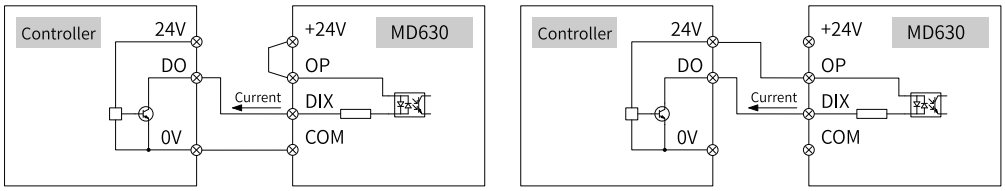
DI terminal wiring

The digital input of the drive supports bi-directional current input. That is, it is compatible with input logic of sink and source modes. Use the following methods to quickly identify the logic of sink and source modes.

- In sink logic mode (active-low), the output transistor of the external controller is grounded to the reference ground, and current flows out of the DI terminal of the drive to switch on the internal optocoupler.
- In source logic mode (active-high), the output transistor of the external controller is grounded to the power supply, and current flows in from the DI terminal of the drive to switch on the internal optocoupler.

Sink wiring

The drive adopts internal 24 V sink wiring mode by default, indicating that the OP terminal is shorted to the +24V terminal through a jumper. If an external 24 V power supply is used, remove the jumper between the +24V and OP terminals. Then, connect the external power supply to the the OP terminal. The current flows out of the DI and flows back to 0V of the external power supply through the external controller contact.

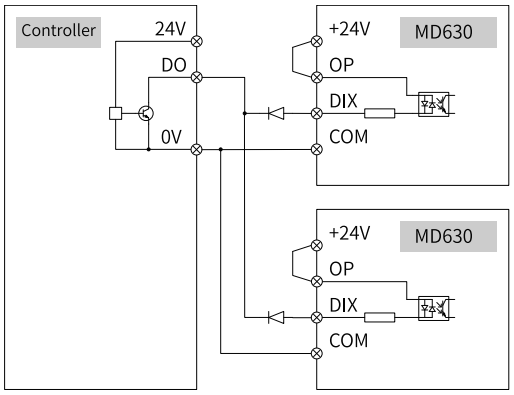


Multi-drive DI parallel sink wiring method with an internal 24 V power supply

Multi-drive DI parallel sink wiring method with an external 24 V power supply

Figure 3-41 Diagram of DI sink wiring

When the DI terminal is powered up by an internal power supply of the drive and the DI terminals of multiple drives are controlled through one output port of the controller, the DI terminals of different drives cannot be connected in parallel. Otherwise, the DI terminals may malfunction. If parallel connection is required, connect a diode (IF > 40 mA, VR > 40 V) in series to the DI terminal, as shown below.

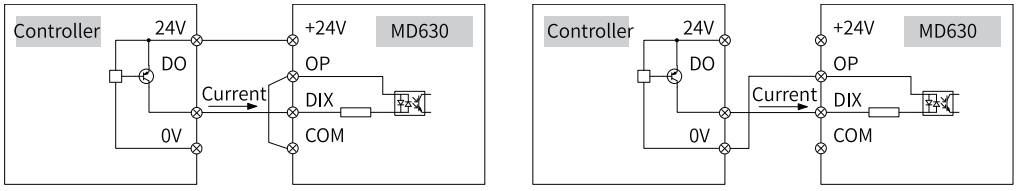


Multi-drive DI parallel sink wiring method
with an internal 24 V power supply

Figure 3-42 Diagram of DI sink wiring in parallel connection

Source wiring

When the drive adopts internal 24 V source wiring mode, it is necessary to install a jumper between the OP and COM terminals, and connect +24 V to the common terminal of the controller. If an external 24 V power supply is used, remove the jumper between the +24V and OP terminals, and connect the 0V terminal of the external power supply to the OP terminal of the drive. The current flows in from the DI to 0V of the external power supply via the internal optocoupler.



Source wiring with an internal 24 V power supply

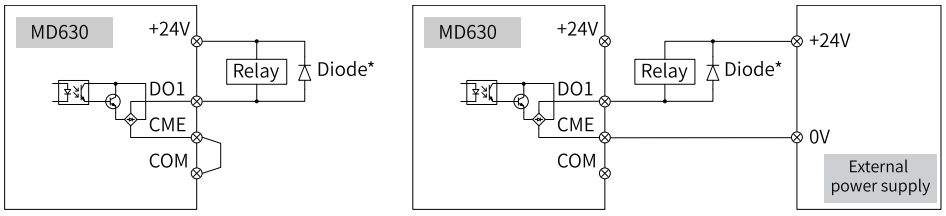
Source wiring with an external 24 V power supply

Figure 3-43 Diagram of DI source wiring

DO terminal wiring

The DO terminal of the drive is powered by the internal 24 V power supply by default. The CME is shorted to COM through a jumper by default. When an external 24 V power supply is used, remove the jumper between CME and COM.

When the DO terminal needs to drive the relay, install a snubber diode at two sides of the relay coil. Otherwise, the DO port may be damaged. The recommended rated current of the relay must be lower than 50 mA.



Wiring through a DO drive controller with an internal 24 V

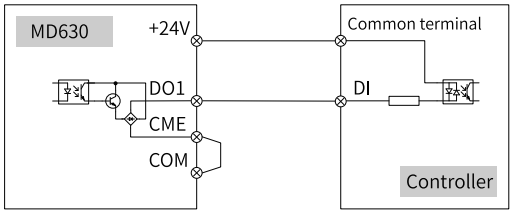
Wiring through a DO drive controller with an external 24 V

Figure 3-44 Wiring diagram of the relay driven by DO

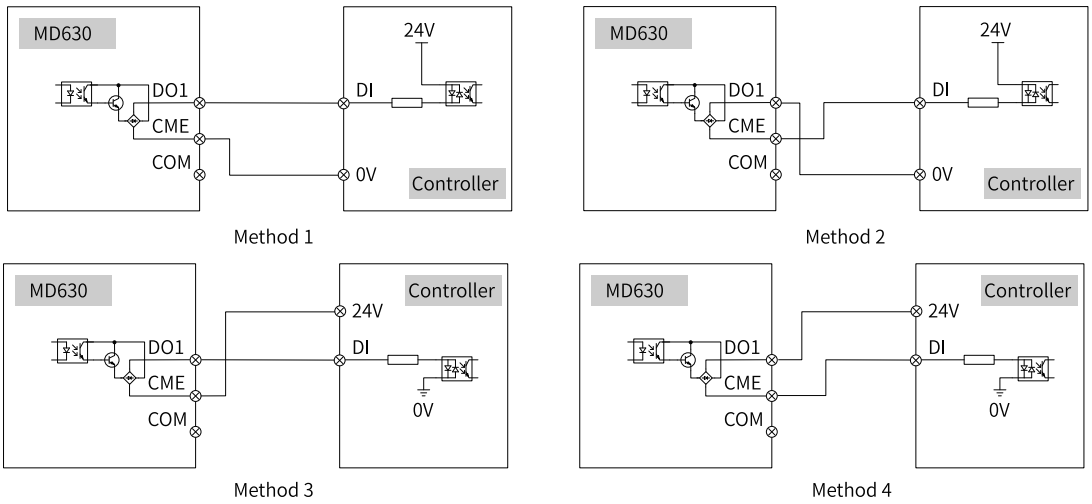
CAUTION

Diode*: Ensure that the polarity of the snubber diode is properly installed; otherwise, the power supply will be damaged due to overcurrent once the internal transistor of DO terminal is switched on.

The DO1 terminal of the drive supports bi-directional output and the following five wiring modes.



Wiring through a DO drive controller with an internal 24 V



Wiring through a DO drive controller with an external 24 V power supply

Wiring of the high-speed digital output terminal FM

The FM terminal of the drive supports only open-drain output. The current flows in from the FM terminal through internal transistor to the reference ground via the COM port. When the FM terminal is set to FMP continuous pulse output through E5-00, the allowed maximum frequency is 100 kHz.

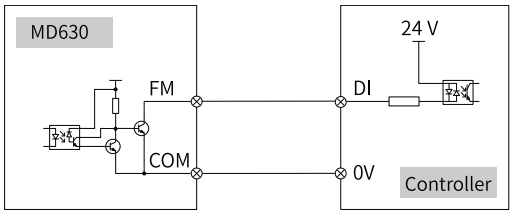


Figure 3-45 Wiring diagram of the FM terminal

3.6.3 Electrical wiring of relay output

Inductive loads (relays, contactors, and motors) may cause voltage spikes when the current is cut off. When the peak voltage exceeds the relay rating, the relay contact may be permanently damaged. It is recommended to connect voltage-sensitive resistors in parallel at both ends of the relay output contacts or install absorption circuits such as voltage-sensitive resistors and RC absorption circuits on inductive loads. The diode reduces the voltage spike generated when the load is switched off, as shown in the following figure.

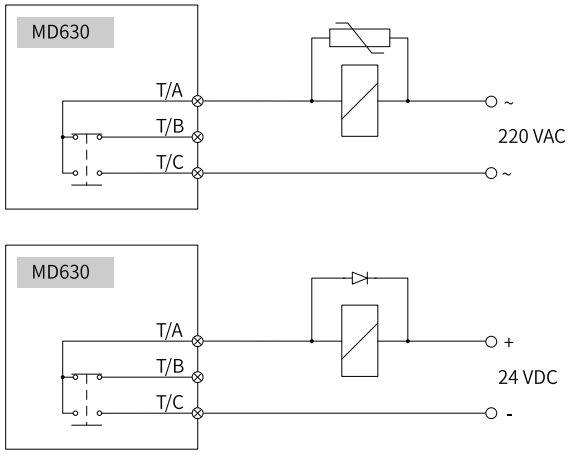


Figure 3-46 Wiring diagram of relay output terminals

3.6.4 Wiring STO Terminals

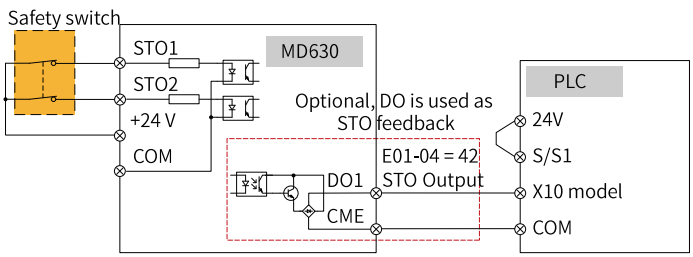


Figure 3-47 STO wiring diagram (internal 24 V)

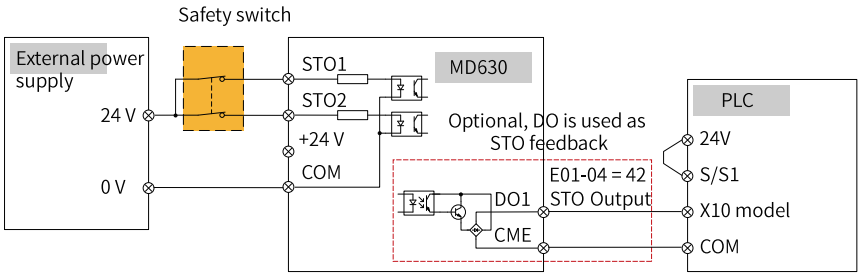


Figure 3-48 STO wiring diagram (external 24 V)

Figure 3-49 Use the PNP output of the external controller as the STO input wiring diagram

Electromagnetic compatibility requirements for STO wiring:

- Ensure that the cable between the drive and safety switch is no longer than 30 m.
- It is recommended to use double-shielded or single-shielded multi-pair cables and crimp the STO cable shield to the grounding bracket to enhance the resistance of the STO cable to electromagnetic interference.

3.6.5 Recommended Control Cables

For control cable requirements, see *" Cable Requirements for Control Circuit" on page 1214*.

3.6.6 Connecting Control Cable

Pre-wiring check

Check the following items before wiring.

Table 3–8 Pre-wiring checklist

No.	Item	Pass
1	Cables used during wiring comply with the requirements on the cross sectional area and the shield.	☐
2	The device and the AC drive are grounded properly.	☐
3	Proper electrostatic discharge (ESD) procedures are followed and anti-static wrist straps are worn.	☐

Connecting the Control Cable

1. Remove the front cover in the direction indicated by the arrow, as shown in figure ①.
2. Locate the terminals that need to access according to *" Descriptions of Control Circuit Terminals" on page 81*. Insert the cables into the terminals and confirm whether the connection is secure, as shown in Figure ②.
   It is recommended to use cable crimping terminals for secure connections. However, if wire cables are used instead, an additional step is required: pressing the terminal button as shown in the figure ③.

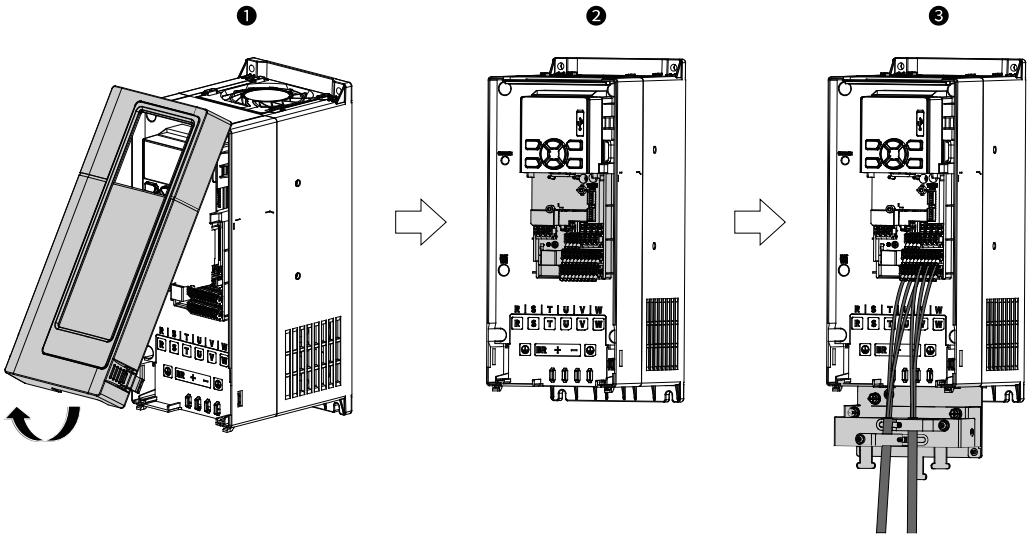


Figure 3-50 Connecting the control cable

I/O connection

For the IO connection diagram, see *"3.2 Electrical Connection" on page 62*, and for details of all supported IO connections of this series AC drives, see *"3.6.2 I/O Wiring" on page 90*.

For the communication details and wiring procedures supported by this series of AC drives, see *" Communication" on page 842*.

3.7 Post-Wiring Check

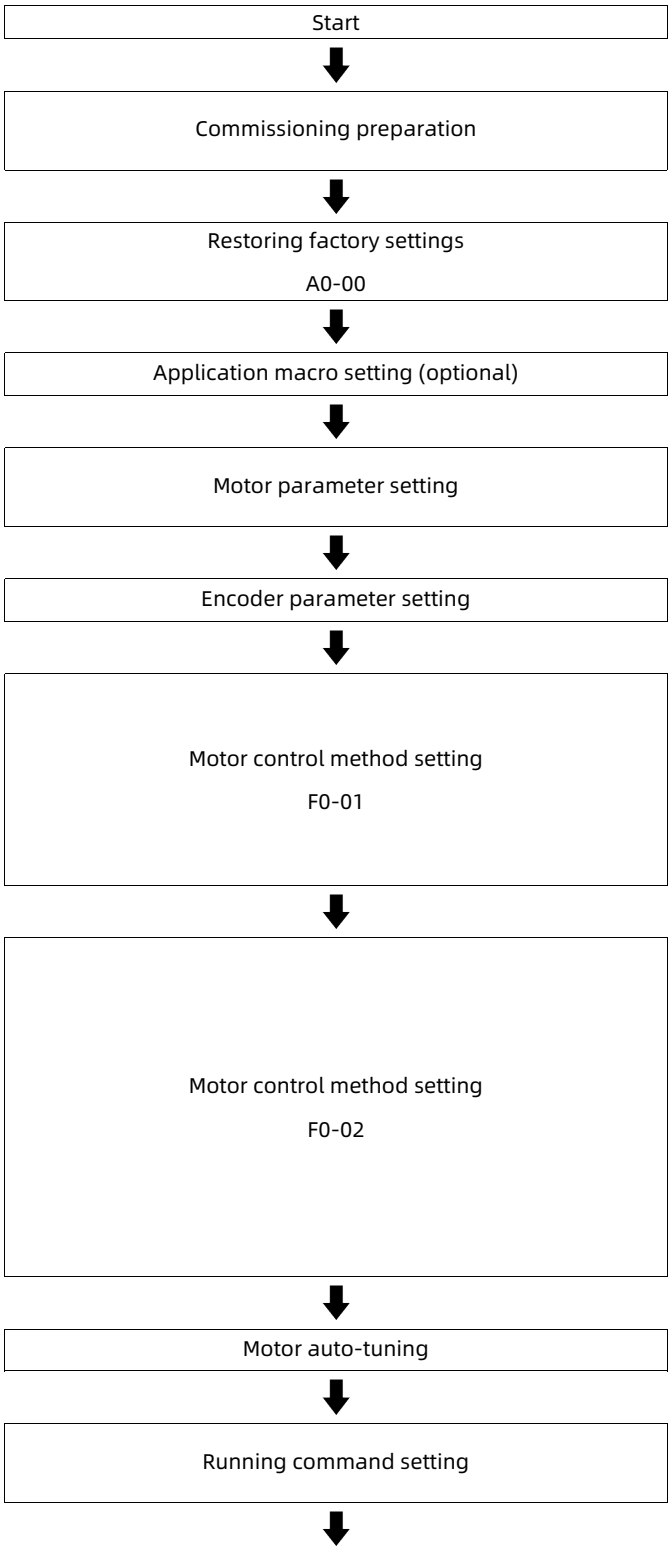
After wiring is completed, check the following items and tick compliant items.

No.	Item	Passed
1	The power supply input cables are connected to the R, S, and T terminals.	☐
2	The motor input cables are connected to the U, V, and W terminals.	☐
3	The dimensions of the main circuit cables meet the requirements.	☐
4	Check that the heat-shrinkable tubes have been applied to the cable lug copper tubes and fully cover the cable conductor of the main circuit.	☐
5	The motor output cable does not exceed 50 m. Otherwise, the carrier frequency needs to be reduced through F2-50.	☐
6	The ground cables are connected correctly.	☐
7	The output terminals and control signal terminals are securely fastened.	☐
8	The braking resistor and braking unit are wired properly. The power of braking resistor and resistance are in the proper range.	☐
9	The control circuit signal cables are shielded twisted pair cables.	☐
10	The control circuit cables are routed separately from the main circuit power cables (the control circuit cables should not be wound together with the main circuit power cables). If it is not possible to route separately, choose the cross-wire routing.	☐
11	There are no screws, gaskets, or exposed cables left inside the product.	☐

4 Commissioning and Trial Run

4.1 Quick Commissioning Guide

Commissioning flowchart



“ Commissioning preparation” on page 119

“ A0-00” on page 101

“ Application Macro” on page 386

“4.4.1 Setting Motor Parameters” on page 123

“ Set Encoder Parameters” on page 125

“ F0-01 (d0 -00)” on page 102

When motor type is set to permanent magnet synchronous motor, the SVC mode is recommended.

The V/f control mode is the only choice if one AC drive needs to drive multiple motors.

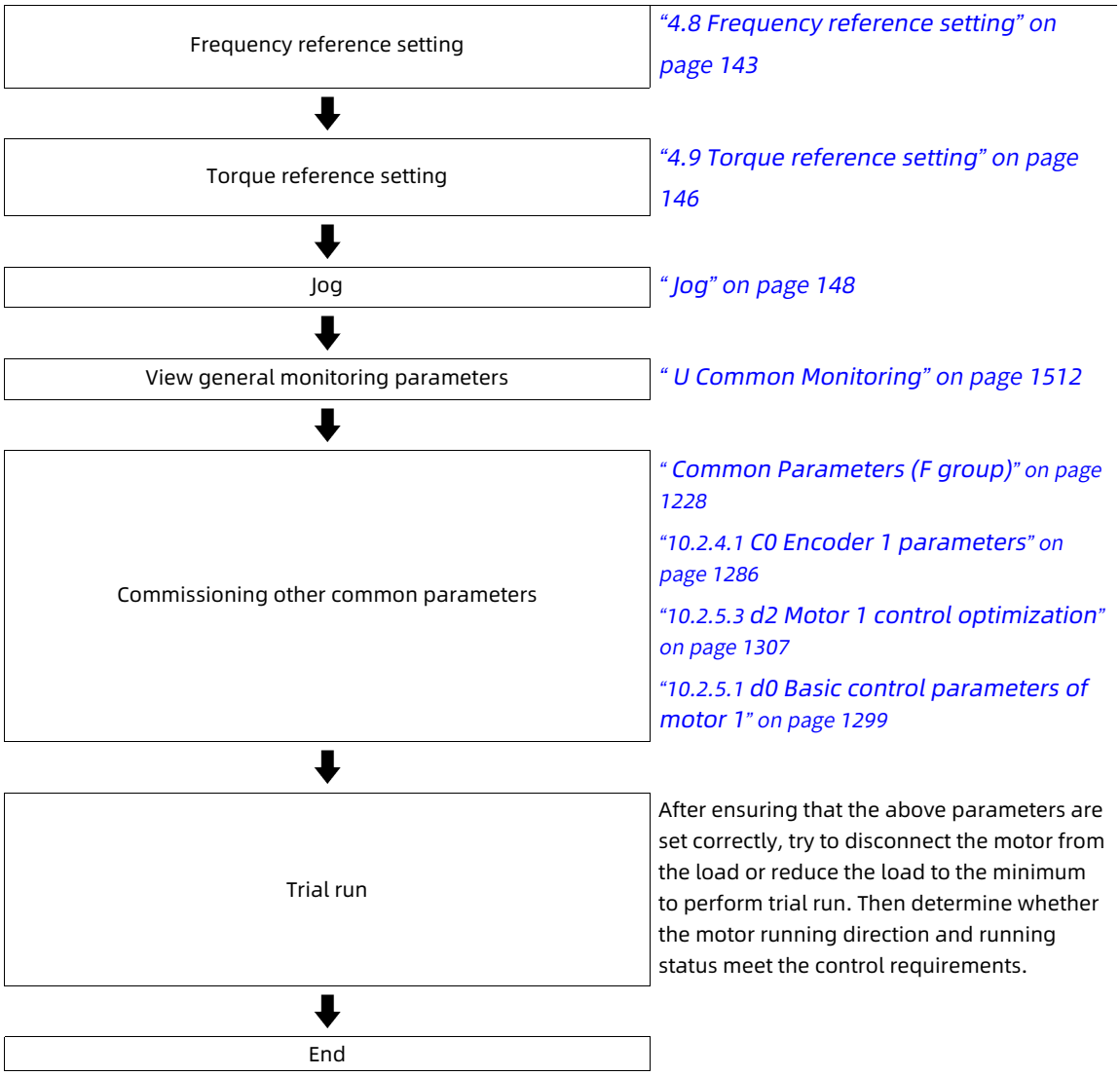
“ F0-02 (d0 -01)” on page 102

If the motor control method is set to the V/f, only the speed control mode is supported.

If the torque control mode is applied under normal operating conditions, switch to the speed control mode during initial commissioning for motor auto-tuning. After the auto-tuning is completed and running direction is adjusted, switch to the torque control mode again.

“ Motor Auto-Tuning” on page 131

“4.7 Running command setting” on page 141


Frequency reference setting
"4.8 Frequency reference setting" on page 143
Torque reference setting
"4.9 Torque reference setting" on page 146
Jog
" Jog" on page 148
View general monitoring parameters
" U Common Monitoring" on page 1512
Commissioning other common parameters
" Common Parameters (F group)" on page 1228
"10.2.4.1 C0 Encoder 1 parameters" on page 1286
"10.2.5.3 d2 Motor 1 control optimization" on page 1307
"10.2.5.1 d0 Basic control parameters of motor 1" on page 1299
Trial run
After ensuring that the above parameters are set correctly, try to disconnect the motor from the load or reduce the load to the minimum to perform trial run. Then determine whether the motor running direction and running status meet the control requirements.
End

Related parameters

Parameter	Name	Default	Value Range	Descriptions
A0-00	Parameters Initialization	0: No operation	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records	0: No operation 1: Restore parameters (excluding motor parameters) to factory settings. AC drive parameters except factory parameters, motor parameters, and records are restored to default settings. 2: Clear records. Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared. 3: Restore parameters (including motor parameters) to factory settings. Except the factory parameters and records, all other parameters of the AC drive are restored to factory settings. This differs from mode 1 in that the motor parameters are also restored. 4: Back up current user parameters. The current parameter settings are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear fault information. The fault information recorded in group H6 to Hb is cleared. 501: Restore user parameters from backup. Parameters backed up by setting A0-00 to 4 are stored, which is the same as the function when A0-38 is set to 500. 503: Restore parameters (including motor parameters) to factory settings and clear records. Except the factory parameters, all other parameters of the AC drive are reset to the factory settings. This differs from mode 3 in that the records are cleared. The factory parameters include model parameters and factory AI/AO correction parameters. The records include fault records, cumulative running time, and cumulative power-on time.

Param.	Name	Default	Value Range	Descriptions
F0-01 (d0-00)	Motor control mode	2	0：SVC 1：FVC 2：V/f	It is used to set the motor control mode based on the application scenario and motor type. F0-01 is the mapping of d0-00 (Motor control mode) in group F. The two parameters have the same function. 0: SVC, which stands for sensorless vector control. It is an open-loop vector control mode, which is applicable to high-performance control applications. In this case, one AC drive can drive only one motor. This mode applies to such loads as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in the SVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. 1: FVC - It is a closed-loop vector control mode. The motor must be configured with an encoder and the AC drive must be installed with a PG card matching the encoder type. This mode is applicable to high-accuracy speed control or torque control applications, where one AC drive can drive only one motor. It is used for loads such as high-speed papermaking machinery, hoisting machinery, and elevators. Parameter auto-tuning is required in the FVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. 2：V/f (speed open loop control) - It is an open loop control mode based on constant voltage/frequency ratio. This mode is applicable to scenarios without high requirements on load control performance, such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simply and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.

Param.	Name	Default	Value Range	Descriptions
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	This parameter set the motor control target according to the actual operating conditions. F0-02 is the mapping of d0-01 [motor control target] in group F. The settings of these two parameters are equivalent. 0: Speed control - Speed is the control target. 1: Torque control - Torque is the control target. 3 to 9: DI1 to DI7 - The control target depends on the DI state. 0 means speed control and 1 means torque control. Others: B connector - The control target depends on the state of B connector. 0 means speed control and 1 means torque control. Torque control is invalid in the V/f mode. The MD630 is in the speed control mode even if the torque control mode is set in the V/f mode.

4.2 Commissioning Tools

The MD630 supports two types of commissioning tools: local operating panel equipped with MD630 (hereinafter referred to as the operating panel) and the iFA Drive commissioning software.

Table 4–1 Commissioning tool list

Tools	Description	Application Scenario
Operating panel	The local operating panel is the standard operating panel equipped with MD630-INT. • It provides functions such as status and data display, parameter settings, and fault information prompts. • It is installed on the product body by default and does not support extension.	Suitable for single-machine commissioning scenario.
iFA Drive commissioning software	iFA Drive is independently developed by Inovance and Inovance fully owns the intellectual property rights to it. It is commissioning software for Inovance general products, and can be used for control, commissioning, fault diagnosis, and operation status monitoring on products. The supported Inovance devices such as AC drives, servo drives, and electrohydraulic servo drives. supports parameter setting and waveform acquisition.	Suitable for complex commissioning scenarios with a PC.

4.2.1 Operating Panel

4.2.1.1 Overview

The operating panel of the MD630S includes LED and keys, with the following functions:

- Parameter display: The LED displays parameters, various monitoring data, and fault codes. The indicators indicate the current status and the unit of parameters.
- Parameter setting: In each level of menu, the data bit you are operating on will flash. You can use the up and down keys to increase or decrease numerical values, and the left and right keys to switch between the bits you are operating on.
- Status monitoring: When the AC drive is stopped or running, the operating panel displays the different status of the AC drive according to the parameter settings (A6-03 to A6-05).

4.2.1.2 Components

The operating panel is shown in the following figure, including the status display area, parameter display area, and key area.

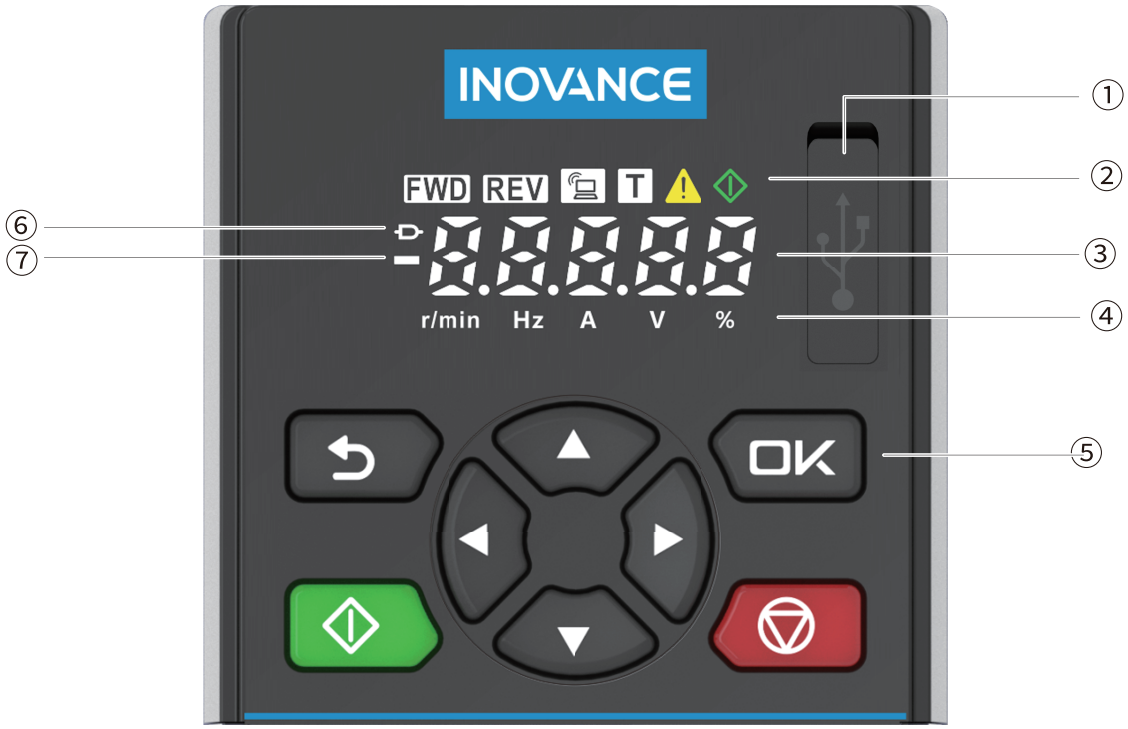


Figure 4-1 Operating panel

Table 4–2 Description of the operating panel

No.	Name	Description
①	Check interface	Used for commissioning the AC drive. The supported commissioning tool is the iFA commissioning software.
②	Status display area	It displays the running state of the AC drive. For details, see *"Table 4-3 Status description" on page 104*.
③	Function code display area	It displays the parameters of the AC drive. For details, see *"4.2.1.3 Display on the Operating Panel" on page 105*.
④	Unit display area	It displays the unit of the current data.
⑤	Key area	For details, see *"Table 4-4 Key descriptions" on page 105*.
⑥	Connector model	Steady ON: Displays the connector parameters.
⑦	Minus sign	Steady ON: Indicates that the current parameter is a negative value or indicates the opposite direction of the content displayed.

Table 4–3 Status description

Symbol	Name	Function description	Description of the status
FWD	FWD	Forward run	Steady on: The AC drive is running forwardly or the forward running mode is set.
REV	REV	Reverse transfer line	Steady on: The AC drive is running reversely or the reverse running mode is set.
	Local/remote	Local/remote connection mode	Off: local control (operating panel) Steady on: Terminal control Flashing: Communication control Flashing quickly: User-defined control mode

Symbol	Name	Function description	Description of the status
	Torque control	Torque control mode	Off: Speed control mode Steady on: Torque control mode
	Alarm	Alarm or fault	Steady on: A fault or an alarm occurs.
	Operation	Running state	Off: The AC drive does not run. Steady on: The AC drive is running.
	Minus sign	Value sign	Steady ON: Indicates that the current parameter is a negative value or indicates the opposite direction of the content displayed.
	Connector	Connector model	Steady ON: Displays connector parameters.

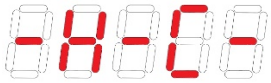
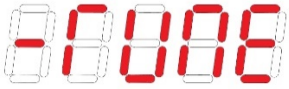
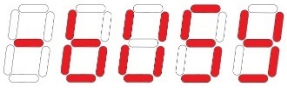
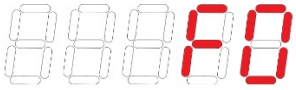
Table 4–4 Key descriptions

Key	Name	Function
	Menu/Back key	• Return to the last interface or undo the operation. • Switch the menu. • Long press the key to enter the multi-function menu.
	Press the key	• Go to Settings/Confirm Settings
	Up key	• Increase the current parameter value.
	Down key	• Decrease the current parameter value.
	SHIFT key	• In the monitoring interface, press the key to switch among monitoring objects. • In the parameter interface, press the key to switch the data bit. • In the multi-function menu interface, press the key to switch among the basic menu, user menu, calibration menu, and error record menu. • In the error record menu, press the key to switch among historical fault records.
	Run key	• In the operating panel control mode, press the key to operate the drive.
	Stop key	• When the drive is running, press the key to stop the drive. • When the drive is in the faulty state, press the key to perform a reset operation.

4.2.1.3 Display on the Operating Panel

The main display area of the operating panel consists of five 8-segment LEDs, which display various monitoring data such as the set frequency and output frequency, as well as the current operating state of the AC drive.

Table 4–5 Panel display

Category	Operating Panel Display	Meaning
Status display		AC drive initialized
		The AC drive is in the auto-tuning state.
		AC drive busy
		The AC drive is in the auto-inspection state.
Parameter display		Parameter group F0
		A0-10
Display of connectors		Connector L2202
Parameter value display		Parameter value 321.5 (Decimal)
		Parameter value 0x000E (Hexadecimal)
Fault display		Fault code E027.1
		Warning code A028.1
		Minor fault code L028.3
		Prompt code N028.2

4.2.1.4 Parameter View and Setting

The LED operating panel adopts a three-level menu to perform operations such as parameter setting. It consists of the following menus:

- Level 1 menu: Function code group
- Level 2 menu: Function code
- Level 3 menu: Function code setting

After entering each level of the menu, when the display bit flashes, you can press and to modify the value of the bit. You can also switch to other display bits by using the and .

In the level 3 menu state, if the parameter is displayed without any blinking bit, this parameter cannot be modified. This may be caused by the following:

- This parameter is non-modifiable, such as product type, actual detection parameters, and running log parameters.
- This parameter cannot be changed in the running state. You need to stop it before you can change it.

You can return to Level II menu from Level III menu by pressing or . The difference between pressing the two keys is:

- After you press , the system saves the parameter setting first, and then goes back to Level II menu and shifts to the next parameter.
- Pressing returns to level-2 menu corresponding to the current parameter without saving the current parameter setting.

Here is the example of setting b5-01 (Digital setting of main frequency) to 30.00 Hz. The basic setting process through the operating panel is as follows.

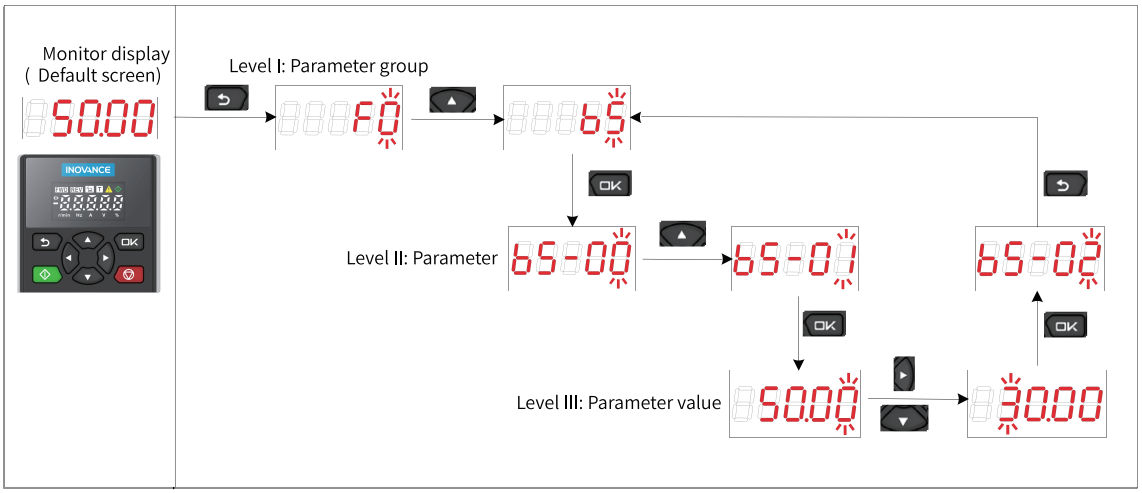


Figure 4-2 Parameter setting

4.2.1.5 Status Monitoring

The operating panel provides a monitoring page to view the status of the AC drive when it is stopped or running.

In this case, the operating panel displays the different status of the AC drive according to the parameter settings (A6-03 to A6-05).

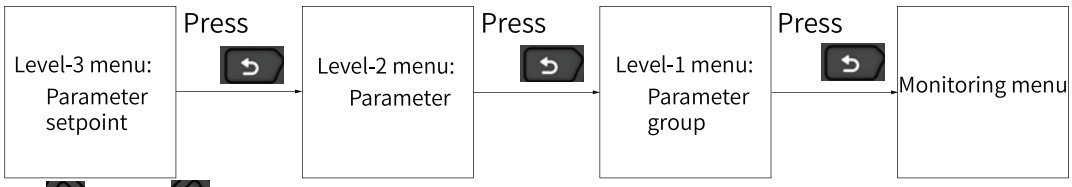
View the monitoring parameters in the stop state

When the AC drive is in the stop state, the set frequency (Hz), bus voltage (V), AI1 voltage (V) are provided by default. AI2 voltage (V) has four monitoring parameters. You can select the monitoring parameters of the stop state through A6-05 (LED keypad stop display parameters).

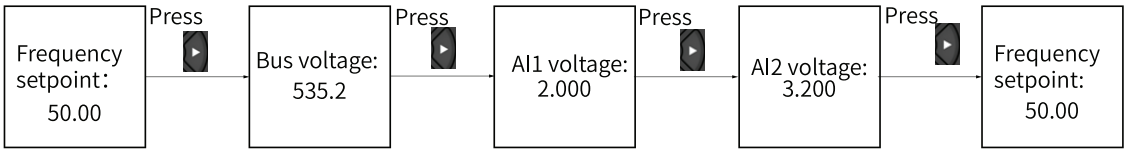
Procedure

1. Go to the monitoring page.
   By default, the operating panel displays the monitoring page. If the operating panel displays 50.00 and flashes, it indicates the monitoring page in the stop state, where 50.00 is the set frequency in the stop state.

   For example, you are in the function code level 3 menu: Function code value, you can press to return to the monitoring page:



2. Press the and keys to switch back and forth through the monitoring parameters to view other states.
   By default, 50.00 is displayed.



   The unit of the current monitored parameter is viewed in the unit display area of the operating panel. *"4.2.1.2 Components" on page 103*

3. If you need to modify the default monitoring parameters in the stop state, modify the corresponding bit of A6-05 (LED keypad stop display parameters).
   If the bit is 1, it can be displayed on the monitoring page of the operating panel. If the bit is 0, it cannot be displayed on the monitoring page of the operating panel. For details, see *"5.6.1 Set Monitoring Parameters Displayed on Operating Panel" on page 761*.

Related parameters

Table 4–6 Simple monitoring parameter selection in the stop state

Parameter	Parameter name	Default value	Value range
A6-05	Parameter displayed on LED operating panel at stop	0x0033	Bit 0: Frequency reference (Hz) Bit 1: Bus voltage (V) Bit 2: DI input status Bit 3: DO output status Bit 4: AI1 voltage (V) Bit 5: AI2 voltage (V) Bit 9: PLC stage Bit 11: PID reference Bit12: HDI input pulse frequency (kHz) (valid only for MD630S) Bit 14: Free mapping 0 Bit 15: Free mapping 1 The bit value is: 0: Not displayed 1: Display

Note

This function code is an extended parameter. You need A0-10 (Current system parameter access level) to be displayed above the extended parameter.

Check the monitoring parameters in the running state

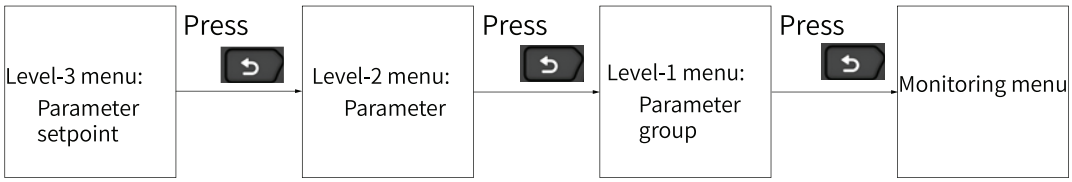
When the AC drive is running, the five monitoring parameters, operating frequency (Hz), the set frequency (Hz), the bus voltage (V), and the output current (V), are provided by default. You can select the monitoring parameters through A6-03 [Parameter 1 displayed on LED operating panel during operation] and A6-04 [Parameter 2 displayed on LED operating panel during operation].

Operation steps:

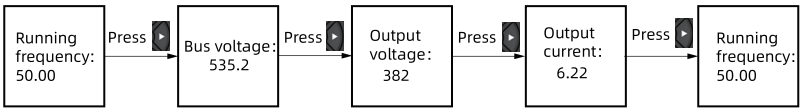
1. If the  on the operator panel is highlighted, the AC drive is running.
2. Enter the monitoring page.

   The operating panel defaults to displaying the monitoring page. When the operating panel shows "50.00" without flashing, it indicates the monitoring page is active and the AC drive is in the running state, with "50.00" representing the current operating frequency.

   For example, when currently in the Level 3 parameter menu: Parameter value, you can press  to return to the monitoring page:



3. Press and keys to cycle through the monitoring parameters and view other statuses.
   By default, 50.00 is the operating frequency.



   The unit of the monitoring parameter is viewed in the unit display area of the operating panel.

4. If you need to modify the default monitoring parameters in the operating state, modify the corresponding bit of the A6-03 and A6-04.
   If the bit value is 1, the monitoring parameters can be displayed on the operating panel. If the bit value is 0, it cannot be displayed.

Related parameters

Table 4–7 Simple monitoring parameter selection in the running state

Param.	Name	Default	Value Range
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	Bit 0: Running frequency (Hz) Bit 1: Frequency reference (Hz) Bit 2: Bus voltage (V) Bit 3: Output voltage (V) Bit 4: Output current (A) Bit 5: Output power (kW) Bit 6: Output torque (%) Bit 7: DI input status Bit 8: DO output status Bit 9: AI1 voltage (V) Bit 10: AI2 voltage (V) Bit 14: Load speed Bit 15: PID reference The bit values are as follows: 0: Hidden 1: Displayed
A6-04	Parameter 2 displayed on LED operating panel during operation	-	Bit 0: PID feedback Bit 1: PLC stage Bit 2: HDI pulse input frequency (kHz) (Only valid for MD630S) Bit 3: Running frequency 2 (Hz) Bit 4: Remaining running time Bit 5: AI1 voltage before correction (V) Bit 6: Free mapping 0 Bit 7: Free mapping 1 Bit 8: Motor speed Bit 9: Current power-on time (min) Bit 10: Current running time (min) Bit 11: Reserved Bit 12: Communication setting value Bit 13: Encoder feedback speed Bit 14: Main frequency X Bit 15: Auxiliary frequency Y The bit values are as follows: 0: Hidden 1: Displayed

Note

This parameter is an extended parameter. A0-10 (Current system parameter access level) shall be above the extended parameter to display the parameter.

4.2.2 Commissioning Software

4.2.2.1 Commissioning Software

Software acquisition

To obtain the latest iFA Drive software, contact Inovance personnel.

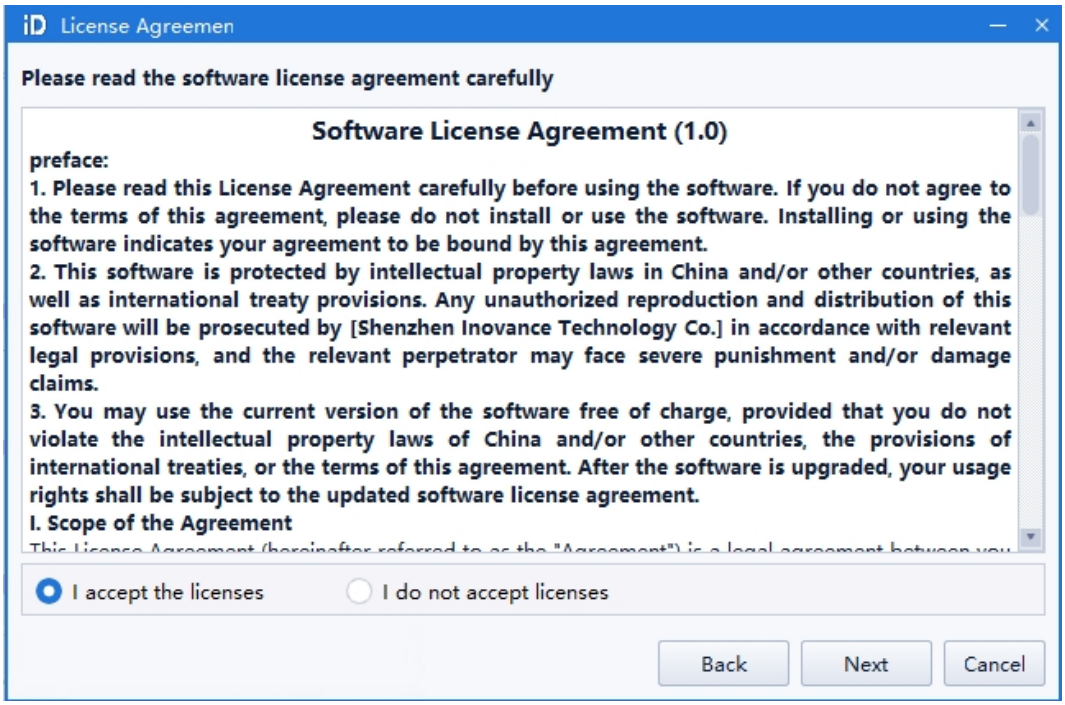
Software installation

Take the installation of iFA Drive under the Windows 10 x64 operating system as an example. It is recommended to obtain the latest software installation package since the installation interface is based on the latest software version.

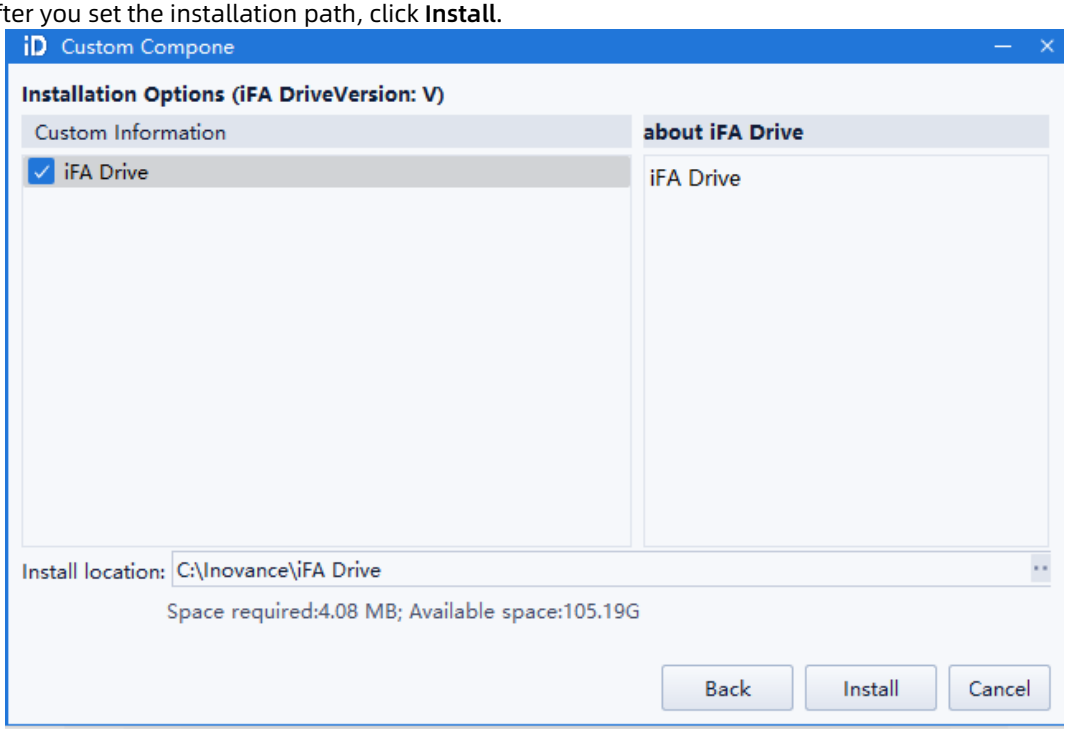
1. Double-click iFA Drive-V1R3C1B14.R.14.exe to enter the software installation wizard.



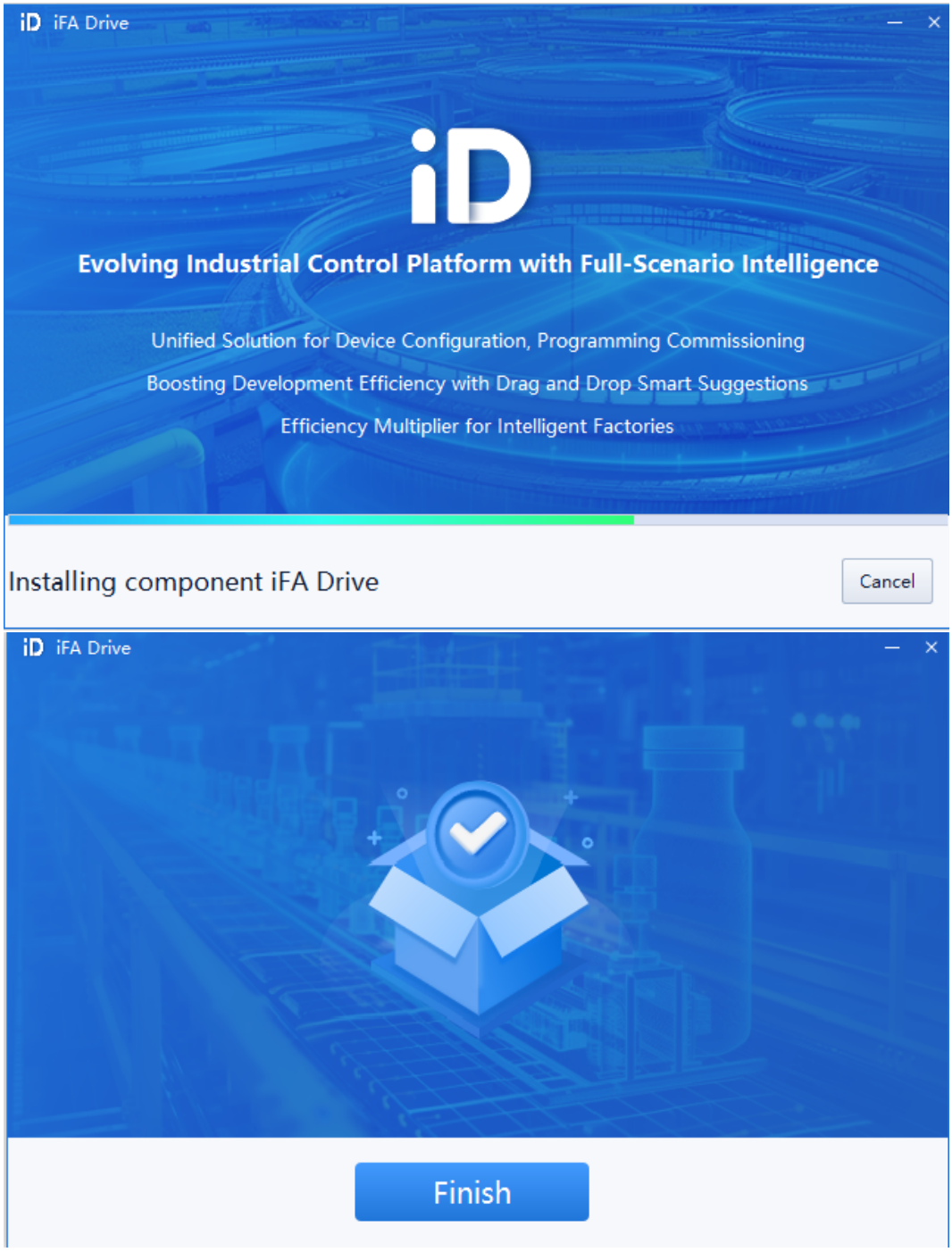
2. After reading the license agreement, if you agree to the license agreement, select **I accept the terms** in the license agreement and click **Next.**



3. After you set the installation path, click **Install**.

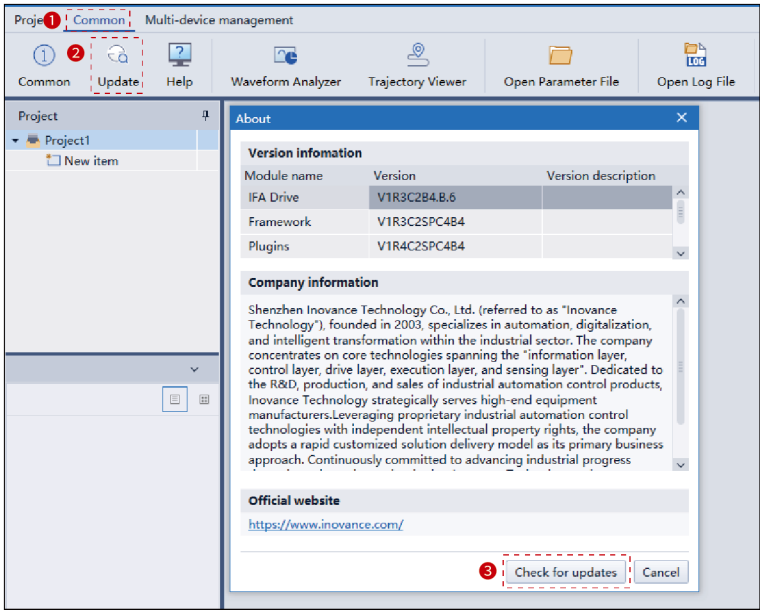


4. After the following screen is displayed, wait until the "Finish" button appears. Click this button. The iFA drive is installed.



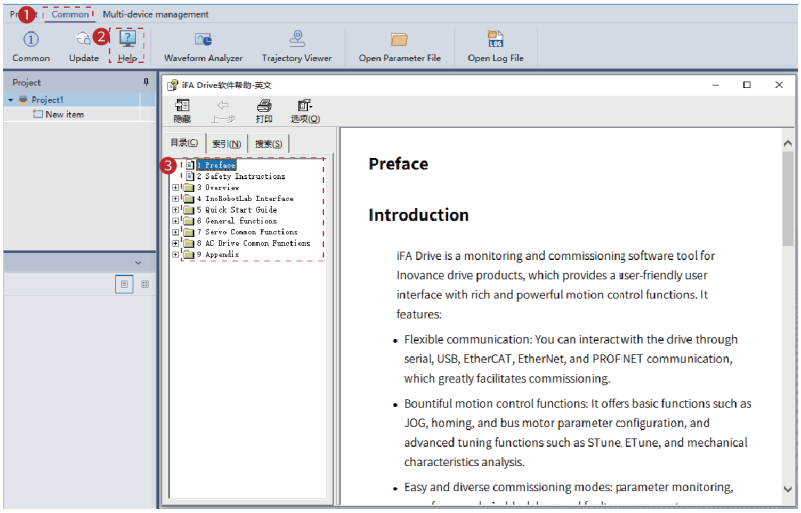
Software upgrade

Click the **Common** in the toolbar, click the **Update** option, and then click the C**heck for Updates** button in the **About** pop-up window.



Software use

For a detailed description of the software interface, quick start, and use of features, see the *iFA Drive Software Help*. Access to the manual: Click the **Common** option in the toolbar, click the **Help** option, and get the relevant information from the pop-up window.



4.2.2.2 Quick Start Guide

Note

To obtain, install, upgrade, and use the iFA Drive software, see *"4.2.2.1 Commissioning Software" on page 112*.

Connecting the PC

Requirements on the installation environment

The following table lists the items required for a PC where iFA Drive software is installed.

Item	Requirement
Operating system	Windows10 x64
CPU	Intel Core i5 and above
Memory capacity	8 GB and above
Hard drive capacity	50 GB and above
Display	1366×768 or higher, with an optimal resolution of 1920×1080
Interface	USB port x 1 and Ethernet port x 1

Wiring procedure

Prepare a cable to connect its USB connector to a PC, and its Type-C connector to the MD630-INT product.

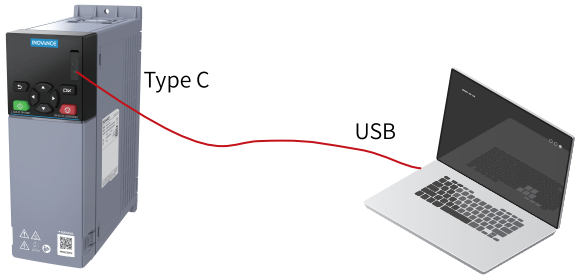
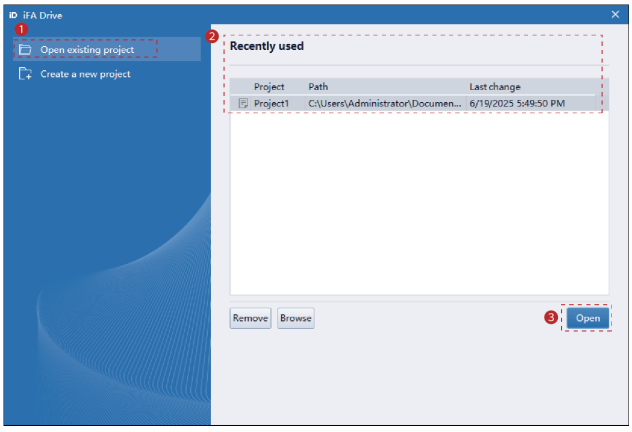
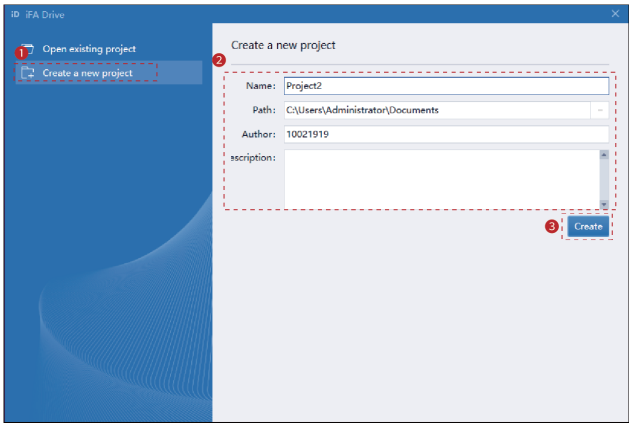


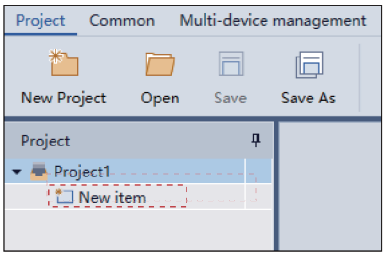
Figure 4-3 Wiring diagram

Enter the project

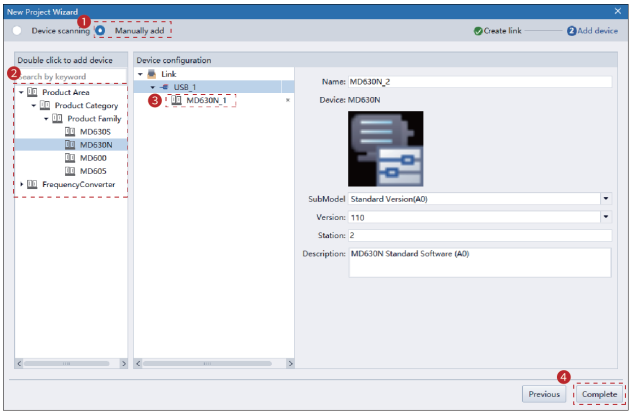
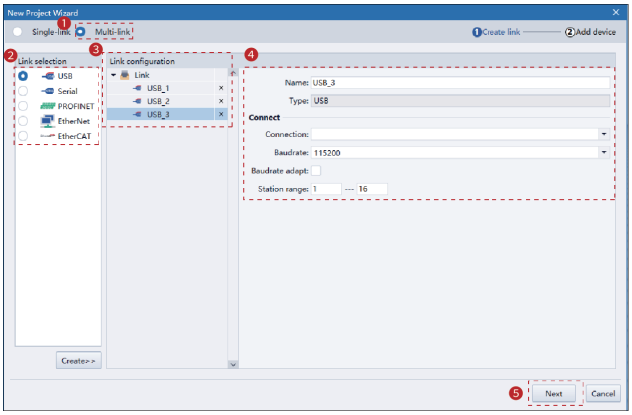
Open an existing project	Create a project
1. Click "Open existing project". 2. Select the corresponding existing project. 3. Click "Open" to open the selected existing project.	1. Click "Create a new project". 2. Set the name, path, and description of the project. 3. Click "Create".
	

Create a project

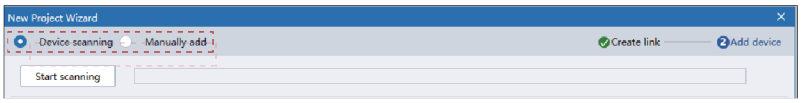
1. After double-clicking "New item" on the left, the "New Project Wizard" window will pop up.



2. Link selection and configuration:

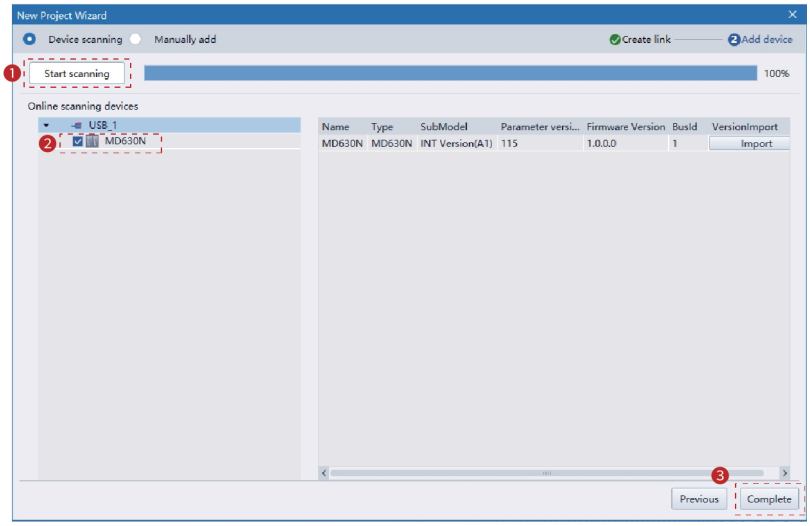
Single link	Multi-link
1. Select the required link "USB", select the required link configuration. Enter link selection, baud rate, station number range, and then click "Next" to create the corresponding link.	1. Click "Multi-link". Select a link and click "Create". In the configuration interface for this link, enter the corresponding link configuration parameters and click "Next".
	

2. After adding the link, perform the process of adding the device. There are two ways to add devices: device scanning and manually add.

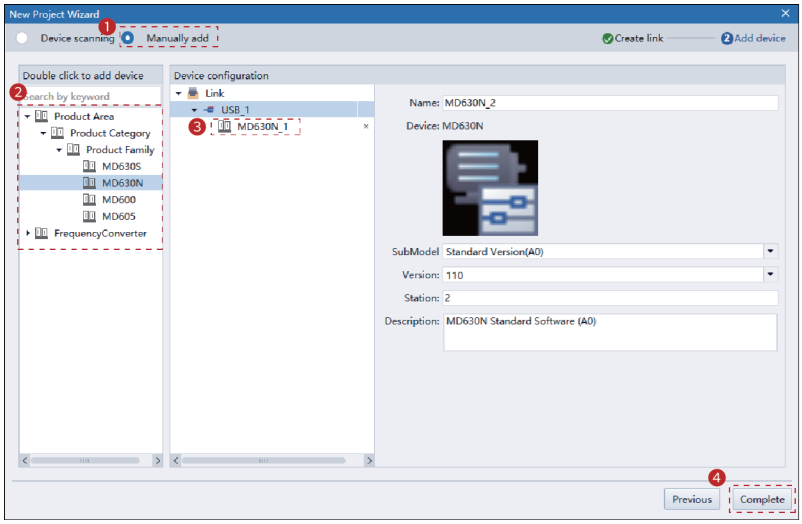
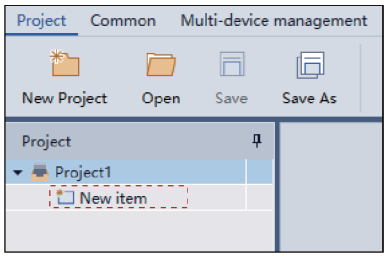
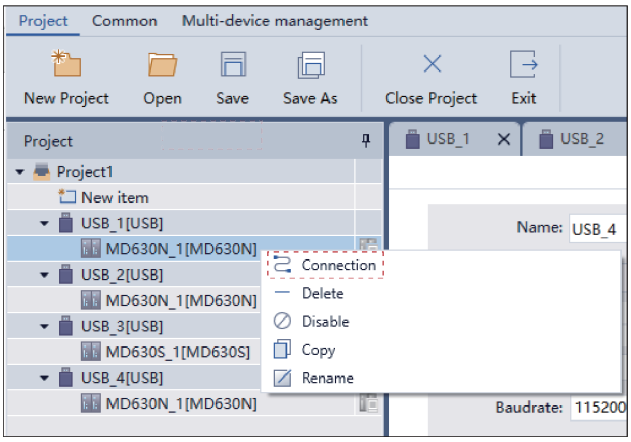


Online Device Scan: Click "Start scanning" and wait. The scanned devices are listed on the left. Click "Complete" in the lower right corner to add the scanned devices to the project tree.

Note: If the scan is aborted manually during USB link scanning, only the scanned devices will be displayed.



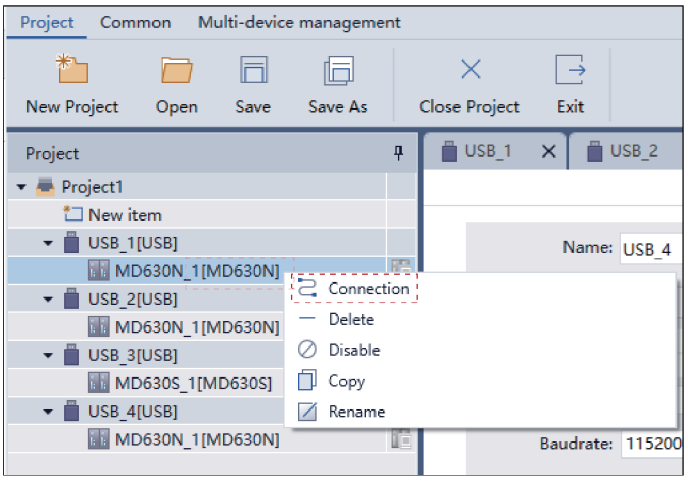
Manually add the device in offline mode: Click "Manually add", select a link. Double-click the device node to be added to automatically add the device node in device configuration, and then click "Complete".

<table>
<tr><th>Single link</th><th>Multi-link</th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>3. The single-link device adding is complete.

</td><td>3. The multi-link device adding is complete.

</td></tr>
</table>

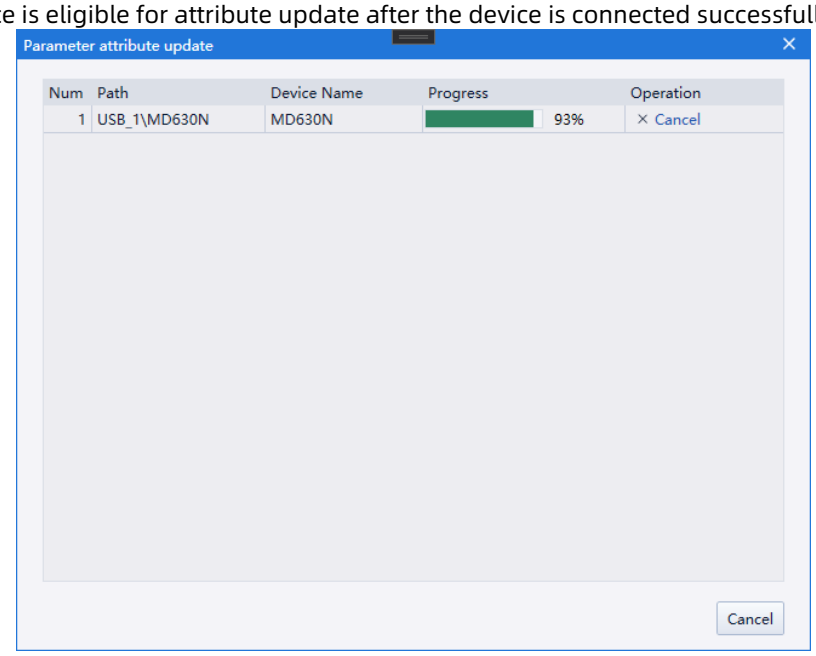
Connecting the drive

After adding the corresponding device, click the "Connect" button. After the drive is connected successfully, the drive can be commissioned.

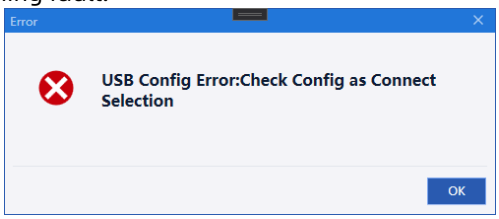
Note: For devices under the EtherCAT_Master communication link, the device is connected only if the link node corresponding to the parent node is online. Devices under other communication links are not subject to this restriction.



1. For devices that support attribute update, the attribute update is triggered automatically if the current device is eligible for attribute update after the device is connected successfully.



2. If no device is actually connected or the connection is incorrect, a fault message will be displayed, indicating a potential scanning fault.



4.3 Commissioning Preparation

4.3.1 Motor Type

Check the motor type through motor nameplate. In some cases, the motor type is not indicated on the nameplate. You can confirm the motor type by using the following two methods:

- The asynchronous motor has slip, and the synchronous motor has no slip. The rated slip of the motor = rated frequency x 60 ÷ rated pole pairs - rated speed. If the calculation result is not zero, the motor is asynchronous motor.
- Short the UVW cable of the motor. The motor with obvious resistance when it is wobbled manually is synchronous motor. Otherwise, the motor type is asynchronous motor. This method can be used to determine whether the reluctance motor is magnet assisted synchronous reluctance motor. The resistance of the reluctance motor without assisted magnet will not increase.

4.3.2 Select Motor Parameter Group 1 on Nameplate

Some motors may have multiple groups of parameters on the nameplates. As shown in the following figure, it is recommended to select the motor parameter group 1 input to the AC drive as the rated parameters. The analysis is as follows:

duty type	n (/min)	P (kW)	U (V)	I (A)	f (Hz)	cos/phi
S1	650	200	414	342	22.3	0.89
S1	765	200	480	296	26	0.88
S1	1950	200	480	300	66.5	0.87
S1	3000	130	480	192	101.5	0.87

V/f is directly proportional to the flux. The U/f of motor parameter group 1 and motor parameter group 2 is about 18.5, which is the rated flux coefficient. The V/f of motor parameter group 3 = 7.2, which is the field-weakening parameter. The V/f of motor parameter group 4 = 4.7, which is the field-weakening parameter. The rated motor parameters in the AC drive cannot be used to set the field-weakening parameters. Selecting motor parameter group 3 or 4 will result in insufficient motor output. Therefore, only group 1/2 can be selected. If the motor parameter group 2 is selected, the maximum output force at low frequency cannot meet the design requirements; therefore the motor parameter group 1 shall be selected. For the AC drive, the maximum output voltage is related to the bus voltage and is not related to the rated motor voltage. Setting the motor group 1 parameters will not result in insufficient output voltage.

4.3.3 Collect Data of AC Drive and Motor

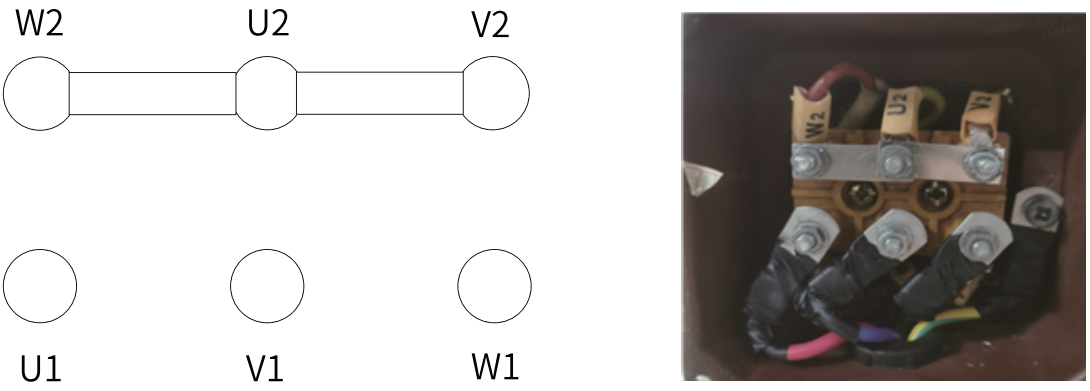
Confirm the following information before commissioning.

- Collect motor data
  See the information on the motor nameplate: rated power, rated voltage, rated current, rated frequency, and rated speed, as well as motor type.

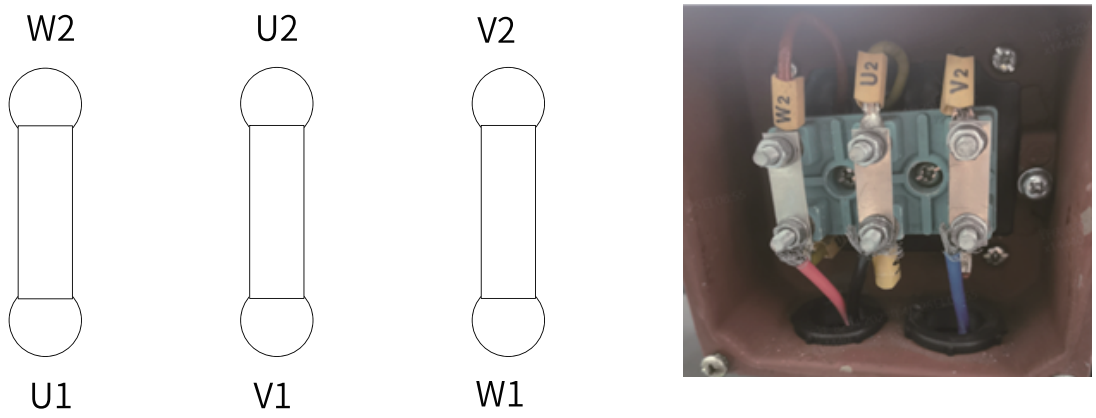
  The motor parameters listed on the nameplate are crucial for successful parameter auto-tuning. Note that the settings for asynchronous and synchronous motors differ. Before setting the motor parameters, confirm the motor type, as shown in *"4.3.1 Motor Type" on page 119*.
- Collect AC drive data
  See the information on the AC drive nameplate: product name, model, power, voltage class, and output current to ensure the IO range and power rating of AC drive match those of the motor.
- Check motor connection mode

Check whether the motor connection method (Y-type or delta type) is consistent with the motor nameplate. The wrong motor connection method will result in poor motor output force and high output current without carrying the load.

Figure 4-4 Motor connection mode



(a) Y connection



(b) Delta connection

4.3.4 Check the cables connecting the AC drive and the motor

Connect the cables between the AC drive and the motor. Before powering on and commissioning the system, ensure that the preparation for power-on has been completed, and check each item in the table.

Table 4–8 Steps

Items	Operation	Passed	Completed
1	The power input of the main circuit is correctly connected based on terminal labels (R, S, and T).	☐	☐
2	The main circuit output terminals (U, V, and W) and motor cables (U, V, and W) are connected in the same phase sequence.	☐	☐
3	The power input terminals (R, S, and T) and output terminals (U, V, and W) of the main circuit are correctly connected. For example, the power input cable is not connected to the output end.	☐	☐

Items	Operation	Passed	Completed
4	The AC drive and motor are reliably grounded.	☐	☐
5	The encoder is correctly connected, and the shield is properly processed.	☐	☐
6	Connect the power supply of the auxiliary circuit properly.	☐	☐
7	Communication cables are correctly connected.	☐	☐
8	External interfaces such as I/O interfaces are correctly connected.	☐	☐

4.3.5 Powering on the AC Drive

After the wiring inspection, connect the main circuit R, S, T to the three-phase AC power supply. Before checking the parameters of the AC drive, ensure it is normally powered.

4.3.6 AC Drive Model Check

Check the equipment information according to the product nameplate. See the following table for inspection parameters.

Table 4–9 Related Parameters

Parameter	Name	Description
A2-21	Device type	1: MD630S-INT (485 standard type + STO) 4: MD630N-INT (Bus type + STO)
A3-02	AC drive rated power	This parameter displays the rated AC drive power.
A3-03	AC drive rated current	This parameter displays the rated AC drive current.
A3-04	Rated AC drive voltage	This parameter displays the rated AC drive voltage.
A3-05	Maximum AC drive current	Sets the maximum current of the AC drive. The base value is the rated current of the AC drive

If the product information such as the rated power, rated voltage, and rated current is inconsistent with that on the nameplate, contact the service personnel for technical support.

4.3.7 Software Version

If you need to use a specific software version for commissioning, check the software version by consulting the following parameters after software update.

Param.	Name	Display range
A2-22	Performance software version	0.0 to 655.35
A2-23	Function software version	0.0 to 655.35
A2-24	Performance software sub-version	0.0 to 655.35
A2-25	Function sub-version	0.0 to 655.35

4.4 Motor Parameter Setting

4.4.1 Setting Motor Parameters

Related parameters

Set motor parameters according to to the motor nameplate.

Table 4–10 Set motor parameters

Param.	Name	Value	Asynchronous motor	Synchronous motor	Synchronous reluctance motor
F1-00 (C4-00)	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Reluctance synchronous motor without permanent magnet 4: Reluctance synchronous motor with permanent magnet	Yes	Yes	Yes
F1-01 (C4-01)	Rated motor power	For applications where multiple motors are driven by one AC drive (multiple motors must be the same), set the rated power of a motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Yes	Yes	Yes
F1-03 (C4-03)	Rated motor voltage	Set the rated motor voltage.	Yes	Yes	Yes
F1-04 (C4-04)	Rated motor current	Set the rated motor current. For applications where multiple motors are driven by one AC drive, set the rated current of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Yes	Yes	Yes
F1-06 (C4-06)	Rated motor frequency	Set the rated motor frequency which corresponds to the rated motor voltage.	Yes	Yes	Yes
F1-07 (C4-07)	Rated motor speed	The parameter indicates the rated rotor speed of the motor. For synchronous motors, synchronous speed is (rated frequency x 60 ÷ number of pole pairs), and for asynchronous motors, slip must be considered. Some motor nameplates do not include a rated speed or only list the synchronous speed, so the rated speed can be set according to the following base value.	Yes	Yes	Yes
F1-10 (C4-10)	Maximum motor frequency	The maximum motor frequency is the base value of the set frequency and acceleration/deceleration time. Scenarios: When the maximum set frequency is lower than the rated motor frequency, the effective maximum frequency is the rated motor frequency. If you want to set the speed limit, set it in F2-22 to F2-27.	Optional	Optional	Optional
F1-11 (C4-11)	Minimum motor frequency	Minimum motor frequency Scenarios: This parameter is not required for the motors that do not support low-speed operation.	Optional	Optional	Optional

Param.	Name	Value	Asynchronous motor	Synchronous motor	Synchronous reluctance motor
F1-12 (C4-12)	Synchronous motor back EMF	The rated back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = F1-07 ÷ 1000 x 120 V. If the effective value of the back EMF on the nameplate is 120 V/krpm, the rated back EMF is F1-07 / 1000 × 120 V. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.	-	Optional	Optional
F1-14 (C4-14)	Number of motor pole pairs	The number of pole pairs can be found on the motor nameplate. It can also be calculated. Number of pole pairs ≈ (rated frequency x 60) / rated speed (rated frequency unit: Hz, rated speed unit: rpm) For example, if the rated frequency is 50 Hz and the rated speed is 1450 rpm, the calculation would be: Number of pole pairs ≈ (50 Hz x 60) ÷ 1450 rpm = 2.07 In this case, the decimal part (0.07) represents the slip, which can be ignored. Therefore, the number of pole pairs is rounded down to 2. Scenarios: If the number of pole pairs does not exceed 12, the software automatically calculates the correct number of pole pairs. Note: The difference between the number of poles and the number of pole pairs is that the number of pole pairs = the number of poles ÷ 2.	Optional	Optional	Optional

Note

The motor parameters in group F1 in the table are the mapping of motor parameters in group C4. The settings of the two groups are equivalent.

Precautions

Set the rated speed of the asynchronous motor based on synchronous speed: 1. See the following table for the recommended slip ratio based on the motor power. 2. Rated speed = Synchronous speed - Recommended slip ratio x Synchronous speed.

Power	2.2 kW	3.7 kW	5.5 kW	7.5 kW	11 kW	15 kW	22 kW
Recommend-ed slip ratio	6%	5%	4%	4%	3.5%	3%	2.5%

After the settings according to the motor nameplate parameters, the output current may exceed the expected values when the motor is running without load in the V/f mode. You can reduce the rated voltage slightly by 10 V to 20 V before performing parameter auto-tuning. This adjustment can lead to improved control performance.

Note

When F1-00 (Motor type) = 3 (Non-auxiliary synchronous reluctance motor) or 4 (Auxiliary synchronous reluctance motor), the default control method is recommended. It is specially developed for the reluctance motor. Supports the following functions: Speed control, current limit, torque limit, power limit, Overvoltage suppression, undervoltage suppression, energy conservation control, etc.

4.4.2 Set the carrier frequency

The carrier frequency of the AC drive is set by A5-01 (Set carrier frequency). In addition to the carrier frequency set by A5-01 and the maximum carrier frequency of the A5-00 AC drive, the actual carrier frequency is limited by functions such as "Carrier frequency with step frequency adjustment" and "Random PWM". For details, see A5-09 to A5-13.

Related parameter

Table 4–11 Carrier frequency setting parameters

Parameter	Parameter Name	Default Value	Value Range
A5-01	Set carrier frequency	4.0	0.8 kHz to 20.0 kHz

Precautions

For high-speed motors, ensure that:

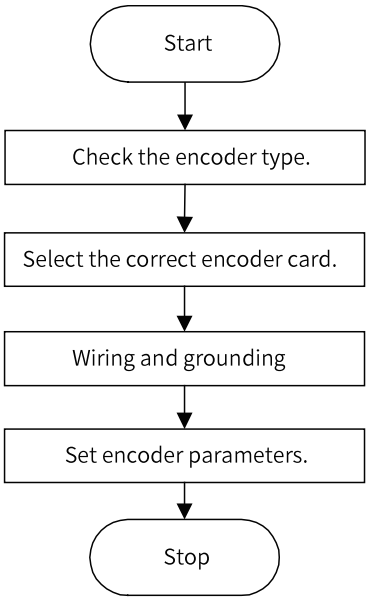
A5-01 > (12 x maximum output frequency)

Otherwise, the control frequency is insufficient during high-speed operation, resulting in oscillation and dissipation overcurrent. The carrier frequency setting at high-speed operation is low, which may result in large output current harmonics. The motor temperature rises too high for long periods of time. Severe conditions may even cause the synchronous motor to demagnetization.

4.5 Set Encoder Parameters

Setting the Encoder

This product supports ABZ encoders, 23-bit encoders, resolver encoders, SSI encoders, sine-cosine encoders, EnDat encoders, and BISS encoders. The encoder commissioning steps are as follows:



The specifications of the encoder card and supported encoder types are as follows:

<table>
<tr><th>Encoder card</th><th>Supported encoder types</th><th>PG expansion card specifications</th><th>Terminal definitions</th></tr>
<tr><td rowspan="5">MD-PG-AU1</td><td>ABZ incremental encoder</td><td>supports TTL/HTL levels; supports differential (500kHz)/push-pull (100 kHz)/OC (50 kHz) signal input; supports hardware open-circuit detection (differential/push-pull);
Differential signals of ABZ encoder can be used in long-line applications;</td><td><table><tr><td>A-</td><td>B-</td><td>C-</td><td>15V</td><td>COM</td><td>OA</td><td>OB</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>A+</td><td>B+</td><td>C+</td><td>5 V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Distribution and Definition” on page 128</td></tr>
<tr><td>Inovance 23-bit communication encoders</td><td>Resolution: 32-bit (maximum);
Data refresh rate: 16 kHz;
Communication rate: 8 Mbps (maximum);</td><td><table><tr><td>DATA -</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA +</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Distribution and Definition” on page 128</td></tr>
<tr><td>SSI Encoder</td><td>Resolution: 32-bit (maximum);
Communication rate: 2 Mbps (maximum);</td><td rowspan="3"><table><tr><td>CLK -</td><td>DATA -</td><td>/</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>CLK +</td><td>DATA +</td><td>/</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Distribution and Definition” on page 128</td></tr>
<tr><td>EnDat encoder</td><td>Resolution: 32-bit (maximum);
Communication rate: 10 Mbps (maximum);</td></tr>
<tr><td>BISS Encoder</td><td>Resolution: 32-bit (maximum);
Communication rate: 10 Mbps (maximum);</td></tr>
<tr><td>Magnetic encoder</td><td>Resolution: 32-bit (maximum);
Data refresh rate: 16 kHz;
Communication rate: 2 Mbps (maximum);</td><td><table><tr><td>DATA -</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA +</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Distribution and Definition” on page 128</td></tr>
<tr><td>MD-PG-R1</td><td>Resolver encoder</td><td>Rotation: SIN/COS/EXC signal
Excitation output:
Vrms = 7 V;
Excitation frequency:
10 kHz/12 kHz/15 kHz/20 kHz (adjustable);
Feedback ratio: 0.5/0.286;
For synchronous motors with resolvers, the number of pole pairs of the motor must be a divisor of the number of pole pairs of the resolver. For example, for a motor with 6 pole pairs, you can choose resolvers with 1/2/3/6 pole pairs. Choosing a resolver with 4 pole pairs will result in improper operation.</td><td><table><tr><td>SIN -</td><td>COS -</td><td>EXC -</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN +</td><td>COS +</td><td>EXC +</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Distribution and Definition” on page 128</td></tr>
</table>

Encoder card	Supported encoder types	PG expansion card specifications	**Terminal definitions**
MD-PG-S1	Sine-cosine encoder	Differential mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V; Common mode voltage: Vcm = 3.0 V (maximum); Input frequency: f = 100 kHz (maximum)	<table><tr><td>SIN-</td><td>COS-</td><td>Z-</td><td>COM</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN+</td><td>COS+</td><td>Z+</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> For details, see *" Encoder Distribution and Definition" on page 128*

Encoder Distribution and Definition

Table 4–12 Layout of encoder terminals

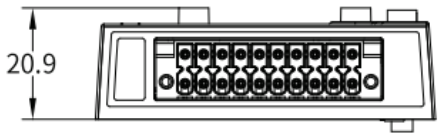
Terminal diagram	Pin numbering diagram
	<table><tr><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>18</td><td>20</td></tr><tr><td>1</td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td><td>17</td><td>19</td></tr></table>

Table 4–13 Descriptions of pin assignments for different encoders

Pin No.	ABZ encoder	23-bit encoder	Resolver	Sin-Cos encoder	EnDat encoder SSI encoder BISS encoder	Magnetic encoder
1	A+ signal	DATA+, positive data signal	SIN+ signal	SIN+ signal	CLK+, positive clock signal	DATA+, positive data signal
2	A- signal	DATA-, negative data signal	SIN- signal	SIN- signal	CLK-, negative clock signal	DATA-, negative data signal
3	B+ signal	/	COS+ signal	COS+ signal	DATA+, positive data signal	/
4	B- signal	/	COS- signal	COS- signal	DATA-, negative data signal	/
5	Z+ signal	/	EXC+, positive excitation signal	Z+ signal	/	/
6	Z- signal	/	EXC-, negative excitation signal	Z- signal	/	/
7	5 V power supply	5 V power supply	/	5 V power supply	5 V power supply	5 V power supply
8	15 V power supply	15 V power supply	/	COM power supply reference ground	15 V power supply	15 V power supply
9	-	-	-	-	-	-
10	COM power supply reference ground	COM power supply reference ground	/	/	COM power supply reference ground	COM power supply reference ground

Pin No.	ABZ encoder	23-bit encoder	Resolver	Sin-Cos encoder	EnDat encoder SSI encoder BISS encoder	Magnetic encoder
19	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)
20	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)

Wiring precautions

- Because the output voltage of the drive is pulse voltage and there is a common mode voltage to ground, the PE terminal of the motor needs to be connected to that of the drive in addition to connection of the U/V/W power cable of the motor. Make sure that the grounding busbar of the electrical cabinet is grounded. Otherwise, the common mode voltage and leakage current interference may back flow from the encoder cable to result in encoder signal interference.
- The encoder cable has high anti-interference capability requirements. You need to select a shield with a tight metal net and connect the shield to the PE port of the terminal. Twisted pair cables are selected and used in pairs. For example, A+ and A- use a pair of twisted pair cables, which can effectively reduce common mode interference.
- Minimize the encoder cable connector, as the connector can result in radiation interference.
- Avoid parallel proximity of encoder cables and motor power cables to prevent power cable interference with encoder signal.
- Ground the short encoder cables (within 10 m) at both ends. For long encoder cables, single-ended grounding at the encoder card end is recommended.

Param.	Name	Default	Value Range	Description	Applicable Encoder
C0-00	Encoder type	0	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	All encoders
C0-02	Encoder pulses per revolution	1	1 to 65535	For ABZ encoders and sin-cos encoders, the nameplate parameter of the incremental encoders is set to identify how many pulses are generated per revolution.	ABZ encoder Sin-cos encoder

Param.	Name	Default	Value Range	Description	Applicable Encoder
C0-13	Number of resolver pole pairs	1	1 to 65535	A resolver is an electromagnetic transducer, also known as a synchronous resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. This parameter indicates the number of pole pairs of the resolver. The higher the number of pole pairs, the higher the precision. If a resolver is applied, set the number of pole pairs of resolver properly.	Resolver
C0-18	ABZ encoder level type	1	1: Derivative output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	The ABZ encoders support derivative output, TTL complementary push-pull output, HTL complementary push-pull output, TTL single-ended push-pull output, HTL single-ended push-pull output, and OC output. If the setting is incorrect, hardware detection will be faulty, including but not limited to unrecognized hardware disconnection signals.	ABZ encoder
C0-23	23-bit encoder communication frequency selection	1	1: 2 M 3: 4 M 4: 8 M	The corresponding communication frequency is set according to the nameplate or user guide of the 23-bit encoder.	23-bit encoder Magnetic encoder
C0-31	SSI communication baud rate	3	0: 2 M 1: 1.5 M 2: 1 M 3: 0.5 M 4: 0.4 M 5: 0.25 M 6: 0.125 M	Set the corresponding communication baud rate according to the SSI encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	SSI encoder
C0-32	SSI encoder signal check	0	0: Zero check 1: Odd check 2: Even check	Set the corresponding check method according to the SSI encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	SSI encoder
C0-33	SSI encoder data encoding format	0	0: Binary 1: Gray code	Set the corresponding data encoding format according to the SSI encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	SSI encoder
C0-34	Number of SSI encoder state bits	0	0 to 8	Set the corresponding number of SSI encoder state bits according to the SSI encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	SSI encoder
C0-41	EnDat encoder communication frequency	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Set the corresponding communication baud rate according to the EnDat encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	EnDat encoder

Param.	Name	Default	Value Range	Description	Applicable Encoder
C0-45	Communication frequency of BISS encoder	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Set the corresponding communication rate according to the BISS encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	BISS encoder
C0-46	BISS encoder signal check	0	0: Calculated CRC opposite to the received CRC 1: Calculated CRC same as received CRC	Set the corresponding check method according to the BISS encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	BISS encoder
C0-47	Number of BISS encoder state bits	0	0 to 8	Set the corresponding number of BISS encoder state bits according to the SSI encoder nameplate or user guide. If the setting is incorrect, it may result in hardware disconnection faults.	BISS encoder
C0-51	Number of single-turn bits of communication-type encoder	23	1 to 32	The number of single-turn bits of EnDat encoders, BISS encoders, and SSI encoders must be set correctly according to the encoder nameplate or user guide.	SSI encoder EnDat encoder BISS encoder
C0-52	Number of multi-turn bits of communication-type encoder	0	0 to 32	The number of multi-turn bits of EnDat encoders, BISS encoders, and SSI encoders must be set correctly according to the encoder nameplate or user guide.	SSI encoder EnDat encoder BISS encoder

Note

- The encoder type of the magnetic encoder needs to be selected as a 23-bit encoder.
- The magnetic encoder only supports a baud rate of 2 Mbit/s, and C0-23 can only be set to 1.

4.6 Motor Auto-tuning

Scenarios

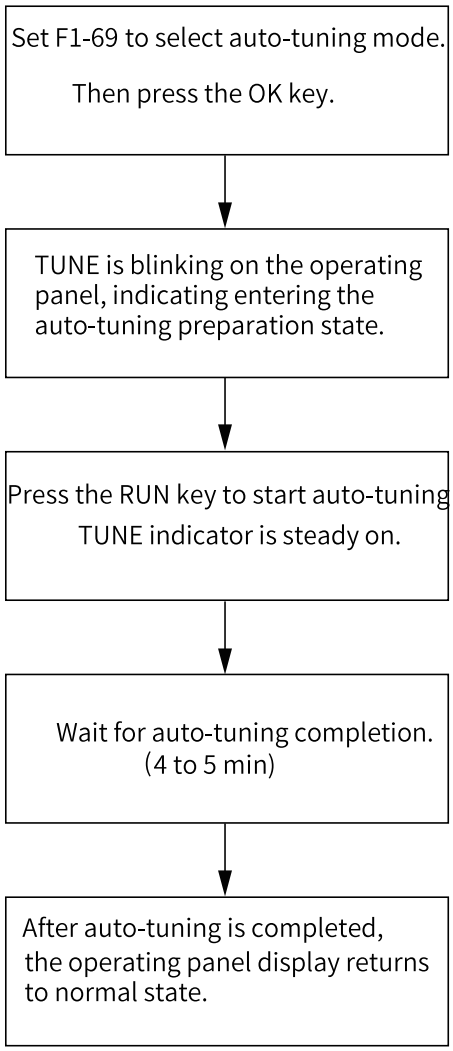
Unlike servo systems which use preset parameters, the AC drives need to be matched with different motors and require the motor parameter auto-tuning before operation The following scenarios are required for motor parameter auto-tuning.

1. Vector control
2. V/f control of asynchronous motor. (Static parameter auto-tuning is required if flying start is applicable.) Conventional V/f applications. (Parameter auto-tuning is recommended for better performance.)

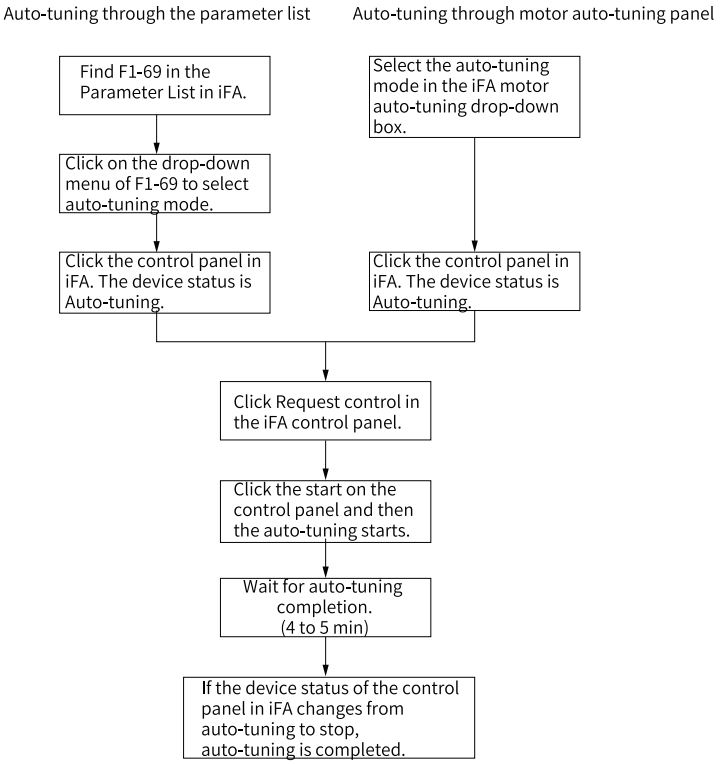
Procedure

The following figure shows the basic steps for parameter auto-tuning through iFA or operating panel.

Auto-tuning through operating panel



Auto-tuning through iFA



Related parameters

Table 4–14 Parameters related to motor auto-tuning

Param.	Name	Default	Value Range	Description
F1-69 (C2-00)	Motor parameter auto-tuning mode	0	0: No operation 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 11: Permanent magnet motor with-load auto-tuning (excluding back EMF) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning 15: MTPA of synchronous reluctance motor without field strengthening 21: Static auto-tuning of synchronous reluctance motor 22: Dynamic auto-tuning of synchronous reluctance motor	Used to set motor parameter auto-tuning mode. **Additional information:** Dynamic auto-tuning and inertia auto-tuning are suitable for occasions where the motor can rotate without load. If little load torque is output after the motor rotates, the scenario will be regarded as no load even through the motor does not completely disconnect from the load mechanism. Static auto-tuning is suitable for situations where the motor cannot rotate. In dynamic auto-tuning, all parameters will be tuned to ensure optimal operating performance. Compared with dynamic auto-tuning, Asynchronous motor: In static complete auto-tuning mode, inertia and friction torque parameters are not tuned, and the mutual induction and no-load current are less accurate. In static partial auto-tuning mode, mutual induction and no-load current are not tuned. Synchronous motor: In static auto-tuning mode, back EMF, inertia, and friction torque are not tuned.

Note

The parameter F1-69 in the table is the mapping of motor parameter C2-00. The settings of the two parameters are equivalent.

Mechanical systems with inertia load will only output torque during acceleration and deceleration, and the steady-speed load is very small. Parameter auto-tuning is carried out during the steady-speed phase, which does not affect the auto-tuning accuracy. Therefore, the system with inertia load can perform no-load rotation auto-tuning (such as metallurgical rolling mills).

4.6.1 Asynchronous Motor Parameter Auto-tuning

Mode selection

The *"Figure 4-5 Asynchronous motor parameter auto-tuning mode" on page 134* shows the parameter auto-tuning process of synchronous motors. For better ease of use and control performance, the commissioning priority is as follows: 1> 2>3 > 4.

1. When auto-tuning motors of the same model with the AC drive, you can save the adjusted parameter file and then copy to other AC drives to perform quick commissioning. For details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*.

2. During initial auto-tuning, if the motor can rotate freely, it is recommended to set F1-69 to 2 (No-load dynamic auto-tuning of asynchronous motor) to achieve optimal control performance.
3. If dynamic auto-tuning is not feasible but asynchronous motor mutual inductance and no-load current (F1-28 and F1-30) are known, set F1-69 to 1 (Static partial auto-tuning of asynchronous motor). After auto-tuning is completed, set the correct no-load current and mutual inductance to obtain good control performance. In FVC mode, you need to confirm that the encoder feedback speed is consistent with the direction of operation.
4. In cases where the motor is immobile without load and the correct motor mutual inductance and no-load current are not known, set F1-69 to 3 (Static complete auto-tuning of asynchronous motor). The motor can also run using this auto-tuning method. In FVC mode, you need to confirm that the encoder feedback speed is consistent with the direction of operation.

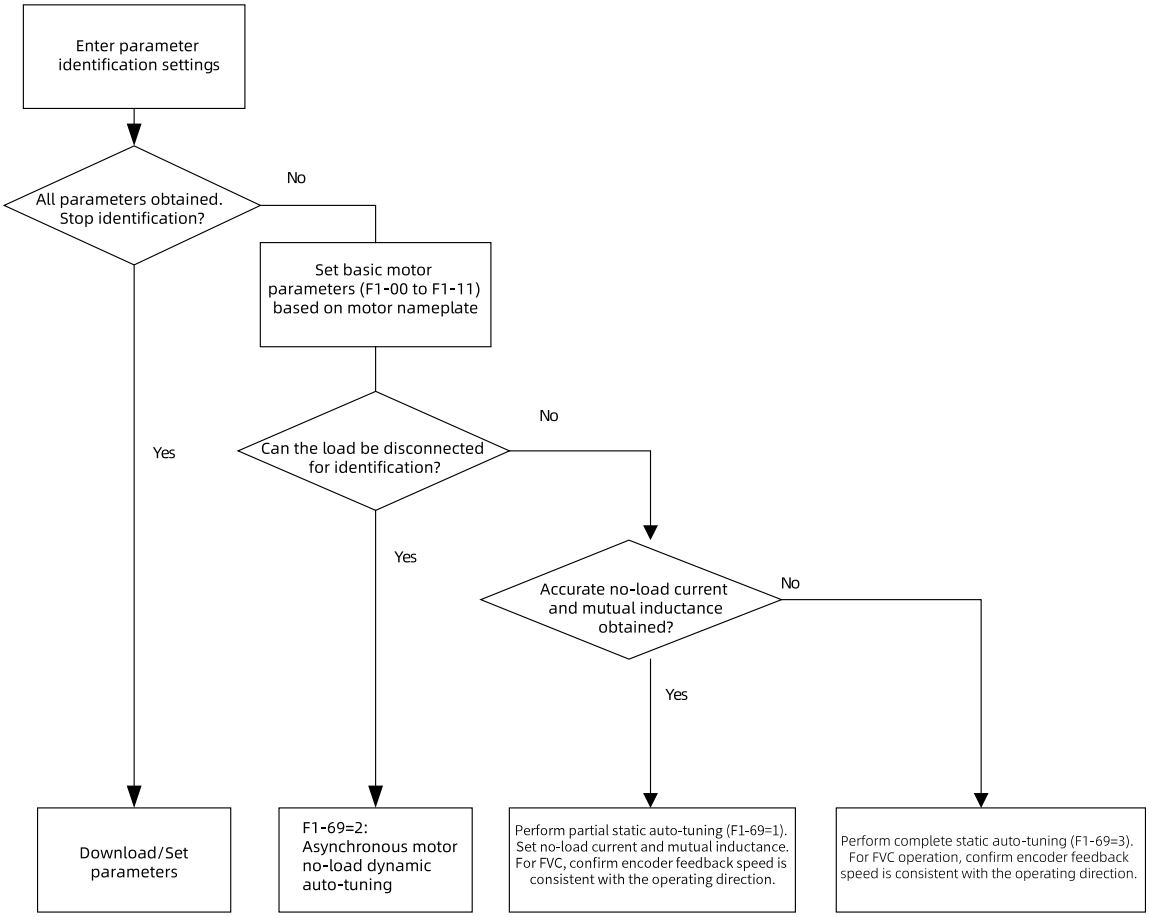


Figure 4-5 Asynchronous motor parameter auto-tuning mode

Related parameters

After auto-tuning is complete, the tuned motor parameters are automatically saved. Parameters to be tuned vary with different auto-tuning methods, as shown in the following table.

Table 4–15 Parameters for asynchronous motor auto-tuning

Parameters	Name	Static partial auto-tuning of asynchronous motor	No-load dynamic auto-tuning of asynchronous motor	Static complete auto-tuning of asynchronous motor	Inertia auto-tuning	Descriptions
F1-20	Stator resistance	Supported	Supported	Supported	-	-
F1-22	Asynchronous motor rotor resistance	Supported	Supported	Supported	-	-
F1-24	Asynchronous motor leakage inductance	Supported	Supported	Supported	-	-
F1-28 F1-30	Asynchronous motor mutual inductance and no-load current	-	Supported	Supported	-	The no-load current and mutual inductance are critical to the low-speed performance of asynchronous motor in SVC mode. No-load dynamic auto-tuning ensures optimal performance. Static partial auto-tuning cannot detect the no-load current mutual inductance. You need to set the correct value manually. After static complete auto-tuning, the motor can run but the control effect is not optimal.
C5-02 to C5-09	Magnetic field saturation flux curve of asynchronous motor	-	Supported	-	-	-
A3-30 to A3-46	Dead zone compensation curve	Supported	Supported	Supported	-	The dead zone compensation curve is critical to the low-speed performance of the SVC mode. It must be included when downloading or setting all parameters.
F2-02 F2-03 F1-48	SVC speed loop Kp/Ti, inertia ratio	-	Supported	-	Supported	The system with fixed inertia can perform inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.
C0-03 C0-02	Encoder direction auto-tuning, check encoder pulses per revolution	-	Supported	-	-	No-load dynamic auto-tuning detects the direction of the encoder and whether the number of encoder pulses per revolution are set accurately and whether the encoder signal is normal. If the motor cannot perform dynamic auto-tuning, the encoder input phase sequence needs to be set first. After the control mode is set to SVC, run to see if the encoder feedback speed (U0-29) is consistent with the motor speed (U6-00); if the speed is not consistent, inverse the value of C0-03.

4.6.2 Synchronous Motor Parameter Auto-tuning

Mode selection

The *"Figure 4-6 Synchronous motor parameter auto-tuning mode" on page 137* shows the parameter auto-tuning process of synchronous motors. For better ease of use and control performance, the commissioning priority is as follows: 1> 2>3 > 4.

1. When auto-tuning motors of the same model with the AC drive, you can save the adjusted parameter file and then copy to other AC drives to perform quick commissioning. For details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*.
2. During initial auto-tuning, if the motor can rotate freely, it is recommended to set F1-69 to 2 (No-load dynamic auto-tuning of asynchronous motor) to achieve optimal control performance.
   Synchronous motor: Set F1-69 = 12 [No-load dynamic auto-tuning of permanent magnet motor]. After auto-tuning, set the correct no-load current and mutual inductance to achieve better control performance.

   Synchronous reluctance motor: Set F1-69 = 22 [Dynamic auto-tuning of synchronous reluctance motor]. After auto-tuning, set the correct no-load current and mutual inductance to achieve better control performance.
3. If dynamic auto-tuning is not feasible but the back EMF of the motor is known, set the F1-12 first, and then set F1-69 = 13 (Static complete auto-tuning of synchronous motor) or 21 (Static auto-tuning of synchronous reluctance motor).
4. In cases where the motor is immobile or the correct back EMF is not known, remove the load and perform no-load dynamic auto-tuning.

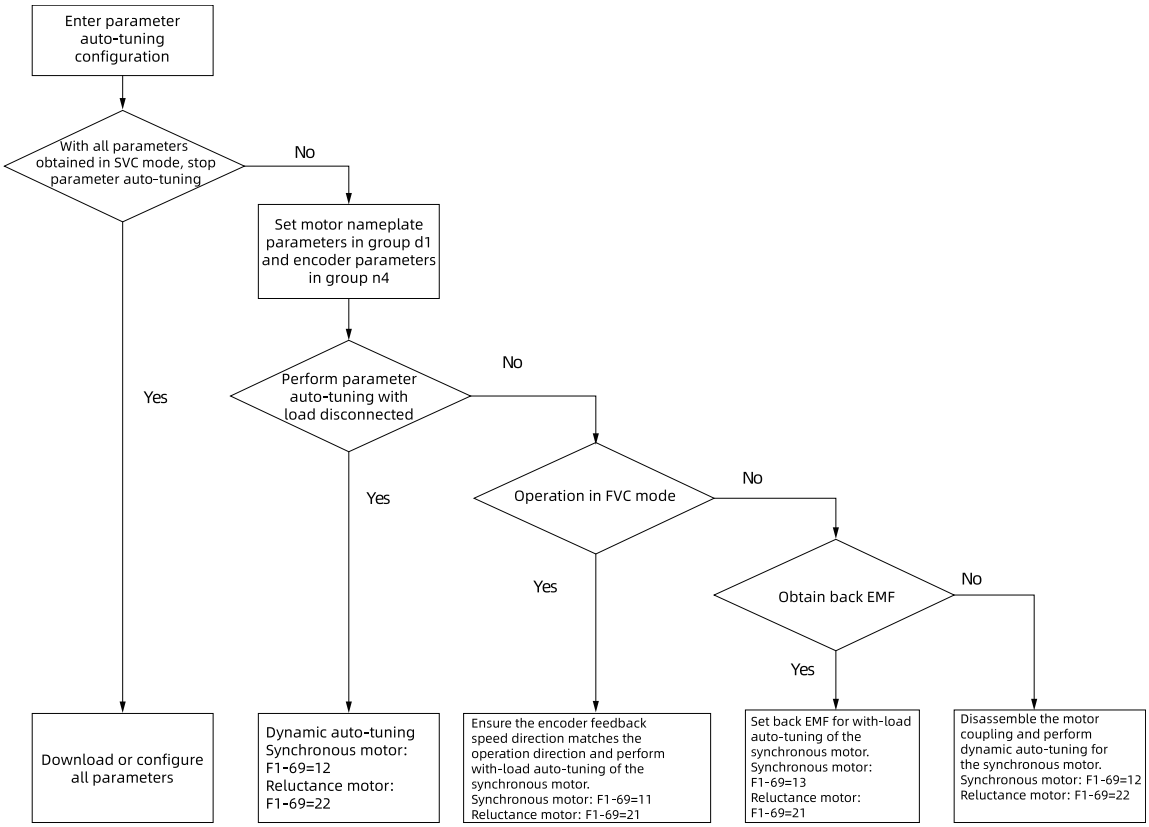


Figure 4-6 Synchronous motor parameter auto-tuning mode

Related parameters

After auto-tuning is complete, the tuned motor parameters are automatically saved. Parameters to be tuned vary with different auto-tuning methods, as shown in the following table.

Table 4–16 Parameters auto-tuned for synchronous motor

Param.	Name	With-load auto-tuning for synchro nous motor	No-load dynamic auto-tuning of synchro nous motor	Static complete auto-tuning of synchro nous motor	Inertia auto-tuning	Descriptions
F1-12	Synchronous motor back EMF	-	Supported	-	-	The back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/ krpm, the rated back EMF = d0- 05 / 1000 x 120 V. Back EMF is the effective value of the line voltage. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.
F1-20	Motor stator resistance	Supported	Supported	Supported	-	-
F1-32 F1-34	d-axis and q-axis inductance	Supported	Supported	Supported	-	-
C5-30 to C5-55	Inductance saturation curve	Supported	Supported	Supported	-	Inductance saturation curve is important to SVC performance. It must be included when downloading or setting all parameters.
A3-30 to A3-46	Dead zone compensation curve	Supported	Supported	Supported	-	The dead zone compensation curve is critical to the low-speed performance of the SVC mode. It must be included when downloading or setting all parameters.
F2-02 F2-03 C4-62	SVC speed loop Kp/Ti, inertia ratio	-	Supported	-	Supported	The system with fixed inertia can perform inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.

Param.	Name	With-load auto-tuning for synchro nous motor	No-load dynamic auto-tuning of synchro nous motor	Static complete auto-tuning of synchro nous motor	Inertia auto-tuning	Descriptions
C0-04	Mounting angle of encoder	Supported	Supported	-	-	When FVC is used, failure to recognize the encoder mounting angle can result in serious accidents such as device runaway. When C2-00 is set to 12 and C2-00 is set to 11, either for FVC or SVC mode,the encoder mounting angle is auto-tuned once the encoder type is selected. Before performing on-load auto-tuning of synchronous motor (C2-00=11), you must verify that the encoder phase sequence (C0-03) is correct. Otherwise, the device runaway may occur.
C0-03	Encoder direction auto-tuning	-	Supported	-	-	For no-load dynamic auto-tuning of synchronous motor, the input phase sequence of the encoder is automatically auto-tuned. If the motor cannot perform dynamic auto-tuning, the encoder input phase sequence needs to be set first. After the control mode is set to SVC, run to see if the encoder feedback speed (U0-29) is consistent with the motor speed (U6-00); if the speed is not consistent, inverse the value of C0-03.
C0-02	Check encoder pulses per revolution	-	Supported	-	-	No-load dynamic auto-tuning of synchronous motor detects the direction of the encoder and whether the number of encoder pulses per revolution are set accurately and whether the encoder signal is normal

Note

Before setting C2-00 to 11 (with load auto-tuning for synchronous motor), you must confirm the encoder phase sequence (C0-03). Otherwise, runaway may occur. The operation is as follows: Set the motor basic parameters and back EMF (if the back EMF is known), set b5-00 to 13 (static partial auto-tuning of synchronous motor), set d0-00 to 0 (operation in SVC mode), and observe whether U0-29 and U6-00 are identical when the motor is running normally.

1. If the values of U0-29 and U6-00 are opposite, change C0-03 (encoder direction).
2. If the values of U0-29 and U6-00 are different, adjust the rotation of the ABZ and sine encoders and adjust the pole pairs of the resolver.
3. If the motor is rotated and the encoder feedback speed is 0, this may be caused by incorrect encoder wiring, incorrect encoder parameter configuration, damaged encoder, and unmatched signal. Make sure that U0-29 and U6-00 are set to the same value and set C2-00 to 11 (with load auto-tuning of synchronous motor).

Back EMF is not tuned when C2-00 is set to 11 (with load auto-tuning of synchronous motor) and C2-00 is set to 13 (static partial auto-tuning of synchronous motor). In the SVC mode, the correct back EMF must be set manually. In the FVC mode, if torque accuracy is required, you must also manually set the correct back EMF or perform no load dynamic auto-tuning.

Table 4–17 Reluctance motor auto-tuning table

Param.	Name	Static auto-tuning of reluctance motor	Dynamic auto-tuning of reluctance motor	Descriptions
F1-12	Synchronous motor rated back EMF	-	Supported	The rated back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. For reluctance motor without magnetic assistance, there is no need to set this parameter. For reluctance motor with magnetic assistance, if the motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = F1-07 / 1000 x 120 V. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.
F1-20	Motor stator resistance	Supported	Supported	-
F1-32 F1-34	d-axis and q-axis inductance	Supported	Supported	-
C5-30 to C5-55	Inductance saturation curve	Supported	Supported	Inductance saturation curve is important to energy-saving performance. It must be included when downloading or setting all parameters.
A3-30 to A3-46	Dead zone compensation curve	Supported	Supported	The dead zone compensation curve is critical to the low-speed performance of the control mode. It must be included when downloading or setting all parameters.
C0-04	Mounting angle of encoder	Supported	Supported	When FVC is used, failure to recognize the encoder mounting angle can result in serious accidents such as device runaway. When C2-00 is set to 22 and C2-00 is set to 21, the encoder mounting angle is auto-tuned. Before performing on-load auto-tuning of reluctance motor (C2-00=21), you must verify that the encoder phase sequence (C0-03) is correct. Otherwise, the device runaway may occur. If the motor type is reluctance synchronous motor without permanent magnet (C4-00=3), encoder mounting angle auto-tuning is not supported when performing on-load auto-tuning of reluctance motors (C2-00=21).

Param.	Name	Static auto-tuning of reluctance motor	Dynamic auto-tuning of reluctance motor	Descriptions
C0-03	Encoder direction auto-tuning	-	Supported	For no-load dynamic auto-tuning of reluctance motor, the input phase sequence of the encoder is automatically auto-tuned. If the motor cannot perform dynamic auto-tuning, the encoder input phase sequence needs to be set first. After the control mode is set to SVC, run to see if the encoder feedback speed (U0-29) is consistent with the motor speed (U6-00); if the speed is not consistent, inverse the value of C0-03.
C0-02	Check encoder pulses per revolution	-	Supported	No-load dynamic auto-tuning of reluctance motor detects the direction of the encoder and whether the number of encoder pulses per revolution are set accurately and whether the encoder signal is normal.

Note

For the pure reluctance motor, when C2-00 is set to 21 (static auto-tuning for synchronous reluctance motor), the encoder mounting angle is not tuned. When C2-00 is set to 22 (dynamic auto-tuning for synchronous reluctance motor), the synchronous BMF is not tuned but the inertia is tuned.

4.7 Running command setting

Selecting Control Channel

Start/stop command also can be called command source. The command source is the source or input mode of commands to control the startup, stop, forward running, reverse running, jogging, and fault reset of the AC drive.

Running command source

In this section, control channel 1 is used as an example, and only the common setting methods are described. For details, see *"5.2.1.1 Operation Command" on page 157*.

Scenarios	Operation example	Related Parameters and descriptions
Control running through the operating panel [b1-00(F0-03)=0]		
Start/stop and other controls of the AC drive can be achieved through the keys on the operating panel.	1. Set b1-00(F0-03) to 0 and press  to set the command source of control channel 1 to the operating panel. 2. Set F0-30 to 10.00 Hz. Press the  key again to display the set frequency to 10 Hz. 3. Press  to start the AC drive (the RUN indicator is on). Then the AC drive runs at the frequency of 10 Hz. 4. When the AC drive is running, press  to stop the AC drive. The RUN indicator becomes off.	**Related parameters:** *"b5-01 (F0-30)" on page 164*
Control running through the DI terminal [b1-00(F0-03)=1]		

Scenarios	Operation example	Related Parameters and descriptions
The two modules are configured with different control modes, which can be switched over through b9-00, to control the start, stop, and forward rotation function of the AC drive.	1. Set b1-00(F0-03) (Main command source of control channel 1) to 1, which is terminal control. 2. Select the terminal mode. • Six terminal control modes are available for MD630-INT series AC drive, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2. • For example, set b9-00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop as module A (two-wire mode 2 by default). • Terminal module A and B can be switched freely from terminal module A (two-wire mode 2) to terminal module B (three-wire mode 1). 3. Set the terminal control mode. For example, set b9-01 (Mode of terminal start/stop module A) to 4, which is to set the terminal control mode to "IN1P (rising edge) start, IN2 stop". 4. Set the functions of the DI terminals. For example, DI1 and DI2 are used to control functions of IN1 and IN2. That is, set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1) and E0-01 (DI2 function selection) to 2 (Terminal start/stop module A_IN2). 5. After the terminal mode and each DI terminal function are configured, start/stop and fault reset can be performed on the AC drive through the DI terminal. For example, when DI2 is active, enable DI1 and the AC drive to run at the set frequency. Disconnect DI2. The AC drive stops running immediately.	**Notes:** • The MD630-INT supports two groups of terminal start/stop modules: Terminal start/stop module A (b9-01 to b9-08) and terminal start/stop module B (b9-09 to b9-16). • The functions of the two groups of terminal start/stop modules are identical. You can switch between them by b9-00 (Terminal start/stop module A/B), and only one terminal start/stop module is active at any time. **Related parameters:** *" b9-00 (F4-00)" on page 164* *" b9--01 (F4-01)" on page 165* *" b9--09 (F4-02)" on page 168*
Control running through communication [b1-00(F0-03)=2]		
To enable remote control of the AC drive, set b1-00 to 2 and select communication as the running command source.	Take 7311H as an example. The following steps are used to set the communication as the command source. 1 .Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect. 2 .Set the corresponding communication parameters, including Modbus communication parameters in group n2, or CAN communication parameters in group n4 to n6. 3 .Set the command source to communication. Set b0-02 (Control channel selection) to 0 (Control channel 1) and b1-00 (Main command source of control channel 1) to 2 (Communication). 4 .Send a write command to the AC drive through the host controller; write 1 to 7311H to start the AC drive, and write 0 to stop the AC drive.	**Notes:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *" n Communication Configuration" on page 1421*. For communication addresses, see *" Communication Address" on page 169*.

Scenarios	Operation example	Related Parameters and descriptions
Control running through the custom channel [b1-00 (F0-03) = 3]		
The MD630-INT series AC drive is configured with a custom master command source in control channel 1/2.	1 .Set F0-03 (Control channel 1 main command source) to 3 (Custom) to set the custom command as the active command source. 2 .Set b1-01 (Custom ON_OFF1 (start/stop) source) to 3 (DI1). 3 .Set E0-00 (DI1 terminal function selection) to 0 (No function). 4 .Set b1-02 (Custom OFF2 (coast to stop) source 1) to 1 (Invalid) and b1-03 (Custom OFF3 (quick stop) source 1) to 1 (Invalid). After setting the preceding steps, the AC drive starts when DI1 is closed. If b1-02 and b1-03 are set to 0 during running, the AC drive stops.	**Related parameters:** *" b1-01 to b1-08" on page 162*

4.8 Frequency reference setting

Select Set Channel

Set b0- 03 (Set channel selection) to modify the active setting channel of the AC drive. For details, see *" b0-03" on page 175*.

Set frequency

In this section, control channel 1 is used as an example, and only the common setting methods are described. For details, see *" Frequency Reference Source Setting Channel" on page 169*.

Scenarios	Operation example	Related Parameters and descriptions
Setting main frequency through parameter [b5-00(F0-29)=0]		
Setting frequency through parameter settings	1. Set b5-00(F0-29) (Main frequency source) to 0 [Set by the parameter (F0-30)]. 2. Set b5-01(F0-30) (Main frequency digital setting) to the set frequency. 3. When the main frequency source is set by parameters, in addition to directly modifying the value of the parameters to set the frequency, you can also set the frequency by using the UPDOWN keys. After setting the preceding steps, when the AC drive is stopped or running, you can increase the set frequency by pressing the  key on the operating panel. Using  key to decrease the frequency setting. The two keys help to set the frequency to the target value in real time.	*" b5--01 (F0-30)" on page 180*
Setting frequency through AI [Main: b5-00 (F0-29) = 2 or 3; Auxiliary: b5-02 (F0-31) = 2 or 3]		

Scenarios	Operation example	Related Parameters and descriptions
As a frequency source, each AI terminal supports five types of AI curves. The AI curve defines the relationship between the analog input voltage (or current) and the corresponding set values.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%", as shown in the example below: • Set E2-40 (minimum input of AI curve 1) to 0.00 V. • Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 (maximum input of AI curve 1) to 10.00 V. • Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through E2-10(F4-21) (AI1 filter time). 3. Set b5-00[(F0-29) (Main frequency source) = 2 (AI1) to select AI as the frequency source. 4. The AI terminal is set to voltage input mode by default. If you need to switch it to current input mode, use the DIP switch. When the analog input is in current mode, 1 mA of current is equivalent to 0.5 V of voltage, meaning 20 mA corresponds to 10 V. After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.	**Notes:** For detailed AI curve setting methods, see "5.2.10.8 Analog Input Terminal (AI)" on page 334. **Parameter configuration:** "Parameter settings when communication is used as the main frequency source" on page 182 **Related parameters:** "E2-40 to E2-43" on page 182 Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) "E2-44 to E2-51" on page 183 Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) "E2-52 to E2-67" on page 185 Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: "E2-38" on page 188 AI1 fitter time: "E2-10" on page 188
Setting frequency through pulse input (HDI). [Main: b5-00 (F0-29) = 5; Auxiliary: b5-02 (F0-31) = 5]		

Scenarios	Operation example	Related Parameters and descriptions
This setting method is applicable to scenarios where a high-speed digital input is used as the frequency source, and the pulse frequency determines the input frequency.	Take the two-point HDI curve setting as example: 1. F4-68 [HDI terminal type selection] = 0 [for HDI use], and configure DI7 as a pulse input terminal. 2. Set the relationship between the HDI frequency input and the two-point curve to "0 V to 20 kHz corresponds to 0% to 100%". • Set F4-71 to 0.00 kHz. • Set F4-72 to 0.0%. • Set F4-73 to 20.00 kHz. • Set F4-74 to 100.0%. 3. Set HDI filter time through F4-83 (HDI filter time). 4. Set F0-29 (Main frequency source) = 5 (HDI) to select HDI as the frequency source. After setting the preceding steps, when HDI inputs a 10kHz power, the AC drive obtains the HDI curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When HDI input voltage is changed, the running frequency changes according to the HDI curve.	**Notes:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 323*. **Parameter configuration:** *" Parameters used to set main frequency through pulse input" on page 188* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 189* *" E4-32(F4-83)" on page 189*
Setting frequency through multi-reference [Main: b5-00 (F0-29) = 6; Auxiliary: b5-02 (F0-31) = 6]		
This mode is suitable for applications where continuous adjustment of the drive's running frequency is not required, and only a few specific frequency values are needed.	After F0-29 (Main frequency source) is set to 6 (Multi-reference), the multi-reference is used as the active frequency source. You can assign the multi-reference terminal function to the DI and switch among pre-set multi-references through the DI. Up to 16 multi-references are supported. You can set four groups of multi-references through group F parameters. The relationship between the reference quantity and DI quantity is as follows: • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 to b8-06 are set to 0. • Five to eight multi-references: Three DIs K1, K2, and K3; b8 set to 0. • 9-16 multi-references: Four DIs (K1, K2, K3, and K4).	**Notes:** To use multi-reference as the main frequency reference source, assign functions 12 to 15 to the DI terminals or set b8-03 (multi-reference selection Bit 0) to b8-06 (multi-reference selection Bit 3). For details, see *" Parameter settings when multi-reference is used as the main frequency source" on page 190*. **Related parameters:** *" b8-03 to b8-24" on page 191*
Setting main frequency through PID [Main: b5-00 (F0-29) = 8; Auxiliary: b5-02 (F0-31) = 8]		

Scenarios	Operation example	Related Parameters and descriptions
As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.	1. After setting F0-29 (Main frequency source) to 8 (PID), the process PID controller is used as the active frequency source. 2. Using PID as the frequency source, you need to manually enable the PID function, that is, P2-00 [process PID enable] = 1 [enable]. 3. Set the PID reference source and feedback source. The default is P2-02 [PID reference source] = 0 [digital reference] (by P2-03), and P2-04 [PID feedback source] = 0 [AI1].	**Notes:** For details on PID functions, see *"5.4.6.2 Process PID Control" on page 601*. **Schematic diagram for control:** *" Principle of process PID control" on page 201* **Related parameters:** *" P2-00 to P2-27 models" on page 201*
Setting Frequency Through Communication [Main: b5-00 (F0-29) = 9; Auxiliary: b5-02 (F0-31) = 9]		
Set parameter b5-00 (Main frequency source) to 9 to select the communication setpoint as the main frequency.	To set Communication as the main frequency source of channel 1: 1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference input source of set channel 1. 2. Set n0-14 and select the 7310H speed setting configuration. 3. Use the host controller to send a write command to the AC drive.	**Notes:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *" n Communication Configuration" on page 1421*. For communication addresses, see *" Communication Address" on page 207*. **Parameter configuration:** *" Parameter settings for using communication as the main frequency reference source" on page 205* **Related parameters:** *" n0-14" on page 206*

4.9 Torque reference setting

Selecting Torque Reference

Set b0- 03 (Set channel selection) to modify the active setting channel of the AC drive. For details, see *" b0-03" on page 175*.

Set Torque Reference

In this section, control channel 1 is used as an example, and only the common setting methods are described. For details, see *"5.2.3.1.1 Selecting the Torque Reference Setting Channel" on page 228*.

Scenarios	Operation example	Related Parameters and descriptions
Setting torque reference through parameter [b5-13=0]		
Select the value of b5- 14 (Torque reference source) as the torque source.	Set b5-13 (Torque reference source) to 0 [Set by the parameter (b5-14)].	" b5-14" on page 236
Setting torque reference through AI [b5-13=2 or 3]		
When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V (or 0 mA to 20 mA) corresponds to 0% to 100%": • Set E2-40(F4-28) (minimum input of AI curve 1) to 0.00 V. • Set E2-41(F4-29) (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42(F4-30) (maximum input of AI curve 1) to 10.00 V. • Set E2-43(F4-31) (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through F4-21 (AI1 filter time). 3. Set b5-13 (Torque reference source) = 2 (AI1) to select AI1 as the torque source. After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the torque setting is 50%. When AI1 input voltage is changed, the torque setting changes according to the AI1 curve.	**Notes:** For detailed AI curve setting methods, see "5.2.10.8 Analog Input Terminal (AI)" on page 334. **Parameter configuration:** " Parameter settings when communication is used as the main frequency source" on page 182 **Related parameters:** " E2-40 to E2-43" on page 182 Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) " E2-44 to E2-51" on page 183 Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) " E2-52 to E2-67" on page 185 Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: " E2-38" on page 188 AI1 fitter time: " E2-10" on page 188

<table>
<tr><th>Scenarios</th><th>Operation example</th><th>Related Parameters and descriptions</th></tr>
<tr><td colspan="3">Setting torque reference through communication [b5-13=9]</td></tr>
<tr><td>Select the communication setpoint as the torque source.</td><td>1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 and select the 7310H torque setting configuration.
3. Use the host controller to send a write command to the AC drive.
When the torque source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive.
The following section describes how to set the main frequency through Modbus communication and address 0x7310. For example, to set the torque reference to 100.0% (1000) through communication, send the write command 01 06 73 10 03 E8 92 35. For details, see the following table.
<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>01H (configurable)</td><td>AC drive address</td></tr>
<tr><td>06H</td><td>Write command</td></tr>
<tr><td>7310H</td><td>Torque reference address</td></tr>
<tr><td>03E8H (1000 in decimal)</td><td>Target torque</td></tr>
<tr><td>9235H</td><td>CRC check</td></tr>
</table>
Set n0-14 = 3, then write 1000 to 7310H to set the torque to 10%. The set torque can be viewed through U6-11.</td><td>Notes:
• MD630S-INT: Modbus
• MD630N-INT: EtherCAT, EtherNet/IP, PROFINET
For communication parameters, see “ n Communication Configuration” on page 1421.
For communication addresses, see “ Communication Address” on page 207.
Related parameters:
“ n0-14” on page 206</td></tr>
</table>

4.10 Jog

4.10.1 Select Set Channel

In some applications, the AC drive needs to run at a low speed temporarily to facilitate equipment testing. In this case, jogging applies. For jog frequency set channel, see “5.2.5.2 Jog Frequency Set Channel” on page 274.

Operation steps

Set b0- 03 (Set channel selection) to modify the active setting channel of the AC drive. For details, see “ b0-03” on page 175.

4.10.2 Set Jog Frequency

Similar to main frequency source, F0-56 and F0-58 allow you to select the frequency source setting method, such as the parameter, AI, multi-reference, and communication.

When the jog command is active, the set frequency of the AC drive is determined by the jog frequency.

- When the jog 1 command is active, the frequency of the AC drive is the jog 1 frequency, allowing AC drive runs at the jog 1 frequency
- When the jog 2 command is active, the frequency of the AC drive is the jog 2 frequency, allowing AC drive runs at the jog 2 frequency

To set the jog frequency source to be digital setting, AI input, HDI pulse setting (MD630S-INT), and multi-reference, set the values of related parameters to corresponding values.

Operation steps:

1. Set F0-56 (Jogging frequency 1 source) and F0-58 (Jogging frequency 1 source) to select the frequency source for Jog 1 and Jog 2.
2. See *"4.8 Frequency reference setting" on page 143* to configure other parameters based on the frequency source (digital setting, AI, HDI, etc.).

If F0-56 is set to 0 (Set by the parameter (F0-57)) or F0-58 is set to 0 (Set by the parameter (F0-59)), then set the value of F0-57 to the jog 1 frequency source. Alternatively, set the value of F0-59 to the jog 2 frequency source.

Related parameters

Table 4–18 Parameters related to jog frequency

Param.	Name	Default Value	Value Range	Descriptions
b5-07 (F0-56)	Jogging frequency 1 source	0: Set by the parameter (F0-57)	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 1 frequency. Note: 0: Set by the parameter (b5-08) The jog frequency 1 source is "jog frequency 1 reference", set by the parameter (b5-08). For details on other options, see the following descriptions, in which jog frequency refers to jog frequency 1
b5-08 (F0-57)	Digital setting of jog 1 frequency	2.00 Hz	-50.00 Hz to 50.00 Hz	This parameter indicates the digital setting of jog 1 frequency. It is activated when b5-07 is set to 0 (b5-08).
b5-09 (F0-58)	Jogging frequency 2 source	0: Set by the parameter (F0-59)	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 2 frequency. Note: 0: Set by the parameter (b5-10) The jog frequency 2 source is "jog frequency 2 reference", set by the parameter (b5-10). For details on other options, see the following descriptions, in which jog frequency refers to jog frequency 2

Param.	Name	Default Value	Value Range	Descriptions
b5-10 (F0-59)	Digital setting of jog 2 frequency	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jogging frequency 2 It is activated when b5-09 is set to 0 (b5-10).

Other value description:

2: AI1 The jog 1 frequency is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve.
3: AI2 - The jog 1 frequency is input by current or voltage signal through AI2 and calculated according to the preset AI curve.
5: HDI pulse reference - The jog 1 frequency is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (valid only for MD630S)
6: Multi-reference - When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values.
7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds.
8: PID The jog 1 frequency is set through PID.
9: Communication The jog 1 frequency is set through communication. When selecting the source, you can set the jog 1 frequency through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices.
Others: F connector A parameter code is set for a floating-point connector, and the value of the connector is read as the jog 2 frequency. This mode is used for expansion of common sources.

4.10.3 Defines the terminal jog operation command

The drive starts or stops by setting the running command through the state of the digital input terminal. When the running command is jog, the AC drive runs at the jog frequency.

The jog acceleration/deceleration time can be selected by F0-62 (Jog ramp source), F0-63 (Jog ramp acceleration time), F0-64 (Jog ramp deceleration time), or normal running ramp time (b7-04 to b7-27).

Operation steps:

1. Set F0-03 (Main command source of control channel 1) to 1 to select the terminals as the active command source.
2. Set b9--00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop as module A.
3. Set F4-03 (DI1 function selection) to 4 (JOG 1 of terminal start/stop module A) and F4-04 (DI2 function selection) to 5 (JOG 2 of terminal start/stop module A).
4. 0: Ramp selection 1: JOG ramp time
5. Set F0-63 (jog frequency), 20.0s (jog acceleration time), and 20.0s (jog deceleration time) properly.

After the preceding steps are set, if DI1 input is active, start at the frequency set by jog 1, and DI2 start at the frequency set by jog 2. If DI1 and DI2 terminals are closed at the same time, start at the frequency set by jog 1.

Related parameters:

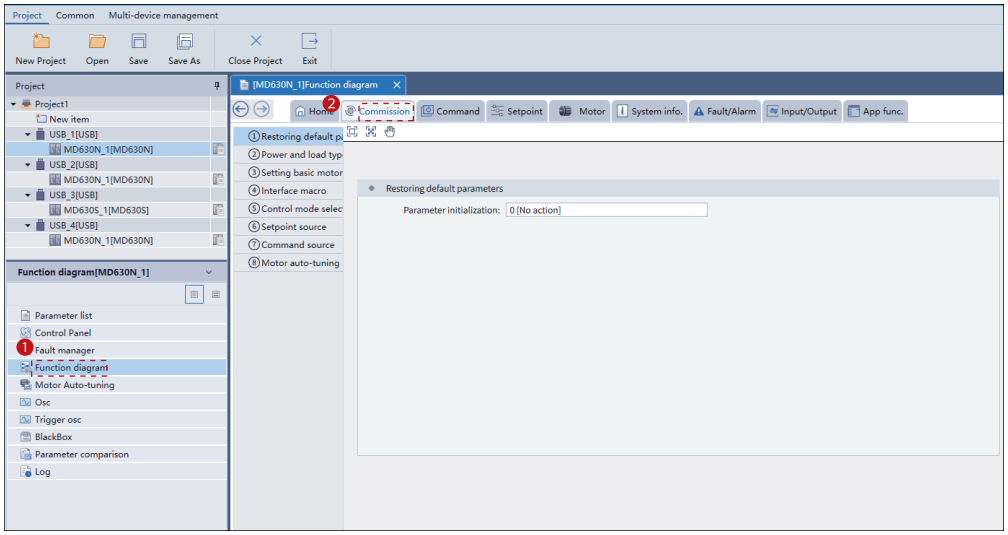
Table 4–19 Parameters related to jog frequency

Item	Name	Default	Value Range	Descriptions
F4-03 (E0-00)	DI1 function selection	1	4: Terminal start/stop module A jog 1(JOG1) 5: Terminal start/stop module A jog 2(JOG2)	Defines the function assigned to DI1. If no special description is provided, the terminal function is level-triggered. **Description** 4: Terminal start/stop module A jog 1 (JOG1) - The drive operates in jog mode. When terminal start/ stop module A is active, the drive runs at low speed for a short period of time in the jog mode 1. The operating frequency and direction are determined by the jog 1 frequency (positive frequency by default). This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control) 5: Terminal start/stop module A jog 2 (JOG2) - The drive operates in jog mode. When terminal start/ stop module A is active, the drive runs at low speed for a short period of time in the jog mode 2. The operating frequency and direction are determined by the jog 2 frequency (positive frequency by default). This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control)
F4-04 (E0-01)	DI2 function selection	4		
F4-05 (E0-02)	DI3 function selection	9		
F4-06 (E0-03)	DI4 function selection	12		
F4-07 (E0-04)	DI5 function selection	13		
F4-08 (E0-05)	DI6 function selection	0		
F4-09 (E0-06)	DI7 function selection	0		
E0-16	DI input filter time 1	0.010s	0.000s to 1.000s	This parameter defines the filter time 1 for the AC drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000s to 1.000s	This parameter defines the filter time 2 for the AC drive to respond to changes in DI terminal status.
F0-62 (b7-31)	Jogging ramp source	0	0: Ramp time of normal running 1: Ramp time of jogging	Sets the jogging ramp source. **Value description** 0: Ramp time of normal running 0: Normal operation ramp time The jog ramp time is the same as the normal operation ramp time. 1: Ramp time of jogging 1: Jog ramp time Jog ramp time is set separately through F0-63 and F0-64.

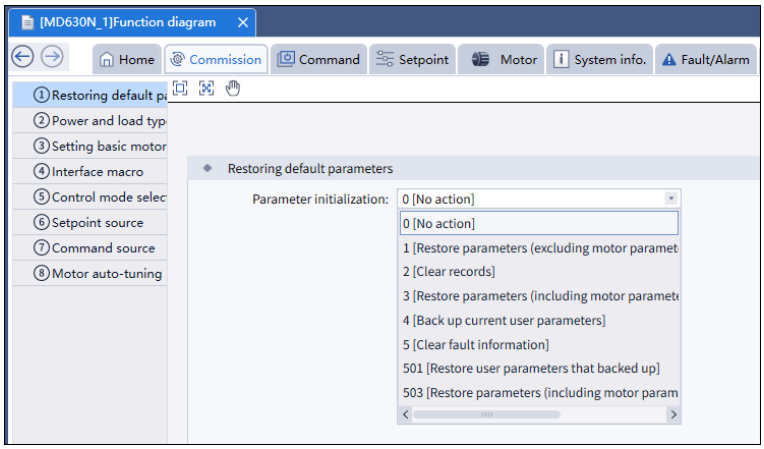
Item	Name	Default	Value Range	Descriptions
F0-63 (b7-32)	Ramp acceleration time of jogging	20	0.00 to 655.00	This parameter defines the time required for the output frequency to rise from 0 to F0-46 (base frequency for acceleration/deceleration time) in the jog mode. It determines the frequency rise rate in the jog mode. **Additional information:** The acceleration current must be limited below the overcurrent capacity of the AC drive to prevent the AC drive from tripping due to overcurrent stall.
F0-64 (b7-33)	Ramp deceleration time of jogging	20	0.00 to 655.00	This parameter defines the time required for the output frequency to fall from F0-46 (base frequency for acceleration/deceleration time) to 0 in the jog mode. It determines the frequency fall rate in the jog mode. **Additional information:** Deceleration time setting requirements: Avoid too large smoothing circuit voltage, so as not to cause the AC drive to trip due to overvoltage stall.

4.11 Commissioning with iFA Drive

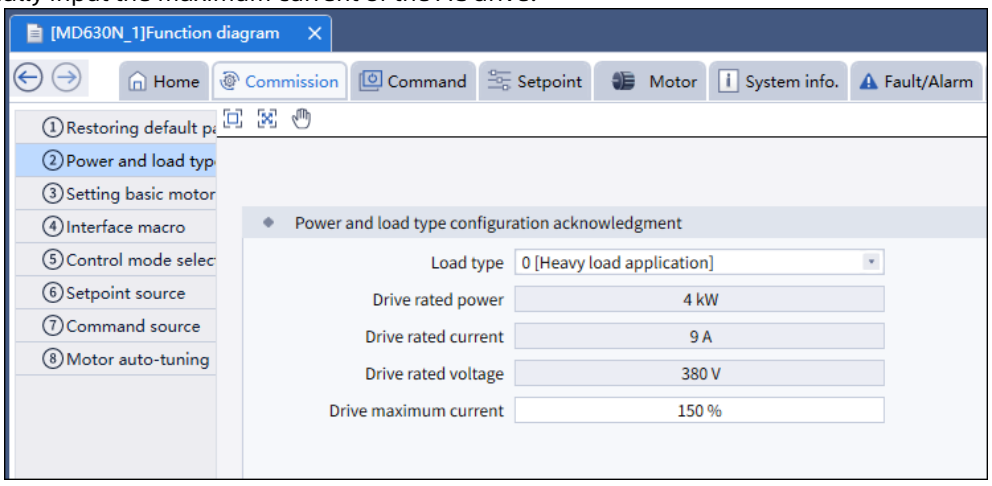
1. Double-click “Function Diagram” (①) and click “Quick Commissioning” (②) on the first-level ribbon to enter the quick commissioning function.



2. Click “Restore default parameters” and select the desired action from the drop-down box.

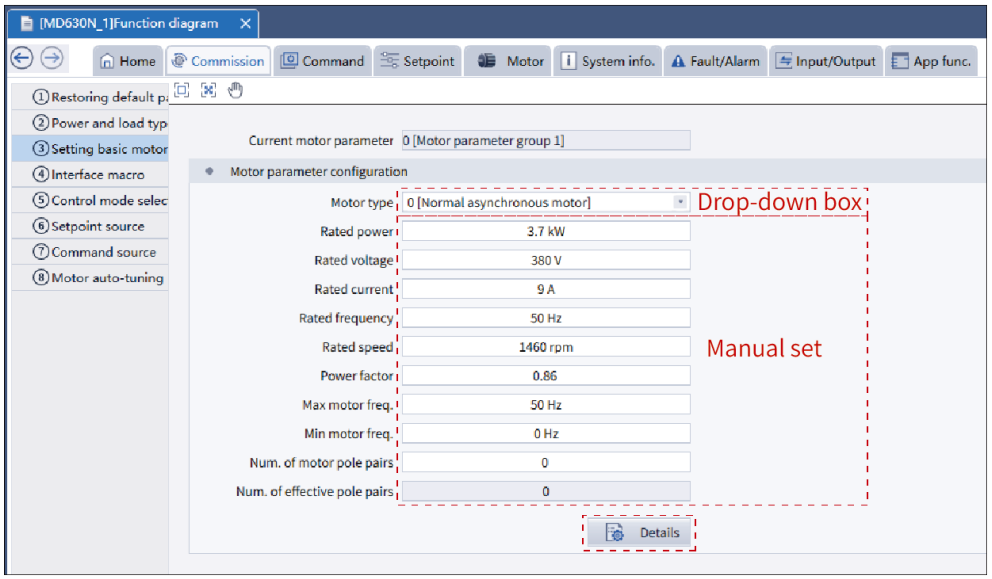


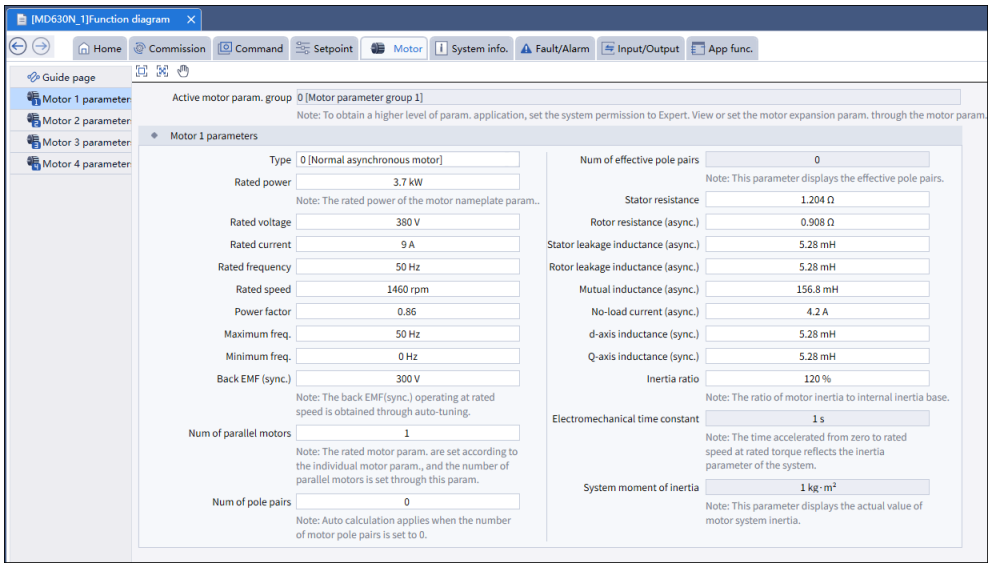
3. Click "Power and load type configuration" and select the load type through the drop-down box to manually input the maximum current of the AC drive.



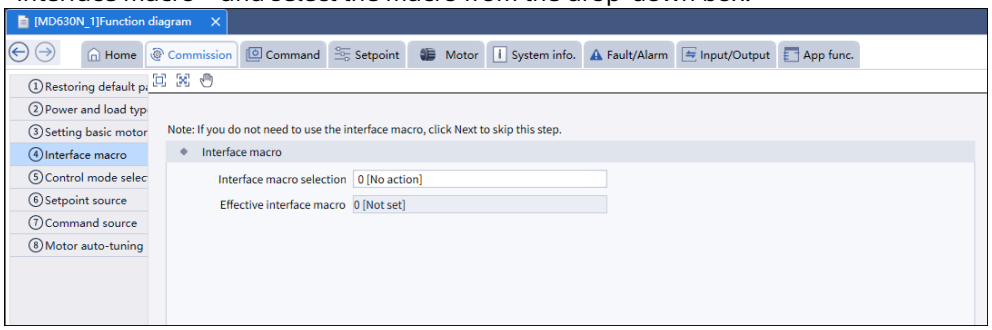
4. Click “Setting basic motor parameters”, select the motor type through the drop-down box, and manually set the motor rated power.

   Note: If you need detailed configuration, click “Details” and the software will jump to the “Motor” tab to configure it.

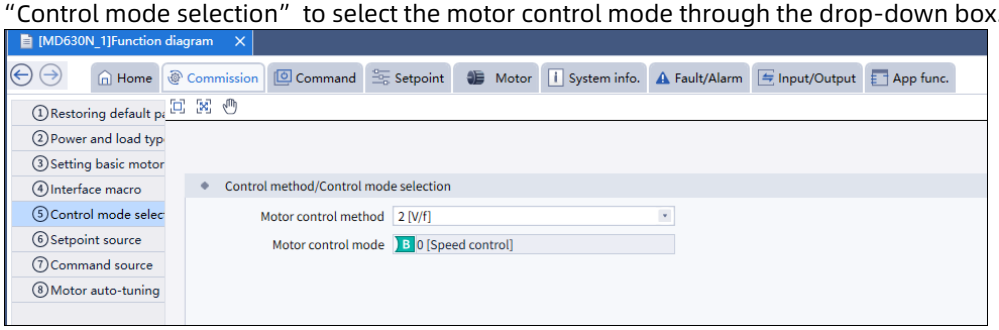




5. Click “Interface macro” and select the macro from the drop-down box.

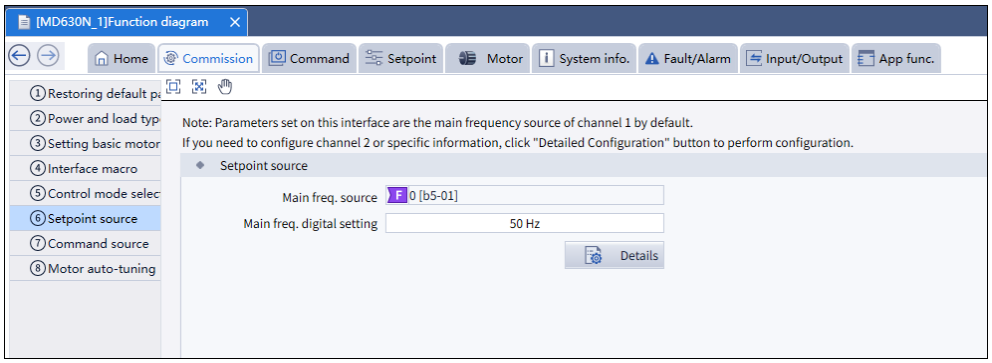


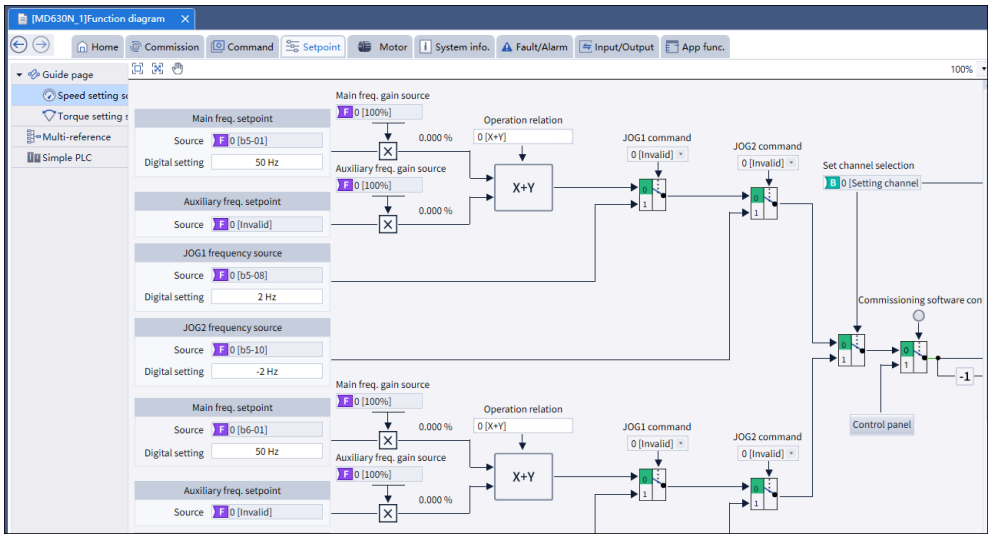
6. Click “Control mode selection” to select the motor control mode through the drop-down box.



7. Click "Setpoint source" to manually input the digital setting of the main frequency.

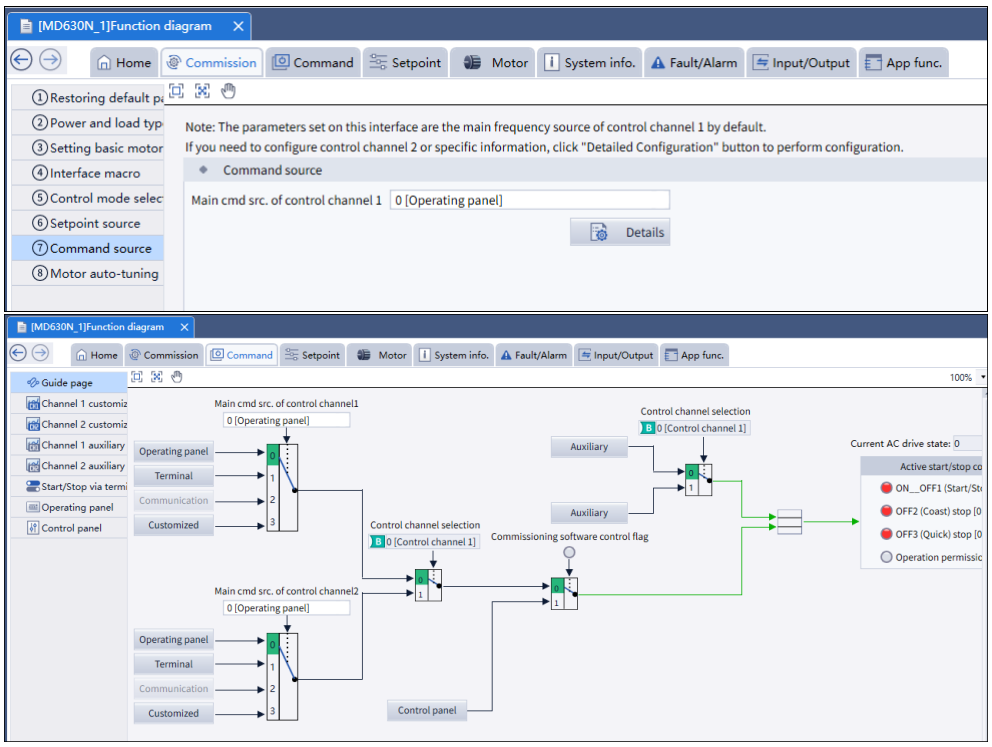
Note: If you need detailed configuration, click “Details” and the software will jump to the “Setpoint” tab to configure it.



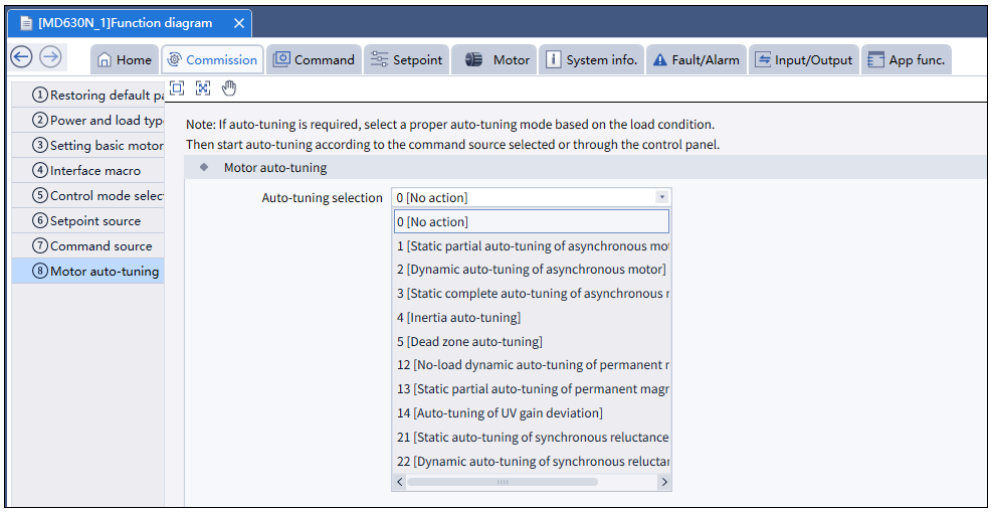


8. Click “Command source”, and select the source of the main command for control channel 1 through the drop-down box.

   Note: If you need detailed configuration, click “Details” and the software will jump to the “Command” tab to configure it.



9. Click "Motor auto-tuning" and select the tuning method from the drop-down box.



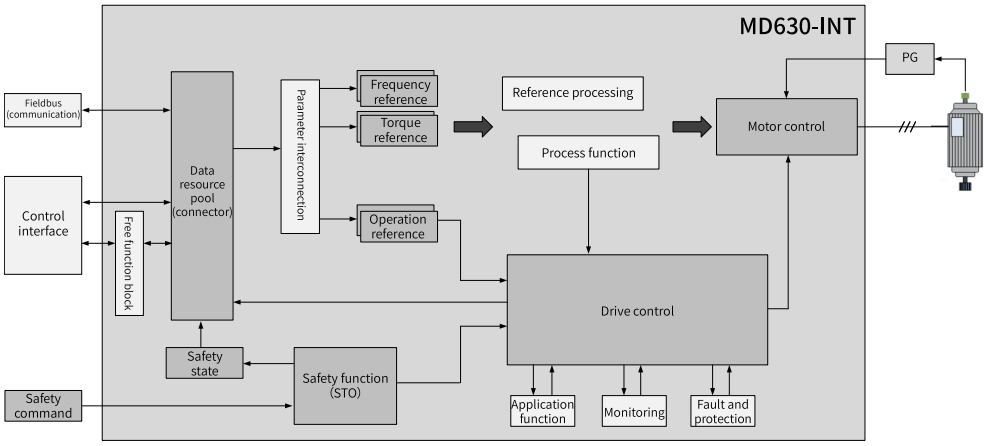
10. The quick commissioning is completed.

4.12 Copy quickly after commissioning is completed

After commissioning is completed, save the commissioned parameters locally and quickly copy them to other AC drives for batch commissioning. For details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*.

5 Functions

5.1 Functions



5.2 Common Function

5.2.1 Commands for Operation

5.2.1.1 Operation Command

Selecting control channels

Start/stop command also can be called command source. The command source is the source or input mode of commands to control the startup, stop, forward running, reverse running, jogging, and fault reset of the AC drive.

You can switch active control channels through b0-02 (control channel selection). For details, see *" b0-02" on page 160*. By default, the active control channel is control channel 1. Control channel 1 is used as an example in this section if no notes are provided.

Operation command source

The operation command source is set through b1-00 or F0-03 and b3-00. For the operation command source of control channel 1, see *" b1--00 (F0-03)" on page 161*. For the operation command source of control channel 2, see *" b3-00" on page 164*.

Scenario	Operation example	Related parameters
Control the drive through the operating panel (b1-00 or F0-03 = 0).		
Control the drive (such as starting or stopping) by pressing the keys on the operating panel.	1. Set b1-00 or F0-03 (main command source of control channel 1) to 0 (operating panel) and press  to set the main command source of control channel 1 to the operating panel. 2. Set F0-30 (digital setting of main frequency) to 10.00 Hz and press . The operating panel displays the set frequency 10 Hz. 3. Press  to start the AC drive (the RUN indicator is on). Then the drive runs at the frequency of 10 Hz. 4. When the AC drive is running, press  to stop the AC drive (the RUN indicator is off).	**Corresponding parameters** *" b5-01 (F0-30)" on page 164*
Control the drive by debugging software		
You can use the iFA debugging software to control the drive (such as starting and stopping).	For details, see *iFA Drive Online Help*. To obtain the guide, see *" Software use" on page 115*.	/
Control the drive through DI (b1-00 or F0-03 = 1).		
The two terminal start/stop modules are configured with different control modes, which can be switched over through b9-00, to control the start, stop, and forward rotation function of the AC drive.	1. Set b1-00 or F0-03 (main command source of control channel 1) to 1, which is terminal control. 2. Select the terminal mode. • Six terminal control modes are available, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2. • For example, set b9-00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop module A. • Terminal module A and B can be switched freely from terminal module A (two-wire mode 2) to terminal module B (three-wire mode 1). 3. Set the terminal control mode. For example, set b9-01 (Mode of terminal start/stop module A) to 4 (IN1P (rising edge) start, IN2 stop). 4. Set the function of each DI. For example, DI1 and DI2 are selected as terminal control functions IN1 and IN2. That is, set E0-00 (DI1 function selection) to 1 (terminal start/stop module A_IN1) and set E0-01 (DI2 function selection) to 2 (terminal start/stop module A_IN2). 5. After the terminal mode and each DI terminal function are configured, start/stop and fault reset can be performed on the AC drive through the DI terminal. For example, when the DI2 terminal is active, the DI1 terminal is enabled, and the drive runs at the set frequency. When the DI2 terminal is disconnected, the drive stops immediately.	**Notes:** • The MD630-INT supports two terminal start/stop modules: terminal start/stop module A (b9-01~b9-08) and terminal start/stop module B (b9-09~b9-16). • The two modules have the same function and can be switched over through b9-00. Only one module can be activated at a time. **Corresponding parameters** *" b9-00 (F4-00)" on page 164* *" b9--01 (F4-01)" on page 165* *" b9--09 (F4-02)" on page 168*
Control the drive through communication (b1-00 or F0-03 = 2).		

Scenario	Operation example	Related parameters
To enable remote control of the drive, set b1-00 to 2 to select communication as the command source for controlling the AC drive.	Take 7311H as an example. The following steps are used to set communication as the command source. 1 .Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect. 2 .Set the corresponding communication parameters, including Modbus communication parameters in group n2, or network communication parameters in groups n4 to n6. 3 .Set the command source to communication. Set b0-02 (Control channel selection) to 0 (Control channel 1) and b1-00 (Main command source of control channel 1) to 2 (Communication). 4 .Send a write command to the AC drive through the host controller; write 1 to 7311H to start the AC drive, and write 0 to stop the AC drive.	**Notes:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see " *n Communication Configuration" on page 1421*. For communication addresses, see " *Communication Address" on page 169*.
Control the drive through the user-defined channel (b1-00 or F0-03 = 3).		
The AC drive includes user-defined main command source in control channels 1/2.	1 .Set F0-03 (Main command source of control channel 1) to 3 to set the user-defined channel as the active command source. 2 .Set b1-01 (custom ON_OFF1 (start/stop) source) to 3 (DI1). 3 .Set E0-00 (DI1 function selection) to 0 (no function). 4 .Set b1-02 (Custom OFF2 (coast to stop) source 1) = 1 (Invalid), and b1-03 (Custom OFF3 (quick stop) source 1) to 1 (Invalid). After the above steps are completed, the drive starts if the DI1 is closed. During operation, if b1-02 and b1-03 are 0, the drive stops.	**Corresponding parameters** " *b1-01 to b1-08" on page 162*

Related parameters

Param.	Name	Default	Setting range	Description
b0-02	Control channel selection	0	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Set the active control channel. If this parameter is 0, control channel 1 is selected. If this parameter is 1, control channel 2 is selected. **Value description:** 0: Invalid - Channel 1 is selected; setting of control channel 1: *"10.2.3.2 b1 Main Command of Control Channel 1" on page 1268*, *"10.2.3.3 b2 Control Channel 1 Auxiliary Command" on page 1269*. 1: Valid - Channel 2 is selected; Settings for control channel 2: *"10.2.3.4 b3: Main command of control channel 2" on page 1270*, *"10.2.3.5 b4: Control Channel 2 Auxiliary Command" on page 1271*. 3 to 9: DI1 to DI7 - The channel selection depends on the terminal state of the DI. Others: B connector - The channel selection depends on the other B connector. You can select the other B connector through the pop-up window.

Working principle:

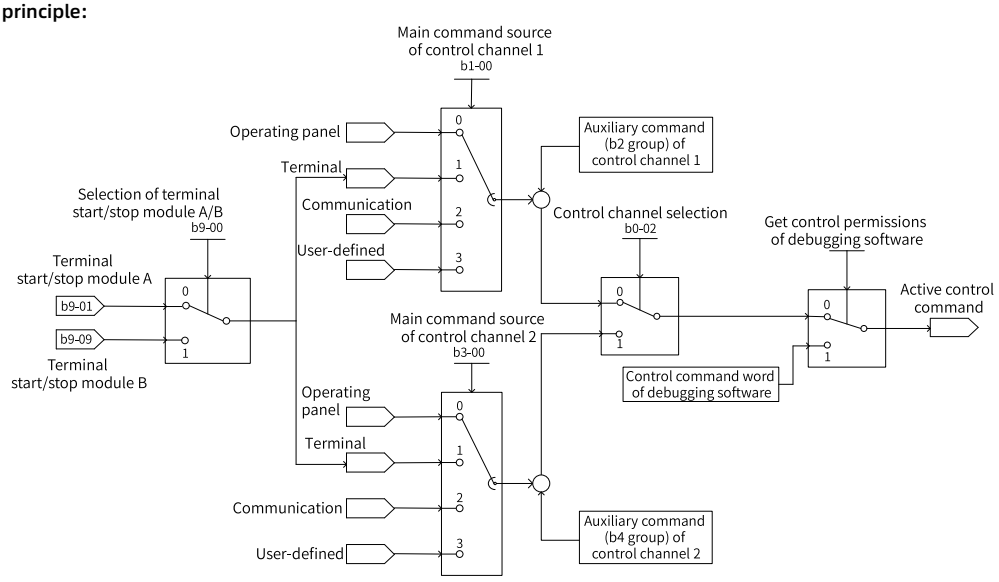


Figure 5-1 Control channel

Note

- The commissioning software can control the start/stop of the AC drive through control in any main command source mode. The commissioning software has the first priority. In this case, the start/stop control mode configured in groups b1/b3 is not effective.
- In any main command source mode (including commissioning software), the auxiliary command word group b2/group b4 corresponding to the effective control channel remains active.

Item	Name	Default	Value Range	Descriptions
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	It is used to set the main command source of control channel 1. **Value description** 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/STOP keys on the keypad. 1: Terminal - Select the main command source of control channel 1 as terminal. Operation commands are input using the DI of the AC drive. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC drive needs to communicate with the host controller. You can input control commands through remote communication. This mode applies to remote control or centralized control of multiple equipment. 3: User-defined. The user-defined control mode is used as the main command source of control channel 1. The control commands can be set by b101 to b109, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

Param.	Name	Default Value	Value Range	Description
b1-01	User-defined ON_ OFF1 (start/stop) source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined ON_OFF (start/stop) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled, indicating the OFF1 start/stop function is active. **Options:** 0: This function is disabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether this function is active depends on other B connector. You can select other B connector through the pop-up window.
b1-02	User-defined OFF2 (coast to stop) source 1	1	0: Enable 1: Disable 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined OFF2 (coast-to-stop) source 1. When the bit signal is 0, this function is enabled and OFF2 (coast-to-stop) is active. When the bit signal is 1, this function is disabled. **Options:** 0: Enable OFF2 (coast-to-stop) is enabled. 1: Disable OFF2 (coast-to-stop) is disabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether this function is active depends on other B connector. You can select other B connector through the pop-up window. **Additional information:** There are three sources for OFF2 (free stop) of control channel 1: b1-02, b2-00, and b2-01. If any source is active, the OFF2 command is active.
b1-03	User-defined OFF3 (quick stop) source 1	1	Same as b1-02	Sets the user-defined OFF3 (quick stop) source 1. When the bit signal is 0, this function is enabled and OFF3 (coast to stop) is active. When the bit signal is 1, this function is disabled. Options: Same as b1-02. **Additional information:** There are three sources of OFF3 (quick stop) of control channel 1: b1-03, b2-02, and b2-03. If any source is active, the OFF3 command is active.

Param.	Name	Default Value	Value Range	Description
b1-04	User-defined operation permission source	1	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined operation permission source. When the bit signal is 0, operation is inhibited. When the bit signal is 1, operation is allowed. **Options:** 0: Operation inhibited 1: Operation allowed 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-05	User-defined issue reset command source 1	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined fault reset command source 1. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. **Options:** 0: Indicates that the issue reset command is disabled. 1: Indicates that the issue reset command is enabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window. **Additional information:** There are three sources of user-defined fault reset for control channel 1: b1-05, b2-04, and b2-05. Any source is valid, and the user-defined fault reset command is valid.
b1-06	User-defined JOG1 (jogging) source	0	0: Disabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined jog (JOG1) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. **Options:** 0: Invalid - The jog command is invalid. 3 to 9: DI1 to DI7 - Whether the jog command is active depends on the terminal state of the DI. Others: B connector - Whether the jog command is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default Value	Value Range	Description
b1-07	User-defined JOG2 (jogging) source	0	Same as b1-06	Sets the user-defined jog (JOG2) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. Options: Same as b1-06.
b1-08	User-defined speed inversion source	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined speed inversion source. When the bit signal is 0, this function is disabled and the speed is not inverted. When the bit signal is 1, this function is enabled and the speed is inverted. **Options:** 0: The speed inversion command is invalid. 1: The speed inversion command is valid. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

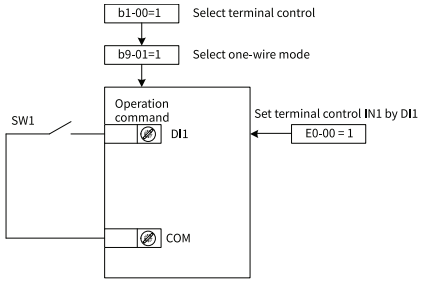
Param.	Name	Default	Value Range	Descriptions
b3-00	Command source of control channel 2	0	Sync control " *b1--00 (F0-03)" on page 161*	It is used to set the main command source of control channel 2. Description " *b1--00 (F0-03)" on page 161*

Item	Parameter Name	Default	Value Range	Descriptions
b5-01 (F0-30)	Digital setting of main frequency	50	0.00 Hz to A2-17	This parameter is used to set the target frequency. It is valid only when the main frequency source is set to digital setting.

Parameter	Name	Default Value	Value Range	Description
b9-00 (F4-00)	Terminal start/stop module selection	0	0: Module A 1: Module B. Others: B connector	Select the terminal module based on the set value. 0 indicates terminal module A. 1 indicates terminal module B. 0: Module A - Used to select the terminal start/stop module A. 1: Module B - Used to select the terminal start/stop module B. Other: Connector B - The value of this parameter is derived from the value of connector B. You can select connector B through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b9-01 (F4-01)	Mode of start/stop module A by terminal	3	0: Disable 1: IN1 start 2: IN1 start, IN2 direction 3: IN1 start in forward direction, IN2 start in reverse direction 4: IN1P (rising edge) start, IN2 stop 5: IN1P (rising edge) start, IN2 stop, IN3 direction 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop	Sets the mode of terminal start/stop module A. This parameter is valid for IN1/IN2/IN3 in the terminal function. **Value description** 0: The terminal is invalid, and IN1/IN2/IN3 are invalid. 1: IN1 start In this mode, a DI terminal is connected. Set function IN1 to control forward rotation and start/stop. 2 [IN1 start, IN2 direction] In this mode, two DI terminals are connected - Functions IN1/IN2 are set, and IN1 is used to control forward rotation and start/stop. IN2 is used to control the running direction. 3: IN1 start in forward direction, IN2 start in reverse direction 3: In this mode, two DI terminals are connected - Set functions IN1/ IN2, and IN1 is used to control the forward rotation and start/stop. IN2 is used to control reverse rotation and start/stop. The AC drive stops when IN1 and IN2 are both active. 4: IN1P (rising edge) start, IN2 stop In this mode, two DI terminals are connected - Functions IN1/IN2 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. 5: IN1P (rising edge) start, IN2 stop, IN3 direction In this mode, three DI terminals are connected - Functions IN1/ IN2/ IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction. 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop In this mode, three DI terminals are connected - Functions IN1/ IN2/ IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction. **Operating principle:**See *"Table 5-1 Terminal command control mode (b9-01/b9-09)" on page 166*.

Table 5–1 Terminal command control mode (b9-01/b9-09)

<table>
<tr><th rowspan="2">Value range:</th><th colspan="2">Working Principle</th></tr>
<tr><th>Example</th><th>Sequence diagram</th></tr>
<tr><td>0: Disable</td><td colspan="2">-</td></tr>
<tr><td>1: IN1 start</td><td>

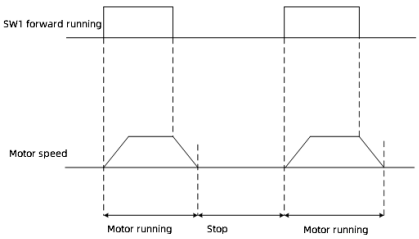
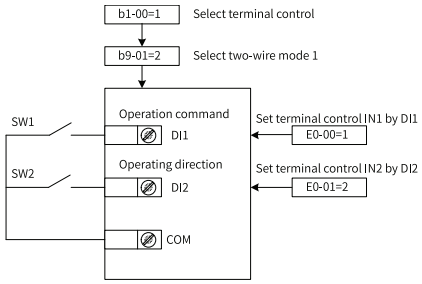
<table>
<tr><th>SW1</th><th>Operation Command</th></tr>
<tr><td>0</td><td>Stop</td></tr>
<tr><td>1</td><td>Run</td></tr>
</table>
Figure 5-2 Wiring and parameter settings for one-wire mode</td><td>

Figure 5-3 Time sequence for one-wire mode</td></tr>
<tr><td>2: IN1 start, IN2 direction</td><td>

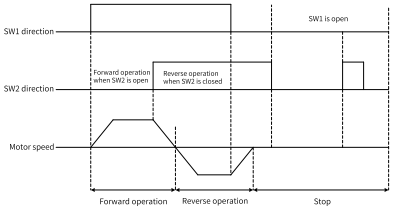
<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>1</td><td>1</td><td>Reverse running</td></tr>
<tr><td>0</td><td>0</td><td>Stop</td></tr>
<tr><td>0</td><td>1</td><td>Stop</td></tr>
</table>
Figure 5-4 Wiring and parameter settings for two-wire control mode 1</td><td>

Figure 5-5 Time sequence for two-wire control mode 1</td></tr>
</table>

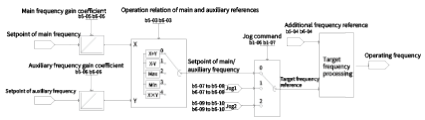
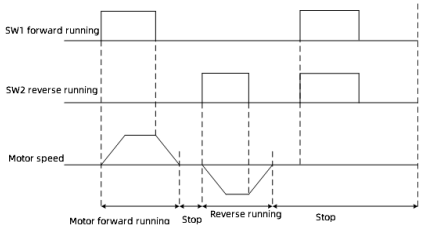
<table>
<tr><td rowspan="2">Value range:</td><td colspan="2">Working Principle</td></tr>
<tr><td>Example</td><td>Sequence diagram</td></tr>
<tr><td>3: IN1 start in forward direction, IN2 start in reverse direction</td><td>

<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>0</td><td>1</td><td>Reverse running</td></tr>
<tr><td>1</td><td>1</td><td>Stop</td></tr>
<tr><td>0</td><td>0</td><td>Stop</td></tr>
</table>
Figure 5-6 Wiring and parameter settings for two-wire 2
</td><td>


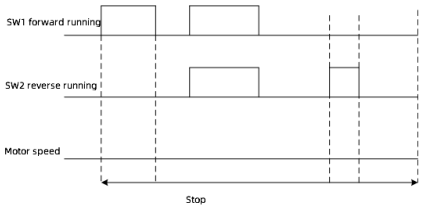
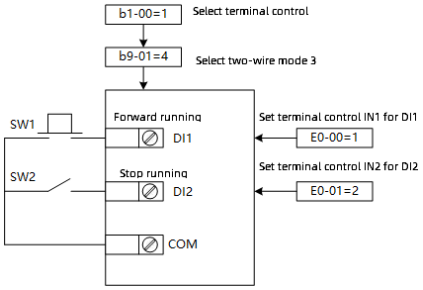
Figure 5-7 Time sequence for two-wire mode 2 (normal)


Figure 5-8 Time sequence for two-wire mode 2 (abnormal)
</td></tr>
<tr><td>4: IN1P (rising edge) start, IN2 stop</td><td>


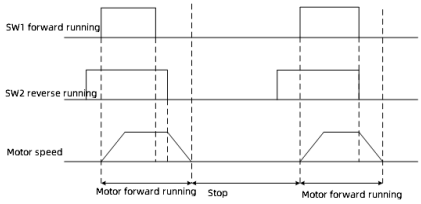
<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>X</td><td>0</td><td>Stop</td></tr>
<tr><td>0->1</td><td>1</td><td>Run</td></tr>
</table>
Figure 5-9 Wiring and parameter settings for two-wire control mode 3
</td><td>


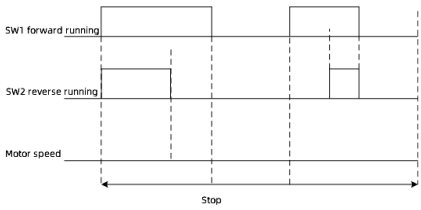
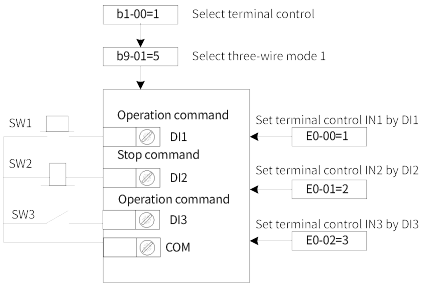
Figure 5-10 Timing sequence for two-wire control mode 3 (normal)


Figure 5-11 Timing sequence for two-wire control mode 3 (abnormal)
</td></tr>
</table>

<table>
<tr><th rowspan="2">Value range:</th><th colspan="2">Working Principle</th></tr>
<tr><th>Example</th><th>Sequence diagram</th></tr>
<tr><td>5: IN1P (rising edge) start, IN2 stop, IN3 direction</td><td>


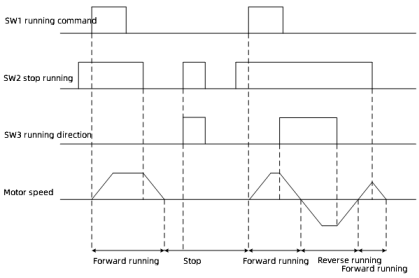
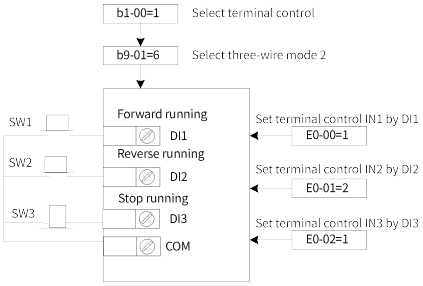
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th><th>Operation Command</th></tr>
<tr><td>X</td><td>0</td><td>X</td><td>Stop</td></tr>
<tr><td>0->1</td><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>0->1</td><td>1</td><td>1</td><td>Reverse running</td></tr>
</table>
Figure 5-12 Wiring and parameter settings for three-wire control mode 1
</td><td>


Figure 5-13 Time sequence for three-wire mode 1
</td></tr>
<tr><td>6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop</td><td>


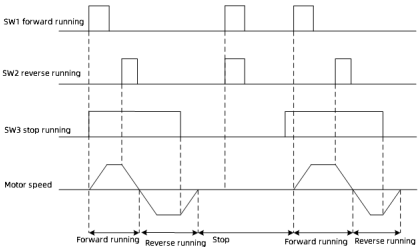
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th><th>Operation Command</th></tr>
<tr><td>X</td><td>X</td><td>0</td><td>Stop</td></tr>
<tr><td>0->1</td><td>X</td><td>1</td><td>Forward running</td></tr>
<tr><td>X</td><td>0->1</td><td>1</td><td>Reverse running</td></tr>
</table>
Figure 5-14 Wiring and parameter settings for three-wire control mode 2
</td><td>


Figure 5-15 Time sequence for three-wire mode 2
</td></tr>
</table>

Param.	Name	Default	Value Range	Descriptions
b9-09 (F4-02)	Mode of start/stop module B by terminal	3	Sync control "*b9--01 (F4-01)" on page 165*	Sync control "*b9--01 (F4-01)" on page 165*

Address

Set F0-03 (Main command source of control channel 1) to 2 (Communication) and configure the communication parameters correctly. After sending a command to the control command address of the AC drive according to the communication protocol, you can control the start, stop, forward rotation, reverse rotation, jog, and fault reset of the AC drive. MD630-INT supports the following control command communication addresses.

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop For example, write 1 to 7311H to control the forward running of the AC drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. bit00: ON_OFF1; 0: stop, 0 to 1: run bit01: OFF2; 0: stop bit02: OFF3; 0: stop bit03: Running allowed; 1: enabled bit04: Reset command; 1: reset Bit05: JOG1; 1: enable Bit06: JOG2; 1: enable bit07: opposite to the speed; 1: opposite For example, write 0x000F to 7321H to control the start of the AC drive.

5.2.2 Frequency Reference

5.2.2.1 Select Frequency Reference Source Channel

Select Set Channel

Set b0- 03 (Set channel selection) to modify the active setting channel of the AC drive. For details, see *" b0-03" on page 175*.

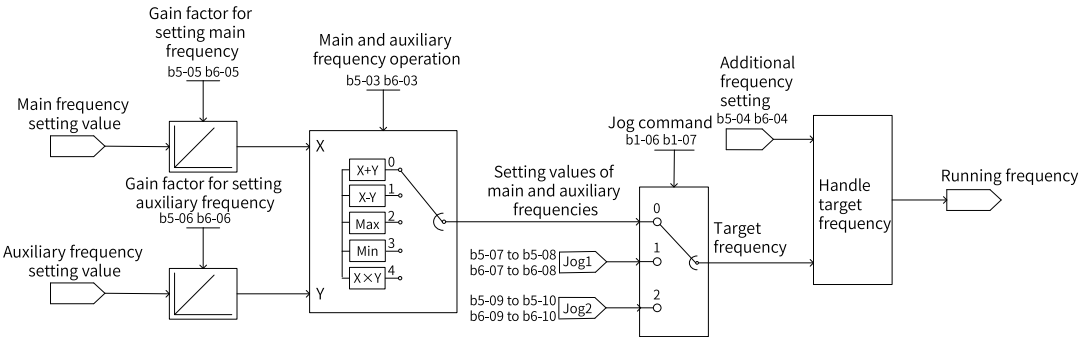


Figure 5-16 Setting channel flowchart

1. Main (Auxiliary) Frequency Setting x Main (Auxiliary) Frequency Gain Coefficient = Effective Main (Auxiliary) Frequency Setting, the value after main and auxiliary calculation of the effective main (auxiliary) frequency setting is used as the input to the ramp function generator.
2. Each setting channel has two jogging frequencies, jogging frequency 1 (2) is only valid when jogging command 1 (2) is active.
3. The additional frequency is used for speed adjustment settings that need to take effect immediately in the process without passing through acceleration and deceleration times. The additional frequency takes effect only during normal operation. The effective value is superimposed directly to the output of the ramp function generator.

Set frequency

Control channel 1: Set main frequency source to b5-00 and auxiliary frequency source to b5-02, see “ *b5--00 (F0-29)” on page 176* and “ *b5--02 (F0-31)” on page 178*; Control channel 2: Set main frequency source to b6-00 and auxiliary frequency source to b6-02, see “ *b6-00” on page 180* and “ *b6-02” on page 180*.

Control channel 1 is used as an example in this section if no notes are provided.

Scenarios	Operation example	Related Parameters and descriptions
Setting main frequency through parameter [b5-00(F0-29)=0]		
Setting frequency through parameter settings	1. Set b5-00(F0-29) (Main frequency source) to 0 [Set by the parameter (F0-30)]. 2. Set b5-01(F0-30) (Main frequency digital setting) to the set frequency. 3. When the main frequency source is set by parameters, in addition to directly modifying the value of the parameters to set the frequency, you can also set the frequency by using the UPDOWN keys. After setting the preceding steps, when the AC drive is stopped or running, you can increase the set frequency by pressing the ▲ key on the operating panel. Using ▼ key to decrease the frequency setting. The two keys help to set the frequency to the target value in real time.	“ *b5--01 (F0-30)” on page 180*
Setting main frequency through operating panel		

Scenarios	Operation example	Related Parameters and descriptions
You can set the main frequency of the AC drive by pressing the key on the operating panel.	1. After power-on, press the  key to enter the parameter setup interface, then use the direction keys to find b0-03, set b0-03= 0, and press the  key to confirm the value write, completing the selection of set channel 1. 2. Locate b5-00 (main frequency source) and set it to 0 (Set by the parameter (b5-01), completing the main frequency setting by digital input. 3. Locate b5-01 (Digital setting of main frequency) and set it to 20.00. That is, the output frequency of set channel 1 to 20.00 Hz. At this time, the LED on the operation panel will flash displaying 20.00.	• Set P0-89 to 1 to restore the frequency reference corrected by the UpDown function after power-on again. • You can modify the running frequency by pressing the key. Set P0-87 to 0. The operating panel LED displays the current running frequency. You can observe the correction effect of the running frequency more visually. • You can set whether the UPDOWN correction frequency reference is memorized at stop during running through P0-88. **Related parameters:** *" b5--01 (F0-30)" on page 180* *" P0-87 to P0-89" on page 181*
Setting frequency through AI [Main: b5-00 (F0-29) = 2 or 3; Auxiliary: b5-02 (F0-31) = 2 or 3]		
As a frequency source, each AI terminal supports five types of AI curves. The AI curve defines the relationship between the analog input voltage (or current) and the corresponding set values.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%", as shown in the example below: • Set E2-40 (minimum input of AI curve 1) to 0.00 V. • Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 (maximum input of AI curve 1) to 10.00 V. • Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through E2-10(F4-21) (AI1 filter time). 3. Set b5-00[(F0-29) (Main frequency source) = 2 (AI1) to select AI as the frequency source. 4. The AI terminal is set to voltage input mode by default. If you need to switch it to current input mode, use the DIP switch. When the analog input is in current mode, 1 mA of current is equivalent to 0.5 V of voltage, meaning 20 mA corresponds to 10 V. After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.	**Notes:** For detailed AI curve setting methods, see *"5.2.10.8 Analog Input Terminal (AI)" on page 334*. **Parameter configuration:** *" Parameter settings when communication is used as the main frequency source" on page 182* **Related parameters:** *" E2-40 to E2-43" on page 182* Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) *" E2-44 to E2-51" on page 183* Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) *" E2-52 to E2-67" on page 185* Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: *" E2-38" on page 188* AI1 fitter time: *" E2-10" on page 188*

Scenarios	Operation example	Related Parameters and descriptions
Setting frequency through pulse input (HDI). [Main: b5-00 (F0-29) = 5; Auxiliary: b5-02 (F0-31) = 5]		
This setting method is applicable to scenarios where a high-speed digital input is used as the frequency source, and the pulse frequency determines the input frequency.	Take the two-point HDI curve setting as example: 1. F4-68 [HDI terminal type selection] = 0 [for HDI use], and configure DI7 as a pulse input terminal. 2. Set the relationship between the HDI frequency input and the two-point curve to "0 V to 20 kHz corresponds to 0% to 100%". • Set F4-71 to 0.00 kHz. • Set F4-72 to 0.0%. • Set F4-73 to 20.00 kHz. • Set F4-74 to 100.0%. 3. Set HDI filter time through F4-83 (HDI filter time). 4. Set F0-29 (Main frequency source) = 5 (HDI) to select HDI as the frequency source. After setting the preceding steps, when HDI inputs a 10kHz power, the AC drive obtains the HDI curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When HDI input voltage is changed, the running frequency changes according to the HDI curve.	**Notes:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 323*. **Parameter configuration:** *" Parameters used to set main frequency through pulse input" on page 188* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 189* *" E4-32(F4-83)" on page 189*
Setting frequency through multi-reference [Main: b5-00 (F0-29) = 6; Auxiliary: b5-02 (F0-31) = 6]		
This mode is suitable for applications where continuous adjustment of the drive's running frequency is not required, and only a few specific frequency values are needed.	After F0-29 (Main frequency source) is set to 6 (Multi-reference), the multi-reference is used as the active frequency source. You can assign the multi-reference terminal function to the DI and switch among pre-set multi-references through the DI. Up to 16 multi-references are supported. You can set four groups of multi-references through group F parameters. The relationship between the reference quantity and DI quantity is as follows: • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 to b8-06 are set to 0. • Five to eight multi-references: Three DIs K1, K2, and K3; b8 set to 0. • 9-16 multi-references: Four DIs (K1, K2, K3, and K4).	**Notes:** To use multi-reference as the main frequency reference source, assign functions 12 to 15 to the DI terminals or set b8-03 (multi-reference selection Bit 0) to b8-06 (multi-reference selection Bit 3). For details, see *" Parameter settings when multi-reference is used as the main frequency source" on page 190*. **Related parameters:** *" b8-03 to b8-24" on page 191*
Setting main frequency through PLC [Main: b5-00 (F0-29) = 7; Auxiliary: b5-02 (F0-31) = 7]		

Scenarios	Operation example	Related Parameters and descriptions
In some industrial applications such as mixture mixing and industrial washing machines, the AC motor only needs to support the functions of start/stop, time- and segment-based speed regulation, and automatic forward and reverse run. the operating speed, direction, and running time can be directly set for each stage through simple PLC.	1. Set F0-29 (Main frequency source) to 7 (PLC) to select the simple PLC as the main frequency reference. 2. Set the multi-reference value parameters P1-09, P1-12, P1-15, P1-18, P1-21, P1-24, P1-27, P1-30, P1-33, P1-36, P1-39, P1-42, P1-45, P1-48, P1-51, P1-54. The 16 multi-reference values correspond to the frequency set in the 16 stages of the simple PLC. Set the parameters P1-10 to P1-11 (other groups follow the same pattern) to define the running time and acceleration/deceleration time of each speed. Set P1-02 to select the running mode of simple PLC. 4. Set the ones position of the value of P1-03 to configure whether the current STEP and the current STEP running time of the simple PLC are retentive upon power-off. Set the tens position of the value of P1-03 to set the simple PLC module status when the calculation is disabled and the calculation is enabled again. 5. Set the P1-01 (simple PLC calculation enable source). • If the source is valid, the simple PLC module runs according to the running mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the current step. • If the source is invalid, the output current STEP, current STEP running time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the value of segment i when the calculation is stopped. Set P1-00 to 1 to enable the simple PLC module. In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP0. The main frequency is set to the frequency set by STEP0, that is, P1-09 (multi-reference 0). After the current STEP is performed by the simple PLC, switch to the next STEP, and the main frequency setpoint is also switched to the frequency set by the PLC.	**Parameter configuration:** *"Parameter settings when communication is used as the main frequency source" on page 194* **Related parameters:** *"P1-00 to P1-56" on page 195*
Setting main frequency through PID [Main: b5-00 (F0-29) = 8; Auxiliary: b5-02 (F0-31) = 8]		
As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.	1. After setting F0-29 (Main frequency source) to 8 (PID), the process PID controller is used as the active frequency source. 2. Using PID as the frequency source, you need to manually enable the PID function, that is, P2-00 [process PID enable] = 1 [enable]. 3. Set the PID reference source and feedback source. The default is P2-02 [PID reference source] = 0 [digital reference] (by P2-03), and P2-04 [PID feedback source] = 0 [AI1].	**Notes:** For details on PID functions, see *"5.4.6.2 Process PID Control" on page 601*. **Schematic diagram for control:** *"Principle of process PID control" on page 201* **Related parameters:** *"P2-00 to P2-27 models" on page 201*

Scenarios	Operation example	Related Parameters and descriptions
Setting Frequency Through Communication [Main: b5-00 (F0-29) = 9; Auxiliary: b5-02 (F0-31) = 9]		
Set parameter b5-00 (Main frequency source) to 9 to select the communication setpoint as the main frequency.	To set Communication as the main frequency source of channel 1: 1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference input source of set channel 1. 2. Set n0-14 and select the 7310H speed setting configuration. 3. Use the host controller to send a write command to the AC drive.	**Notes:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *" n Communication Configuration" on page 1421*. For communication addresses, see *" Communication Address" on page 207*. **Parameter configuration:** *" Parameter settings for using communication as the main frequency reference source" on page 205* **Related parameters:** *" n0-14" on page 206*
Setting frequency through F connector [Main: b5-00(F0-29) = other; Auxiliary: b5-02 (F0-31) = other]		
This function is applicable for parameter interconnection, expanding the sources for parameter settings. You can select different parameters as the setting source for the main frequency based on actual needs.	The following uses the F connector parameter L2244 [AI1 input value] as an example to illustrate the usage method when the main frequency source is the F connector. 1. Set b5-00 to "Other". 2. Locate L22 (floating-point connector 1) in the pop-up menu and select L2244 (AI1 input value). After setting, the main frequency source is AI1. After setting the corresponding AI1 curve, you can convert the corresponding set frequency based on AI1 input voltage.	**Notes:** You can select any parameter from L22 (floating-point connector 1) to L32 (floating-point connector 11) as the frequency source. **Related parameters:** *"10.2.14.13 L22 Floating-point connector 1" on page 1562*to *"10.2.14.19 L32 Floating-point connector 11" on page 1570*

Related parameters

Param.	Name	Default	Value Range	Description
b0-03	Set channel selection	0	0: Set channel 1 1: Set channel 2 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Set the active set channel. If this parameter is 0, set channel 1 is selected. If this parameter is 1, set channel 2 is selected. **Description** 0: Invalid: Channel 1 is selected, group b5 is activated. 1: Valid - channel 2 is selected. Group b6 is activated. 3 to 9: DI1 to DI7 - Indicates that whether this function is active depends on the terminal state of the DI. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. Others: B connector - The selection depends on the other B connector. You can select the other B connector through the pop-up window. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. **Additional information:** After the DI function is set with 71 [Setting channel selection], the value of b0-03 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).

Param.	Name	Default	Value Range	Descriptions
F0-29 b5 = 00	Main frequency source	0: Set by the parameter (F0-30)	0: Set by the parameter (F0-30) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter is used to set the main frequency source of set channel 1. F0-29 is the mapping of b5-00 (main frequency source) in group F. The two parameters have the same function.

Description

0: b6-01– The main frequency is set by b6-01. The frequency can be changed by using the ▲ and ▼ keys on the keypad or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered off and then powered on, whether the frequency adjusted by using UP/DOWN keys is saved depends on the configuration of "retain values set by using UP/DOWN keys". The "clear values adjusted by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key" function of the DI allows you to clear values set by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key.

2: AI1 – The frequency is input by current or voltage signal through the AI1. The frequency is calculated according to the preset AI curve.

3: AI2 – The frequency reference is input with current or voltage signal through AI2. The frequency is calculated according to the preset AI curve.

5: HDI pulse – The frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency.

6: Multi-reference – When multi-reference is used as the frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies.

7: Simple PLC – Simple PLC is a multi-reference operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the values of each frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set.

8: PID – The main frequency is set through PID.

9: Communication – The main frequency is set through communication. The frequency can be set through remote communication.

Others: F connector – Set a parameter number for a float connector, and the value of this connector is used as the main frequency reference. This mode is used for expansion of common sources.

When the main frequency source is set to 0, the main frequency set by parameters is in the unit of Hz. When the main frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by the frequency per unit value of A2-04.

Additional information:

The addresses for the frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0--13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

Param.	Name	Default	Value Range	Descriptions

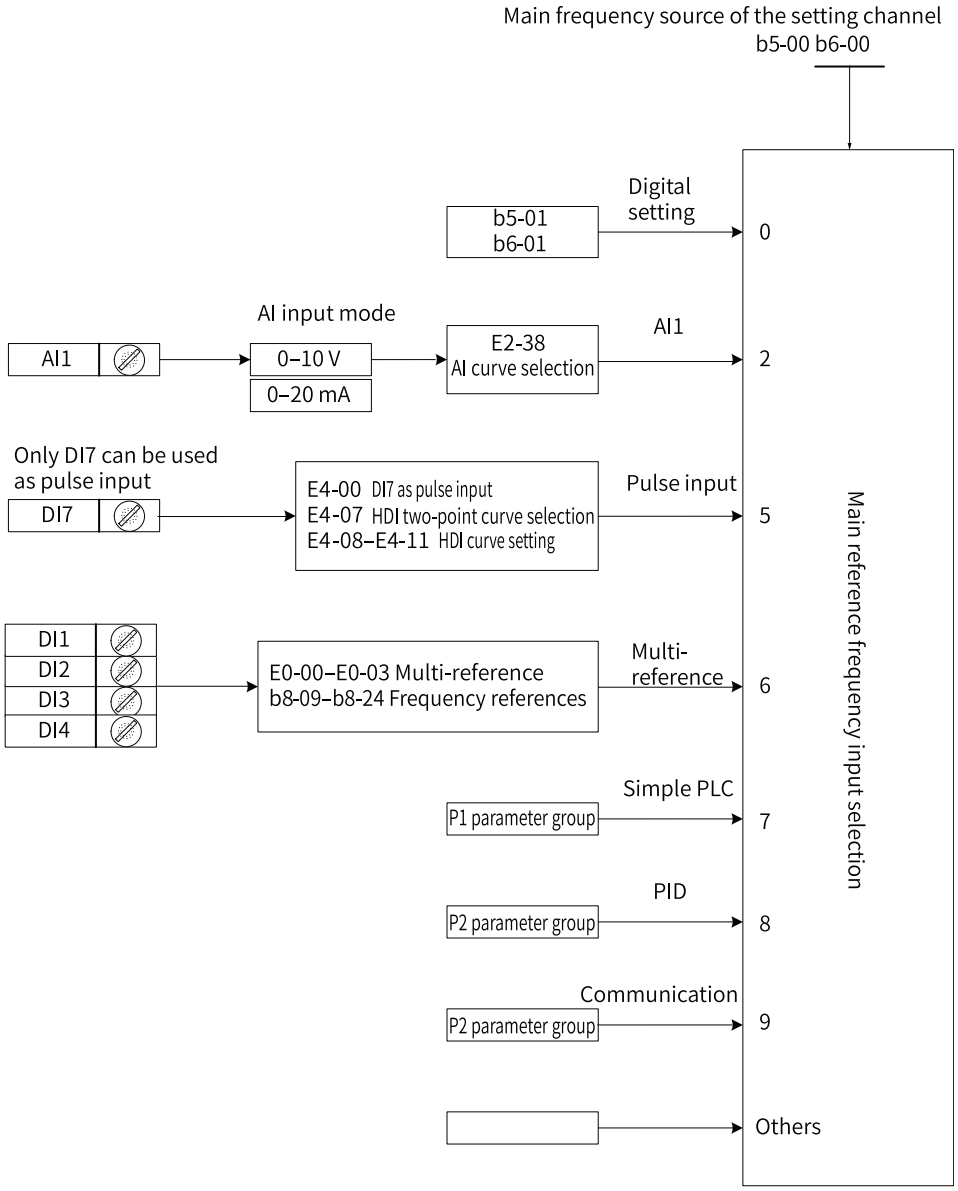


Figure 5-17 Main frequency reference selection

Param.	Name	Default	Value Range	Descriptions
b5-02 (F0-31)	Auxiliary frequency source	0	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the auxiliary frequency source.

Value description

0: 0 The auxiliary frequency is set to 0.

2: AI1 The auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve.

3: AI2 - The auxiliary frequency reference is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve.

5: HDI pulse - The frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency.

6: Multi-reference In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies.

7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies can be set.

8: PID The auxiliary frequency is set through PID.

9: Communication The auxiliary frequency is set through communication. The frequency can be set through remote communication.

Others: F connector

This parameter is set to the number of a floating connector. In this case, the value of the connector is read as an auxiliary frequency reference. This mode is used for expansion of common sources.

Note:

The addresses for the auxiliary frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

Param.	Name	Default	Value Range	Descriptions

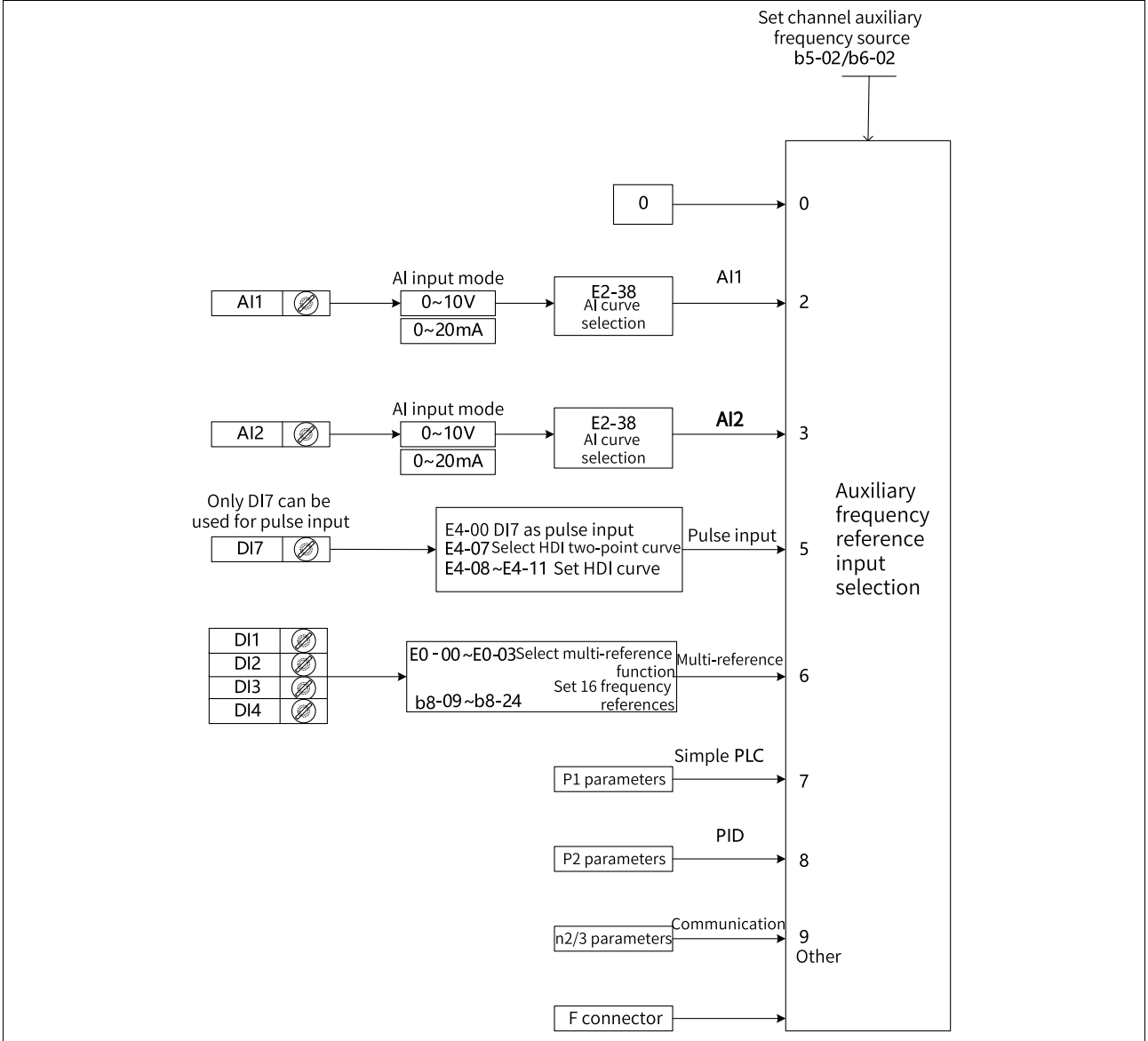


Figure 5-18 Auxiliary frequency reference source selection

Param.	Name	Default	Value Range	Description
b6-00	Main frequency source	0: Set by the parameter (b6-01)	0: Set by the parameter (b6-01) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Set the main frequency source. **Value description and the additional information:** Same as " *b5--00 (F0-29)" on page 176*. Main frequency reference selection, same as " *b5--00 (F0-29)" on page 176*.

Param.	Name	Default	Value Range	Descriptions
b6-02	Auxiliary frequency source	0	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the auxiliary frequency source. **Value description and the additional information:** Same as " *b5--02 (F0-31)" on page 178*. Auxiliary frequency reference setting channel selection

Param.	Name	Default	Value Range	Descriptions
b5-01 (F0-30)	Digital setting of main frequency	50.00 Hz	0.00 Hz to A2-17	This parameter is used to set the target frequency. It is valid only when the main frequency source is set to digital setting. b501 and F0-30 are the same parameter. After F0-30 is modified, b501 is automatically synchronized.

Parameter	Name	Default Value	Value Range	Description
P0-87	UPDOWN reference during running	0	0: Operating frequency 1: Frequency reference	Defines the frequency reference adjusted by UPDOWN key during running. **Value description** 0: Running frequency - The target frequency increases or decreases from the running frequency adjusted by UPDOWN keys. 1: Set frequency - The target frequency increases or decreases from the set frequency adjusted by UPDOWN keys.
P0-88	UPDOWN retention selection upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UPDOWN is retentive when the AC drive stops. **Value description** 0: Disable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel. Then, correct the frequency through the ▲ and ▼ keys on the operating panel, or UP and DOWN terminals. After the AC drive stops, the frequency correction value is cleared. 1: Enable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel. Then, correct the frequency through the ▲ and ▼ keys on the operating panel, or UP and DOWN terminals. After the AC drive stops, the frequency correction value is retained.
P0-89	UPDOWN retention selection upon power failure	0	0: Disable 1: Retentive	Defines whether the frequency corrected by UPDOWN is retentive upon power failure. **Value description** 0: Disable - Set b5-01 and b6-01 (Digital setting of main frequency) using the operating panel. Then, correct the frequency through the ▲ and ▼ keys on the operating panel, or UP and DOWN terminals. After the AC drive is powered off, the frequency correction value is cleared. 1: Enable - Set b5-01 and b6-01 (Digital setting of main frequency) using the operating panel. Then, correct the frequency through the ▲ and ▼ keys on the operating panel, or UP and DOWN terminals. After the AC drive is powered off, the frequency correction value is retained.

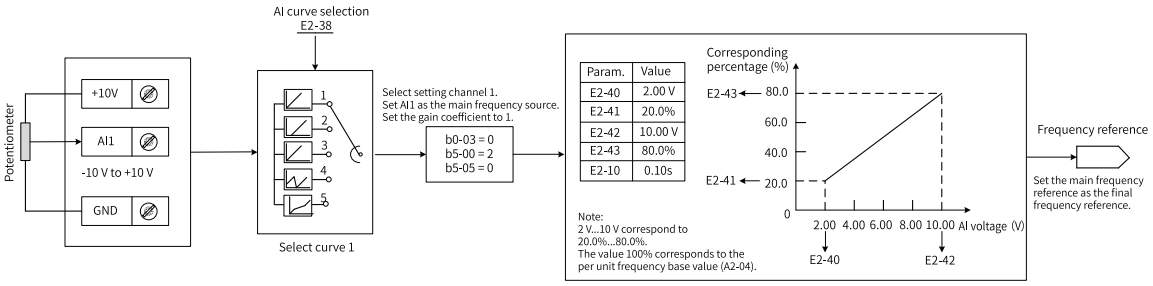


Figure 5-19 Parameter settings for voltage-type AI1 to be used as the main frequency reference source

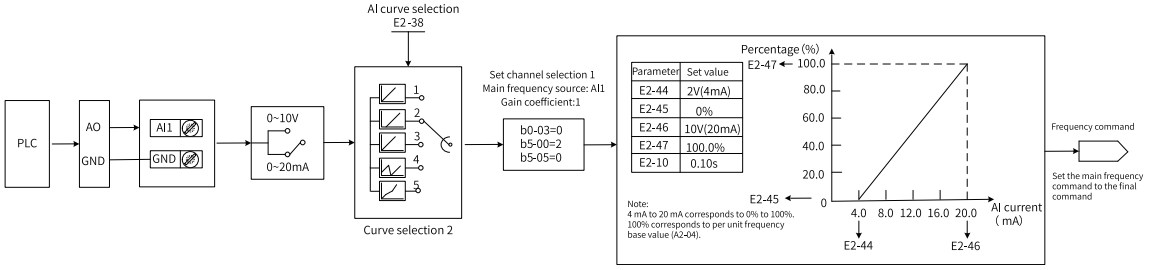


Figure 5-20 Parameter settings for current-type AI1 to be used as the main frequency reference source

Parameter	Name	Default Value	Value Range	Description
E2-40	Minimum input of AI curve 1	0.00	-10.00 to E2-42	Defines the minimum input point of x-axis on AI curve 1, namely the minimum analog input voltage (or minimum analog input current). **Remarks** 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y-axis represents the percentage to the rated frequency of the motor. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0	-800.0 to 800.0	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-42	Maximum input of AI curve 1	10.00	E2-40 to 10.00	Defines the maximum input point of x-axis on AI curve 1, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 1 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.

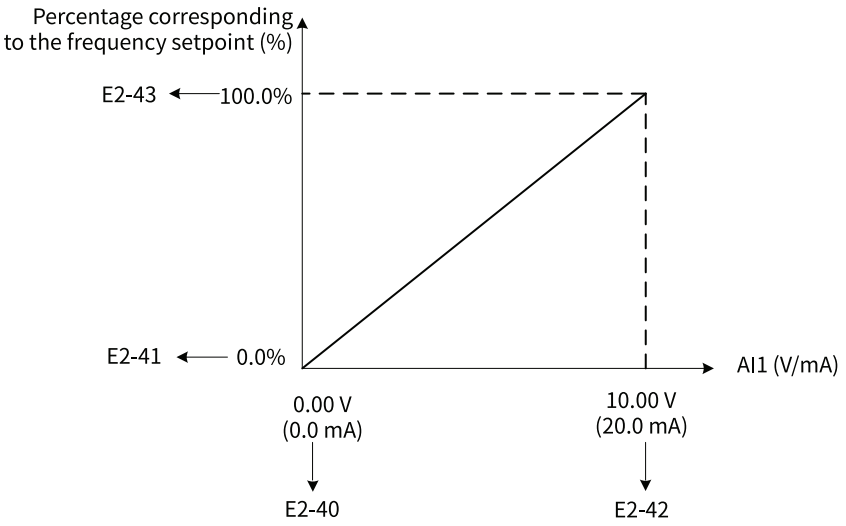


Figure 5-21 Setting AI curve 1

The AI is used to set 100.0% of the frequency reference time, voltage, or current input, which is the percentage relative to the base value A2-04. When the analog current input is used, 0 mA to 20 mA current corresponds to 0 V to 10 V voltage. For example, if AI1 is used as the frequency reference, and the input voltage of A1 is 0 V to 10 V. When the input is 5 V. The frequency is set to 50 x (A2-04). If A2-04 is set to 50 Hz, the frequency is set to 25 Hz.

Parameter	Name	Default Value	Value Range	Description
E2-44	Minimum input of AI curve 2	0.00	-10.00 to E2-46	Defines the minimum input point of x-axis on AI curve 2, namely the minimum analog input voltage (or minimum analog input current). **Remarks** Same as E2-40.
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 2 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Remarks** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-46	Maximum input of AI curve 2	10.00	E2-44 to 10.00	Defines the maximum input point of x-axis on AI curve 2, namely the maximum analog input voltage (or maximum analog input current). **Remarks** Same as E2-40.
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 2 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Remarks** Same as E2-40.
E2-48	Minimum input of AI curve 3	0.00	-10.00 to E2-50	Defines the minimum input point of x-axis on AI curve 3, namely the minimum analog input voltage (or minimum analog input current). **Remarks** Same as E2-40.
E2-49	Percentage corresponding to the minimum input of AI curve 3	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 3 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Remarks** Same as E2-40.
E2-50	Maximum input of AI curve 3	10.00	E2-48 to 10.00	Defines the maximum input point of x-axis on AI curve 3, namely the maximum analog input voltage (or maximum analog input current). **Remarks** Same as E2-40.
E2-51	Percentage corresponding to the maximum input of AI curve 3	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 3 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Remarks** Same as E2-40.

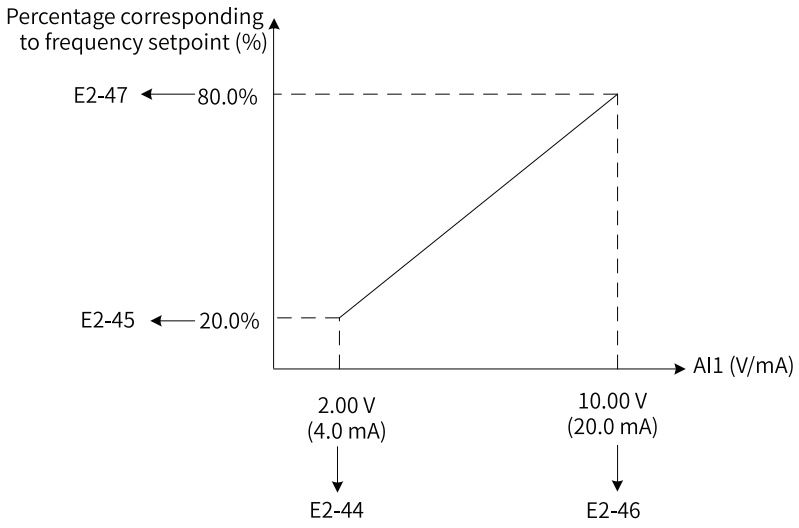


Figure 5-22 Schematic diagram for curve 2 and curve 3

Set curve 2 and curve 3 " *E2-40 to E2-43" on page 182* in the same way as curve 1, see.

Parameter	Name	Default Value	Value Range	Description
E2-52	Minimum input of AI curve 4	0.00	-10.00 to E2-54	Defines the minimum input point of x-axis on AI curve 4, namely the minimum analog input voltage (or minimum analog input current). **Supplementary description:** 1. The x-axis of the AI curve indicates the analog input voltage (or analog input current). The y-axis indicates the per-unit percentage corresponding to the analog input voltage. If AI input is frequency setting, the y-axis is the percentage relative to the maximum frequency (C4-10). 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-53	Corresponding percentage of AI curve 4 minimum input	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 4 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.
E2-54	Inflection point 1 input of AI curve 4	3.00	E2-52 to E2-56	This parameter defines the inflection 1 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-55	Percentage corresponding to inflection point 1 input of AI curve 4	30.0	-800.0 to 800.0	Defines the y-axis corresponding to inflection point 1 of AI curve 4, namely the per-unit percentage corresponding to the analog input of inflection point 1. **Supplementary description:** Same as E2-40.
E2-56	Inflection point 2 input of AI curve 4	6.00	E2-54 to E2-58	This parameter defines the inflection 2 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-57	Percentage corresponding to inflection 2 input of AI curve 4	60.0	-800.0 to 800.0	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Supplementary description:** Same as E2-40.
E2-58	Maximum input of AI curve 4	10.00	E2-56 to 10.00	Defines the maximum input point of x-axis on AI curve 4, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.
E2-59	Percentage corresponding to maximum input of AI curve 4	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 4 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.
E2-60	Minimum input of AI curve 5	-10.00	-10.00 to E2-62	Defines the minimum input point of x-axis on AI curve 5, namely the minimum analog input voltage (or minimum analog input current). **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-61	Percentage corresponding to the minimum input of AI curve 5	-100.0	-800.0 to 800.0	Defines the y-axis of AI curve 5 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.
E2-62	Inflection point 1 input of AI curve 5	-3.00	E2-60 to E2-64	This parameter defines the inflection 1 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-63	Percentage corresponding to inflection point 1 input of AI curve 5	-30.0	-800.0 to 800.0	Defines the y-axis corresponding to inflection point 1 of AI curve 5, namely the per-unit percentage corresponding to the analog input of inflection point 1. **Supplementary description:** Same as E2-40.
E2-64	Inflection point 2 input of AI curve 5	3.00	E2-62 to E2-66	This parameter defines the inflection 2 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-65	Percentage corresponding to inflection 2 input of AI curve 5	30.0	-800.0 to 800.0	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Supplementary description:** Same as E2-40.
E2-66	Maximum input of AI curve 5	10.00	E2-64 to 10.00	Defines the maximum input point of x-axis on AI curve 5, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-67	Percentage corresponding to the maximum input of AI curve 5	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 5 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.

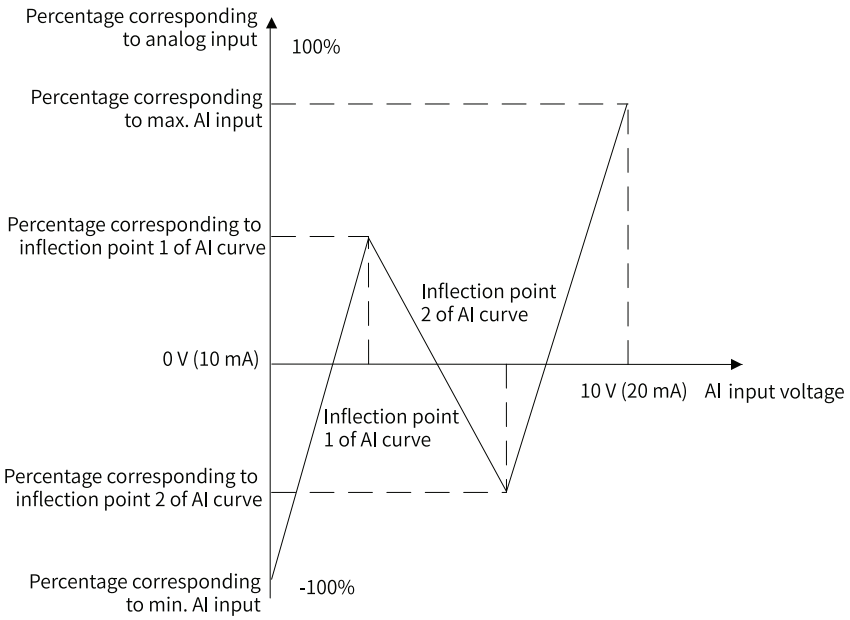


Figure 5-23 Schematic diagram for curve 4 and curve 5

The function of curve 4 and curve 5 is similar to that of curve 1 to curve 3, but curve 1 to curve 3 are straight lines, and curve 4 and curve 5 are 4-point curves. The x axis in AI curves 4 and 5 represents the analog input voltage (or current), and the y axis represents the set value corresponding to the analog input, that is, the percentage relative to the per-unit base value of frequency (A2-04). The four points on curves 4 and 5 are the minimum input point, inflection point 1, inflection point 2, and maximum input point.

When setting curve 4 and curve 5, the minimum input voltage, inflection point 1 voltage, inflection point 2 voltage, and maximum input voltage must be increased in ascending order. E2-52 to E2-59 are used to set curve 4. E2-60 to E2-67 are used to set curve 5.

Parameter	Name	Default	Value Range	Descriptions
E2-38	AI curve	0x21	Ones position: AI1 curve selection 1：Curve 1 (2 points, E2-40 to E2-43) 2：Curve 2 (2 points, E2-44 to E2-47) 3：Curve 3 (2 points, E2-48 to E2-51) 4：Curve 4 (4 points, E2-52 to E2-59) 5：Curve 5 (4 points, E2-60 to E2-67) Tens position: AI2 curve selection 1：Curve 1 (2 points, E2-40 to E2-43) 2：Curve 2 (2 points, E2-44 to E2-47) 3：Curve 3 (2 points, E2-48 to E2-51) 4：Curve 4 (4 points, E2-52 to E2-59) 5：Curve 5 (4 points, E2-60 to E2-67) Hundreds position: Reserved Thousands position: Reserved	Defines the curve selection of AI1 and AI2 (assigned by the ones and tens in sequence).

Parameter	Name	Default Value	Value Range	Description
E2-10	AI1 filter time	0.10	0.00 to 10.00	Defines the software filter time of AI1. **Supplementary explanation:** 1. The filter acts directly on AI hardware sampling. 2. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 3. When on-site analog signals may be easily disturbed, you may increase the AI filter time to enhance the stability of the analog signals.

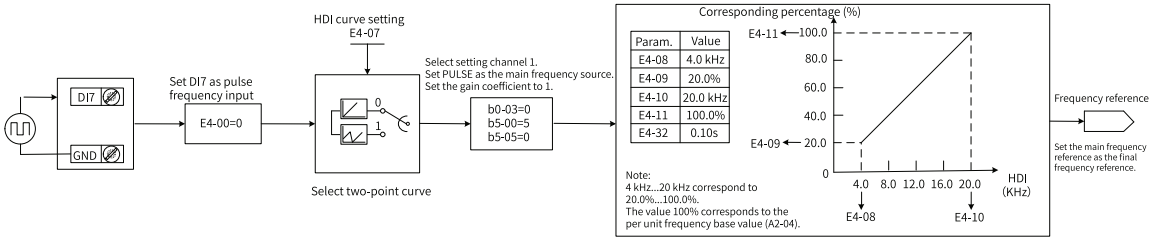


Figure 5-24 Parameters used to set the main frequency through pulse input

Param.	Name	Default	Value Range	Descriptions
E4-08 (F4-71)	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency. **Additional information:** When the high-speed pulse at the DI7 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the HDI terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-08 corresponds to the minimum input point on the x axis, that is, the minimum pulse frequency.
E4-09 (F4-72)	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. **Additional description:**Same as E4-08.
E4-10 (F4-73)	Maximum input of two-point HDI curve	20.00 kHz	E4-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency. **Additional description:**Same as E4-08.
E4-11 (F4-74)	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. **Additional description:**Same as E4-08.

Param.	Name	Default	Value Range	Descriptions
E4-32	HDI filter time	0.10	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Set the HDI filter time 1. Filter the per-unit percentage value obtained after the pulse input is processed by the HDI curve (not filtering the HDI sampling value). 2. When on-site signals are prone to interference, you may increase the HDI filter time to enhance the stability of the per-unit percentage value input to the AC drive.

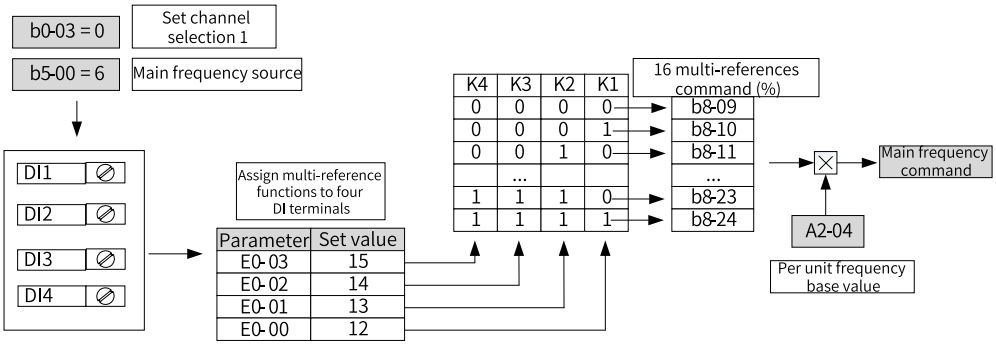


Figure 5-25 Multi-reference setting

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values, For details, see the following table.

Table 5–2 Description of multi-reference function

K4	K3	K2	K1	Reference	Param.
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08=0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

Param.	Name	Default	Value Range	Descriptions
b8-03	Multi-reference selection bit0	0	0:0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Defines the source of multi-reference selection bit0. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit1, bit0, bit2, and bit3. **Description** 0: 0 - The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 9: DI1 to DI7 - Multi-reference bit 0 depending on the final state of DI The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Others: B connector - Indicates whether this function is active depends on other B connector. You can select other B connector through the pop-up window. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. **Additional information:** A total of 16 multi-reference can be supported through binary combination of b803 [Multi-reference selection bit0], b804 [Multi-reference selection bit1], b805 [Multi-reference selection bit2], and b806 [Multi-reference selection bit3]. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.
b8-04	Multi-reference bit 1	0	0:0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 1. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit2, and bit3. The value description and the additional information are the same as b8-03.
b8-05	Multi-reference bit 2	0	0:0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 2. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit3. **Value description and the additional information:** Same as b8-03.

Param.	Name	Default	Value Range	Descriptions
b8-06	Multi-reference bit 3	0	0:0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 3. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit2. **Value description and the additional information:** Same as b8-03.
b8 = 08 (F0-38)	Multi-reference 0 setting mode	0	0: Set by the parameter (F0-39) 1: AI1 2: AI2 4: HDI pulse (valid only for MD630S) 5: PID 6: Digital setting of main frequency (b5-01/b6-01) for the current valid channel Others: F connector	This parameter sets the multi-reference 0 source. F0-38 is the mapping of b5-08 (Multi-reference 0 setting mode) in group F. The two parameters have the same function. **Description** 0: F0-39 Multi-reference 0 is set by F0-39. 1: AI1 - Multi-reference 0 is input by current or voltage signal through AI1. The corresponding per-unit value is calculated according to the preset AI curve. 2: AI2 - Multi-reference 0 is input by current or voltage signal through AI2. The corresponding per-unit value is calculated according to the preset AI curve. 4: HDI pulse - Multi-reference 0 is set through the pulse frequency of DI7. The corresponding per unit value is calculated according to the curve of the relationship between the pulse frequency and the set frequency. 5: PID - PID output is selected as the source of multi-reference 0. 6: b5-01/b6-01 (digital setting of the main frequency of the effective set channel) Multi-segment value 0 is set through b5-01/b6-01 (digital setting of main frequency). The corresponding frequency per unit value is calculated based on the frequency. Others: F connector A function code is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. **Description:** When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Param.	Name	Default	Value Range	Descriptions
b8-09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	The source of multi-reference 0 is selected through b808. Other multi-references are defined through digital settings of parameters. **Additional information:** 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b803 to b806), which provide 16 states, corresponding to 16 frequency setpoints. 2. This parameter defines the frequency reference for each speed when the frequency reference source is set to multi-reference. Parameters b809 to b824 correspond to a total of 16 frequency references for speeds 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency.
b8-10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8-11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8-12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8-13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8-14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8-15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8-16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8-17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8-18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8-19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8-20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8-21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8-22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8-23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8-24	Multi-reference 15	0.00%	b8-43 to b8-42	

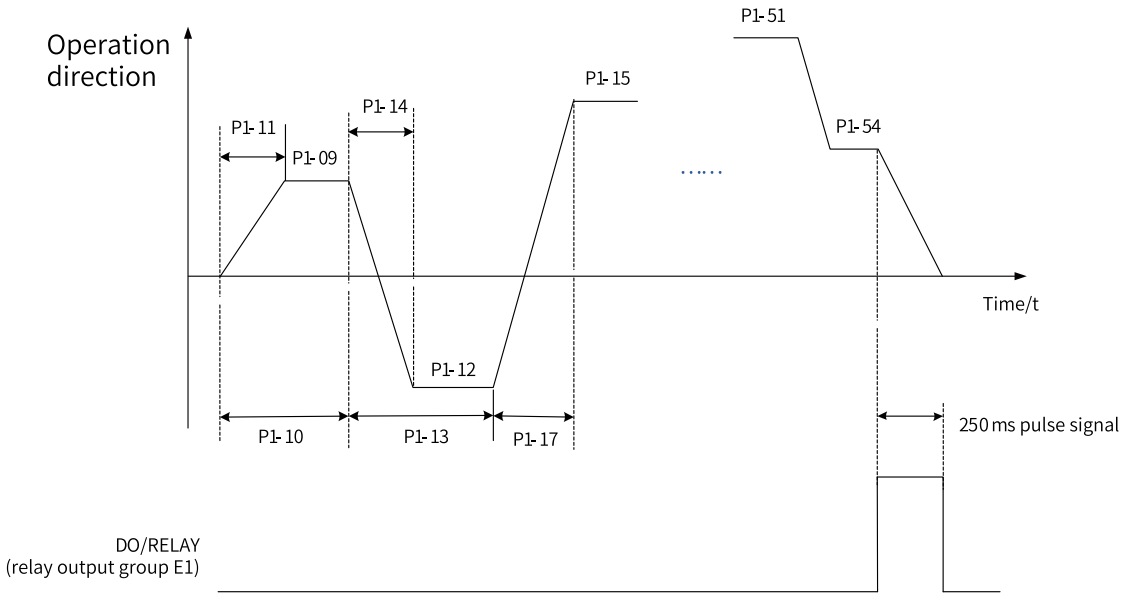


Figure 5-26 Use of simple PLC as the main frequency source

Param.	Name	Default	Setting range	Description
P1-00	Enabling simple PLC module	0	0: Disable 1: Enable	Set whether to enable the simple PLC module. **Value description:** 0: Disable If the simple PLC module is disabled, the output current STEP and current STEP running time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the simple PLC step, are all cleared. 1: Enable The simple PLC module is enabled, but whether the PLC module is calculated and output is normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the simple PLC calculation enable source. **Value description:** 0: Invalid The simple PLC calculation function is invalid. 1: Valid The simple PLC calculation function is valid. 3 to 9: DI1 to DI7 Whether simple PLC calculation is valid depends on the input state of DI1 to DI7 terminals. 0: Invalid; 1: Valid Others: Connector B - Whether simple PLC calculation is valid depends on the status of the selected connector B. 0: Invalid; 1: Valid **Note:** 1. If the simple PLC calculation is enabled, the simple PLC module runs according to the running mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time of the simple PLC, as well as the output per-unit value obtained in the current step. 2. If the simple PLC calculation is disabled, the output current STEP, current STEP running time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default	Setting range	Description
P1-02	Simple PLC running mode	0	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. **Value description:** 0: Keep multi-reference value 0 after running for one cycle Multi-reference value 0 is output after the simple PLC module runs for one cycle. 1: The final values are output after single-cycle running of the simple PLC module. 2: The simple PLC starts running again from the first stage after completing a cycle. 3: After simple PLC runs for a cycle, the output per-unit value obtained in the simple PLC step is 0. **Note:** 1. If this parameter is set to 0, 1, and 3, the single-cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2. If this parameter is set to 2, the simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed.
P1-03	Simple PLC function selection	0	Ones position: Retention selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled	Sets the simple PLC function. **Value description:** Ones position: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC is retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time.
P1-04	Simple PLC status reset	0	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the simple PLC status reset. **Value description:** 0: The simple PLC status reset is disabled, and the simple PLC operates according to the setting. 1: The simple PLC status reset is enabled. The simple PLC module is restored to the initial state. Simple PLC running phase is 0, and the simple PLC output is the setpoint of the multi-reference 0 of P1-09. 3 to 9: Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI7 terminals. 0: Invalid; 1: Valid Others: Connector B - Whether the simple PLC status reset is enabled depends on the status of the selected connector B. 0: Invalid; 1: Valid

Param.	Name	Default	Setting range	Description
P1-08	Unit of simple PLC running time	0	0: s (second) 1: h (hour)	Sets the unit of simple PLC running time. **Value description:** 0: Set the unit of simple PLC running time to second. 1: Set the unit of simple PLC running time to hour.
P1-09	Multi-reference 0 set by simple PLC	0	-800.0 to 800.0	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Running time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Sets the running time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. **Note:** It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.
P1-11	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0	0: Ramp 1 acceleration/ deceleration time b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time) 1: Ramp 2 acceleration/ deceleration time b7-10 (ramp 2 acceleration time) and b7-11 (ramp 2 deceleration time) 2: Ramp 3 acceleration/ deceleration time b7-16 (ramp 3 acceleration time) and b7-17 (ramp 3 deceleration time) 3: Ramp 4 acceleration/ deceleration time b7-22 (ramp 4 acceleration time) and b7-23 (ramp 4 deceleration time)	Sets the acceleration/deceleration time of multi-reference 0 set by simple PLC. **Value description:** 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 1: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 2: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 3: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/deceleration time of multi-reference 0 set by simple PLC.
P1-12	Multi-reference 1 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-13	Running time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-15	Multi-reference 2 set by simple PLC	0	Same as P1-09	Same as P1-09

Param.	Name	Default	Setting range	Description
P1-16	Running time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-18	Multi-reference 3 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-19	Running time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-20	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-21	Multi-reference 4 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-22	Running time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-24	Multi-reference 5 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-25	Running time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-27	Multi-reference 6 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-28	Running time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-30	Multi-reference 7 set by simple PLC	0	Same as P1-09	Same as P1-09

Param.	Name	Default	Setting range	Description
P1-31	Running time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-33	Multi-reference 8 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-34	Running time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-36	Multi-reference 9 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-37	Running time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-39	Multi-reference 10 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-40	Running time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-42	Multi-reference 11 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-43	Running time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11

Param.	Name	Default	Setting range	Description
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Running time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-48	Multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-49	Running time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-50	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-51	Multi-reference 14 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-52	Running time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-53	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-54	Multi-reference 15 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-55	Running time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

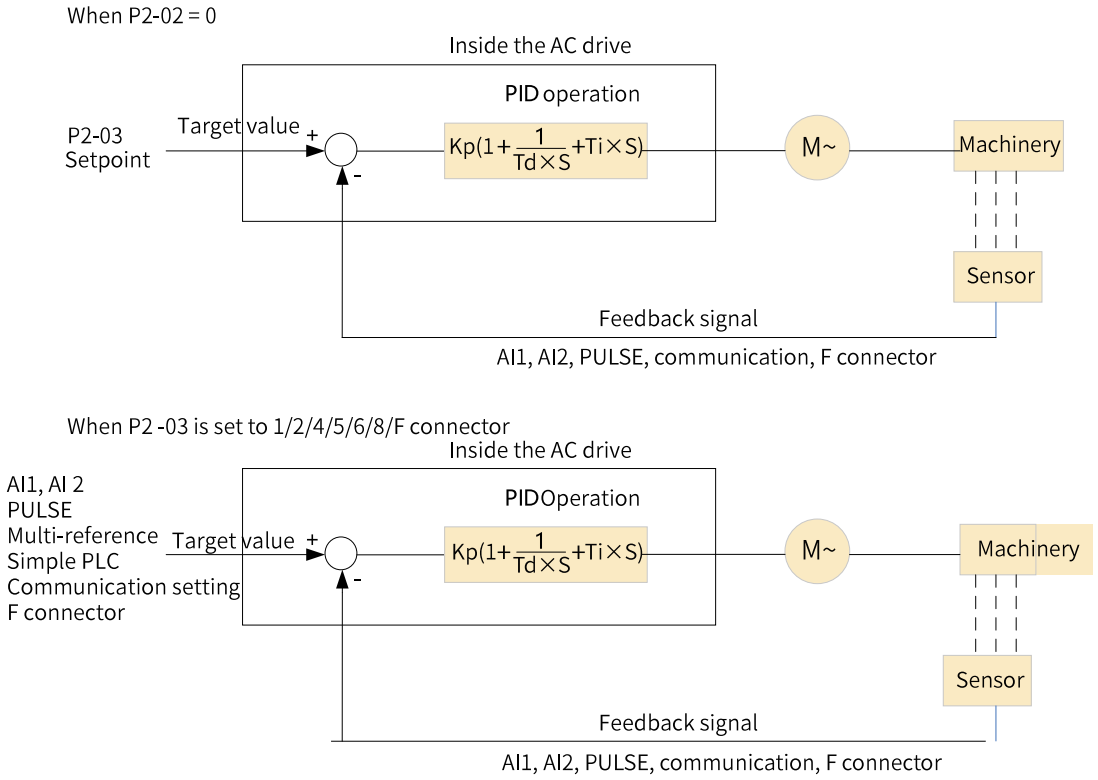


Figure 5-27 Principle of process PID control

Param.	Name	Default	Value Range	Descriptions
P2-00	PID enable	0	0: Disabled 1: Enable Other: B connector	Sets whether PID is enabled 0: Disable The process PID is not used for calculation and the output is cleared. 1: Enable PID operation is performed based on parameters. Others: B connector Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Positive 1: Negative Others: B connector	Sets the PID action direction. 0: Positive When the feedback value is lower than the PID reference, the output frequency of the AC drive increases. 1: Negative When the feedback value is lower than the PID reference, the output frequency of the AC drive decreases. Others: B connector Select the parameter in the bit connector to control PID direction. (The value 0 represents positive action and 1 represents negative action.)

Param.	Name	Default	Value Range	Descriptions
P2-02	PID reference source	0	0: PID digital setting 1: AI1 2: AI2 4: HDI pulse reference (active only for MD630S) 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	This parameter specifies the PID reference source. **Value description** 0: PID digital setting The PID target reference is the value of P2-03 (PID digital setting). 1: AI1 - The PID reference is set by AI1 input. 2: AI2 - The PID reference is set by AI2 input. 4: HDI pulse setting - The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency. 5: Multi-reference In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-02 is set to 5 (Multi-reference), b8-08 (Source of multi-reference 0) cannot be set to 5 (PID reference). 6: Simple PLC - PID target setting source is simple PLC. 8: Communication setting The PID reference is set through remote communication. Others: F connector The PID target reference is set by the parameter of the float connector. **Additional information:** When P2-00 is set to 5 (multi-reference), b808 (multi-reference 0 setting mode) cannot be set to 5 (PID reference).
P2-03	PID digital setting	50.0%	0.0%–800.0%	When P2-02 (PID reference source) is set to 0, this parameter shall be set.
P2-04	PID feedback source	0	0: AI1 1: AI2 4: HDI pulse reference (active only for MD630S) 5: Communication Others: F connector	It is used to select the PID feedback channel. **Value description** 0: AI1 - The PID reference is set by AI1 input. 1: AI2 - The PID reference is set by AI2 input. 4: HDI setting - The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency. 5: Communication - The PID reference is set by remote communication.
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. **Additional information:** The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.

Param.	Name	Default	Value Range	Descriptions
P2-15	PID parameter 1 integral time Ti1	2.00	0.01s to 10.00s	Indicates the integral time Ti of the first group of parameters in PID control. **Additional information:** This parameter determines the integral adjustment intensity of the PID controller. The shorter the integral time is, the greater the regulation intensity will be.
P2-16	PID parameter 1 differential time Td1	0.000	0.000s to 10.000s	Defines the derivative time Td of the first group of parameters in PID control. **Additional information:** It decides the regulating intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity will be.
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. **Additional information:** See P2-14.
P2-18	PID parameter 2 integral time Ti2	2.00	0.01s to 10.00s	Indicates the integral time Ti of the second group of parameters in PID control. **Additional information:** See P2-15.
P2-19	PID parameter 2 differential time Td2	0.000	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. **Additional information:** See P2-16.

Param.	Name	Default	Value Range	Descriptions
P2-26	Source of maximum PID output	0	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the maximum PID output value, which is the per-unit value in percentage. **Value description** 0: 100% The maximum PID output value is 100%. 2: AI1 - The PID output source is the AI1 input. 3: AI2 - The PID output source is the AI2 input. 5: HDI pulse setting - The maximum value of PID output is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and operating frequency. 6: Multi-reference - When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - The maximum value of PID output is defined by simple PLC output setting. 8: PID - The maximum value of PID output is the current PID output. 9: Communication - The maximum value of PID output is set through communication. The maximum value of PID output can be inputted through remote communication. Others: F connector The maximum PID output value is the value of the selected float connector.
P2-27	Source of minimum PID output	0	0: -100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the minimum PID output value, which is the per-unit value in percentage. **Value description** 0: -100% The minimum PID output value is -100%. 2: AI1- The minimum PID output source is the AI1 input. 3: AI2- The minimum PID output source is the AI2 input. 5: HDI pulse setting - The minimum value of PID output is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and operating frequency. 6: Multi-reference - When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - The maximum value of PID output is defined by simple PLC output setting. 8: PID - The maximum value of PID output is the current PID output. 9: Communication - The minimum value of PID output is set through communication. The minimum value of PID output can be inputted through remote communication. Others: F connector - The minimum PID output value is the value of the selected float connector.

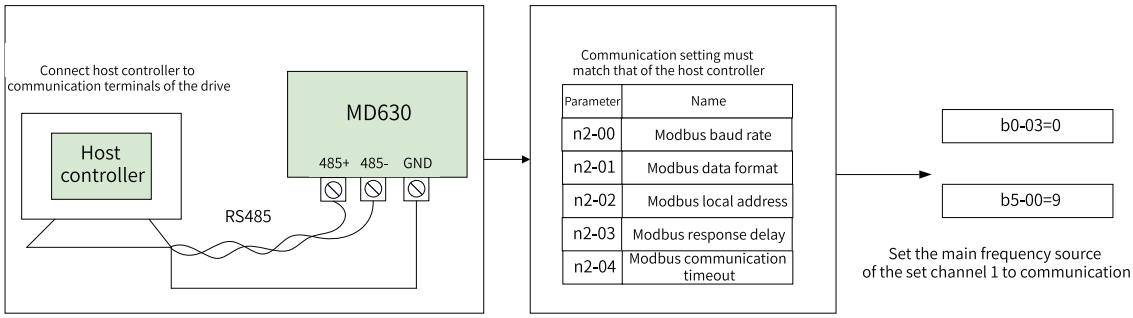


Figure 5-28 Parameter settings for using communication as the main frequency reference source

Param.	Name	Default	Value Range	Descriptions
n0-14	7310H speed setting	1	0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places) 0: Disable 1: Enable	This parameter specifies the target speed written through the 7310H communication address. Value description 0: Frequency (Unsigned 16-bit) - When n0-14 is set to 0, the unit is frequency and the value is an unsigned 16-bit number with decimal places defined by A0-70. For example, when decimal 1000 is written and A0-70 is set to 2, the frequency reference is 10.00 Hz. When the decimal value 40000 is written and A0-70 is set to 1, the frequency reference is 4000.0 Hz. 1: Frequency (Int16) - When n0-14 is set to 1, the unit is frequency and the value is an Int16 number with the number of decimal places defined by A0-70. For example, when decimal -1000 is written and A0-70 is set to 2, the frequency reference is -10.00 Hz. When the decimal value 20000 is written and A0-70 is set to 1, the frequency reference is 2000.0 Hz. 2: Speed (signed 16-bit) When n0-14 is set to 2, the unit is speed and the value is a signed 16-bit number without decimal places. For example, when decimal 1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When the decimal value -3000 is written and the number of pole pairs is 2, the frequency reference is -100.00 Hz. 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the rated frequency. For example, when the decimal value 1000 is written and the rated frequency is 50.00 Hz, the frequency reference is 5.00 Hz. When decimal -10000 is written and the rated frequency is 50.00 Hz, the frequency reference is -50.00 Hz. 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places) When n0-14 is set to 4, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the maximum frequency. For example, when the decimal value 1000 is written and the rated frequency is 150.00 Hz, the frequency reference is 15.00 Hz. When decimal -10000 is written and the rated frequency is 150.00 Hz, the frequency reference is -150.00 Hz.

Communication Address		Description
Communication setpoint 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 (7310H speed setting). The converted floating point value can also be set as communication of the commonly-used float point connector. When n0-14 is set to 0, the unit is frequency and the value is an unsigned 16-bit number with decimal places defined by A0-70 (frequency decimal place). For example, when decimal 1000 is written and A0-70 is set to 2, the frequency reference is 10.00 Hz. For instance, if you write the decimal value 40000 and set A0-70 (frequency decimal place) to 1, this means the frequency is set to 4000.0 Hz. When n0-14 is set to 1, the unit is frequency and the value is an Int16 number with the number of decimal places defined by A0-70 (frequency decimal place). For example, when decimal -1000 is written and A0-70 is set to 2, the frequency reference is -10.00 Hz. For instance, if you write the decimal value 20000 and set A0-70 (frequency decimal place) to 1, this means the frequency is set to 2000.0 Hz. When n0-14 is set to 2, the unit is speed and the value is an Int16 number without decimal places. For example, when decimal 1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When the decimal value -3000 is written and the number of pole pairs is 2, the frequency reference is -100.00 Hz. When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the rated frequency. When n0-14 is set to 4, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the maximum frequency.

5.2.2.2 Selecting the Auxiliary Frequency Source

Description

There are multiple auxiliary frequency reference sources including AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication, potentiometer MD-BP-M,and F connector. You can set through b5-02 and b6-02.

When the auxiliary frequency source is set to "0: 0", the auxiliary frequency is set to 0. When the auxiliary frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by the frequency per unit value of A2-04.

When the auxiliary frequency is used as a reference source, it is set in the same way as the main frequency reference. For the setting of the auxiliary frequency, see the main frequency setting. The output main and auxiliary frequency is set after the main and auxiliary operation relationship.

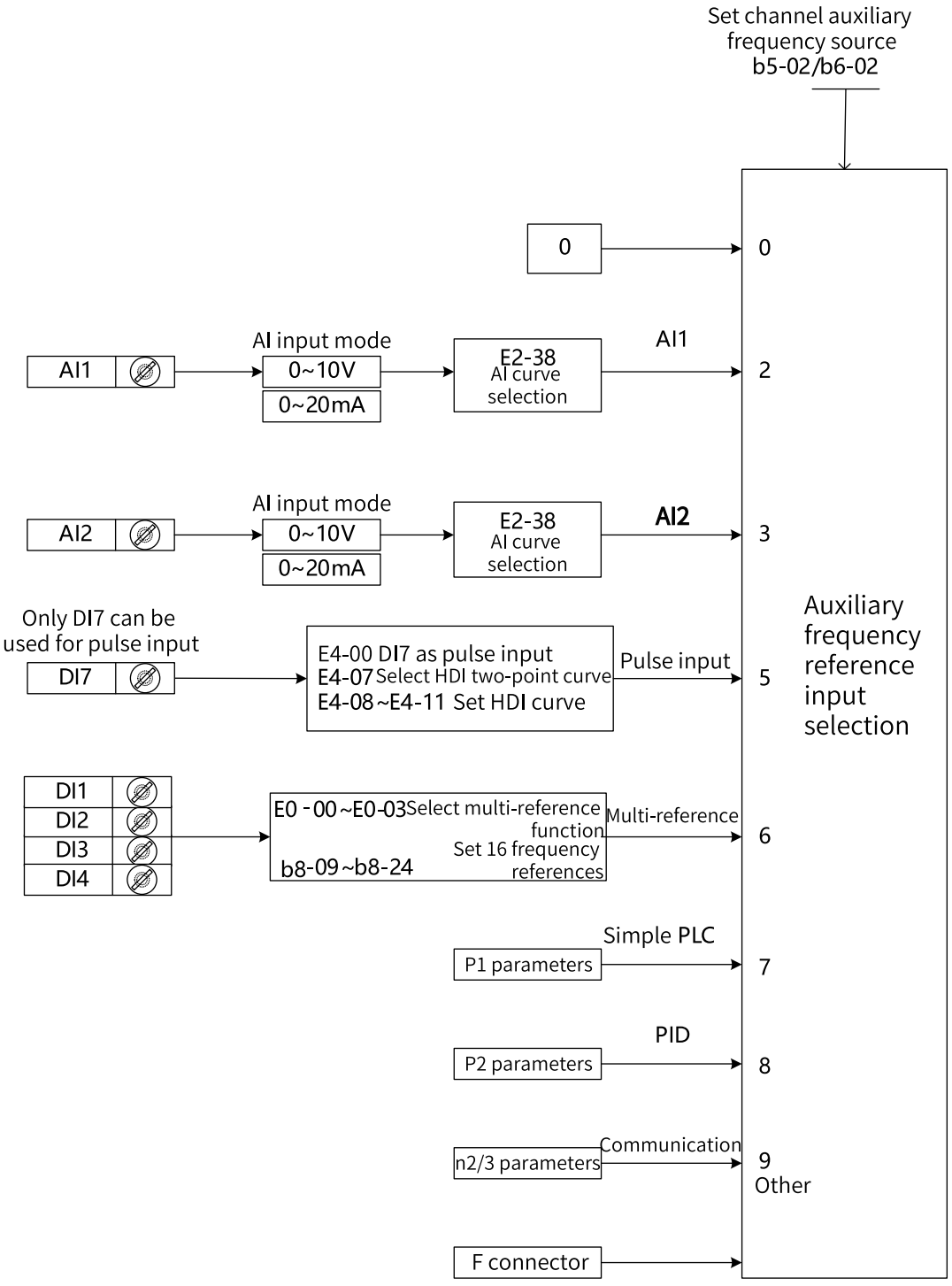


Figure 5-29 Auxiliary frequency reference source selection

Related parameters

Param.	Name	Value Range	Default	Descriptions
b5-02 (b602) (F0-31)	Auxiliary frequency source	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	Sets the auxiliary frequency source. Value description 0: 0 The auxiliary frequency is set to 0. 2: AI1 The auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The auxiliary frequency reference is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse - The frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies can be set. 8: PID The auxiliary frequency is set through PID. 9: Communication The auxiliary frequency is set through communication. The frequency can be set through remote communication. Others: F connector This parameter is set to the number of a floating connector. In this case, the value of the connector is read as an auxiliary frequency reference. This mode is used for expansion of common sources. Note: The addresses for the auxiliary frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

5.2.2.3 Selecting Source of Main Frequency and Auxiliary Frequency Superposition

Scenarios

This function is applicable to a given frequency that is calculated in combination with the main and auxiliary frequencies instead of the main frequency as the effective frequency.

Description

Main and auxiliary frequency operation is used to set the frequency reference by performing operations on the main frequency and auxiliary frequency. Set F0-32 (b5-03) (Main and auxiliary frequency operation) to define the relationship between the target frequency and the main/auxiliary frequency operation. The default value is 0: Main frequency + auxiliary frequency. The main frequency and auxiliary frequency are calculated in %. Multiply the calculation result by A2-04 (per-unit frequency base value) to obtain the frequency.

There are five main and auxiliary operation relationships:

- 0 (Main frequency + auxiliary frequency): The main frequency is superimposed by the auxiliary frequency as the target frequency.
- 1 (Main frequency - auxiliary frequency): The target frequency is set by subtracting the auxiliary frequency from the main frequency
- 2 [Max (|Main|, |Auxiliary|)]: The target frequency is the maximum result by comparing the absolute values of the main and auxiliary frequencies and is the original value (without the absolute value symbol).
- 3 [Min(|Main|, |Auxiliary|)]: The target frequency is the minimum result by comparing the absolute values of the main and auxiliary frequencies and is the original value (without the absolute value symbol).
- 4: Main frequency x auxiliary frequency: The operation result is the main frequency multiplied by the auxiliary frequency.

For example, assume that the main frequency is 100%, the auxiliary frequency is 30%, and A2-04 (Per-unit base value of frequency) is 50.00 Hz. When b5-03 (Main and auxiliary frequency operation) = 1 Main frequency - auxiliary frequency), the frequency reference value is (100%-30%) x 50.00 = 35.00 Hz.

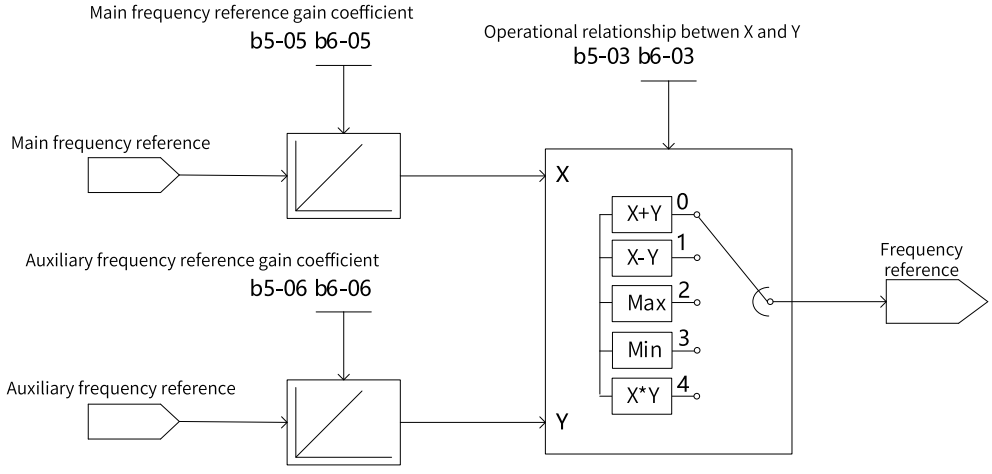


Figure 5-30 Main and auxiliary frequency source selection

5.2.2.4 Setting Jog Frequency and Additional Frequency

Scenarios

In addition to the main frequency and auxiliary frequency, each set channel has two jog frequencies. Jog frequency 1 is valid only when jog command 1 is active, and jog frequency 2 is valid only when jog command 2 is active.

Additional frequency: Set b5-04 and b6-04 to set the additional frequency of two set channels, which is used for speed adjustment without acceleration/deceleration time. The additional frequency takes effect only during normal operation. The effective value is superimposed directly to the output of the ramp function generator.

Description

The following figure shows the relationship between the main frequency, auxiliary frequency, jog frequency, and additional frequency.

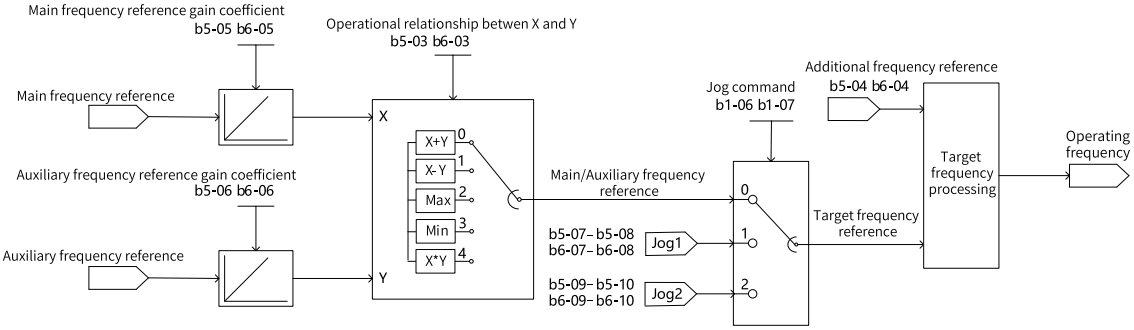


Figure 5-31 Frequency reference channel

Related parameters

Table 5–3 Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
b5-04	Auxiliary frequency source	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Set the additional frequency source of set channel 1. Value description 0: Disable The additional frequency is set to 0. 2: AI1 The additional frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The additional frequency is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse The additional frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/ deceleration time of each frequency. Up to 16 frequencies can be set. 8: PID The additional frequency is set through PID. 9: Communication The additional frequency is set through communication. In this mode, the additional frequency is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter code is set for a floating-point connector, and the value of the connector is read as the additional frequency. This mode is used for expansion of common sources. Note: The addresses for the additional frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14. The additional frequency is superimposed directly on the set frequency.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-07 (F0-56)	Jogging frequency 1 source	0	0: Set by the parameter (b5-08) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets Jog 1 frequency source Value description 0: Digital setting The jog frequency 1 source is "jog frequency 1 reference" , set by the parameter (b508). 2: AI1 The jog 1 frequency is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 3: AI2 The jog 1 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse The jog 1 frequency is set by using the pulse frequency of the DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog 1 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID The jog 1 frequency is set through PID. 9: Communication The jog 1 frequency is set through communication. In this mode, the jog frequency 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources. b5-07 and F0-56 are the same parameter. After F0-56 is modified, b5-07 is automatically synchronized.
b5-08 (F0-57)	Digital setting of jog frequency 1	2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 1 Activated when b5-07 is set to 0. b5-08 and F0-57 are the same parameter. After F0-57 is modified, b5-08 is automatically synchronized.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-09 (F0-58)	Jogging frequency 2 source	0	0: Set by the parameter (b5-10) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets Jog 2 frequency source Value description 0: Digital setting The jog frequency 2 source is "jog frequency 2 reference" , set by the parameter (b510). 2: AI1 The jog 2 frequency is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 3: AI2 The jog 2 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse The jog 2 frequency is set by using the pulse frequency of the DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID The jog 2 frequency is set through PID. 9: Communication The jog 2 frequency is set through communication. In this mode, the jog frequency 2 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. This mode is used for expansion of common sources. b5-09 and F0-58 are the same parameter. After F0-58 is modified, b5-09 is automatically synchronized.
b5-10 (F0-59)	Digital setting of jog frequency 2	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 2 b5-10 is activated when b5-09 is set to 0. b5-10 and F0-59 are the same parameter. After F0-59 is modified, b5-10 is automatically synchronized.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-04	Auxiliary frequency source	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets additional frequency source. Value description 0: Disable The additional frequency is set to 0. 2: AI1 The additional frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The additional frequency is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse The additional frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/ deceleration time of each frequency. Up to 16 frequencies can be set. 8: PID The additional frequency is set through PID. 9: Communication The additional frequency is set through communication. In this mode, the additional frequency is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter code is set for a floating-point connector, and the value of the connector is read as the additional frequency. This mode is used for expansion of common sources. Note: The addresses for the additional frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14. The additional frequency is superimposed directly on the set frequency.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-07	Jogging frequency 1 source	0	0: Set by the parameter (b6-08) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets Jog 1 frequency source Value description 0: Digital setting The jog frequency 1 source is "jog frequency 1 reference" , set by the parameter (b6-08). 2: AI1 The jog 1 frequency is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 3: AI2 The jog 1 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse The jog 1 frequency is set by using the pulse frequency of the DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog 1 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID The jog 1 frequency is set through PID. 9: Communication The jog 1 frequency is set through communication. In this mode, the jog frequency 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b6-08	Digital setting of jog frequency 1	2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 1 It is valid when b6-07 is set to 0.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-09	Jogging frequency 2 source	0	0: Set by the parameter (b6-10) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets Jog 2 frequency source Value description 0: Digital setting The jog frequency 2 source is "jog frequency 2 reference" , set by the parameter (b6-10). 2: AI1 The jog 1 frequency is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 3: AI2 The jog 1 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse The jog 2 frequency is set by using the pulse frequency of the DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID The jog 2 frequency is set through PID. 9: Communication The jog 2 frequency is set through communication. In this mode, the jog frequency 2 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b6-10	Digital setting of jog frequency 2	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 2 Activated when b6-09 is set to 0.

5.2.2.5 Frequency Reference Limits

Scenarios

This function is used to limit the motor from running above or below a certain frequency by setting the frequency limit.

Working Principle

Frequency upper limit: Defines the maximum running frequency of the motor. Frequency lower limit: Defines the minimum running frequency of the motor. Maximum frequency: Defines the maximum output frequency. Minimum frequency: Defines the minimum output frequency.

When C4-06 (Rated motor frequency) is set to a value higher than C4-10 (Maximum motor frequency), the maximum motor frequency is automatically kept equal to the rated motor frequency.

The frequency reference limits includes the forward frequency upper limit, the forward frequency lower limit, the reverse frequency upper limit, and the reverse frequency lower limit.

The active positive frequency upper limit is constrained by the combination of three parameters: C4-10 (Maximum motor frequency), d1-05 (Source of negative frequency upper limit 2) and d1-03 (Digital setting of positive frequency upper limit 1). The minimum value of the three parameters is the positive frequency upper limit.

For the active positive frequency lower limit, the two limit parameters are C4-11 (Minimum motor frequency) and d1-07 (Digital setting of positive frequency lower limit). The maximum values of the two parameters are the final effective limit of the forward frequency lower limit of the set frequency. The reverse frequency limits are similar.

The set frequency is also limited by the RFG forward/reverse speed limit after being fed into the RFG. The RFG forward speed upper limit is limited only by the minimum value of C4-10 (Maximum motor frequency) and d1-05 (Source of positive frequency upper limit 2). The RFG reverse speed upper limit is limited by the maximum value of C4-10 (Maximum motor frequency) and d1-06 (Source of negative frequency upper limit 2).

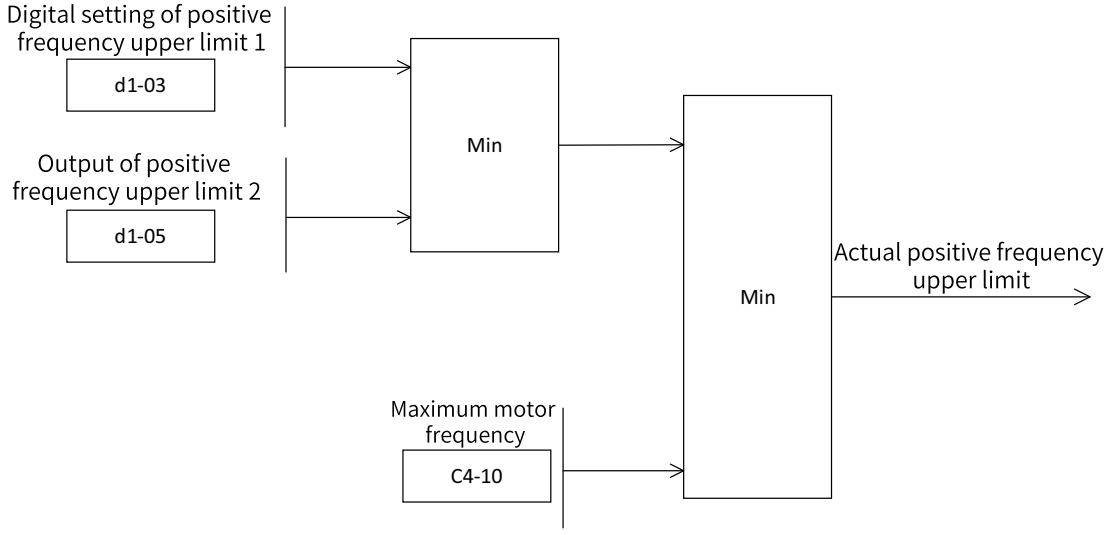


Figure 5-32 Effective positive frequency upper limit

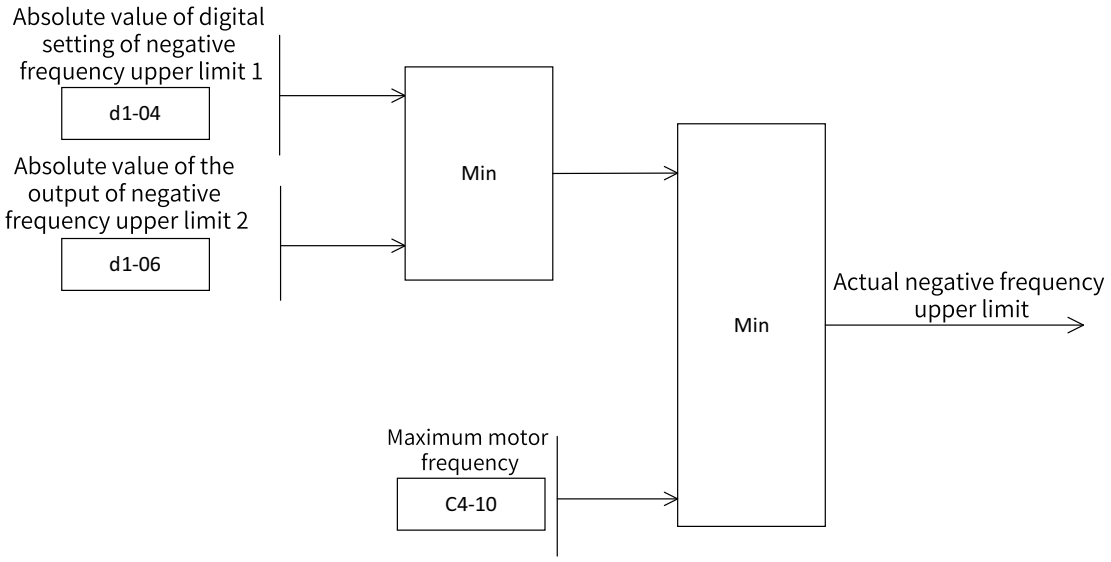


Figure 5-33 Effective positive frequency lower limit

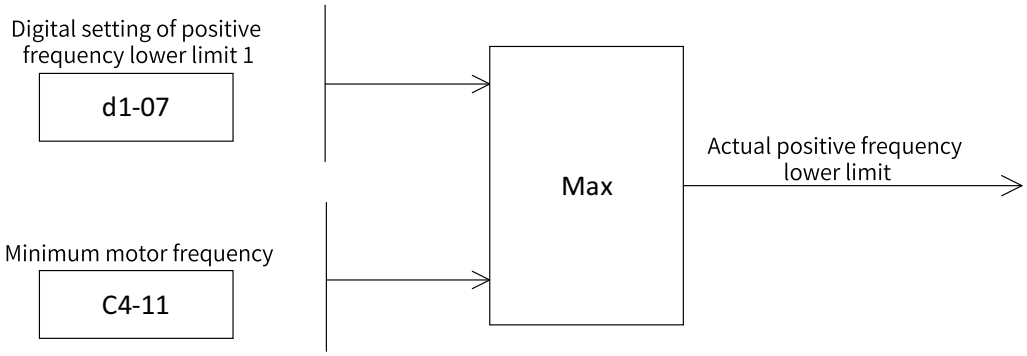


Figure 5-34 Effective negative frequency upper limit

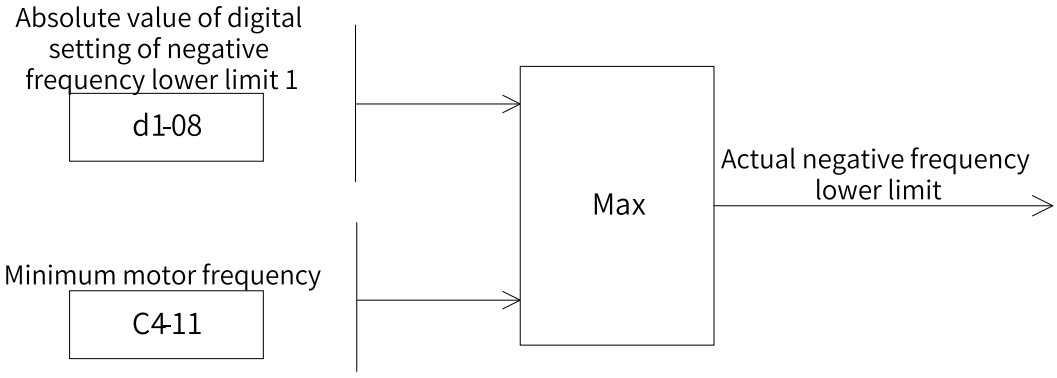


Figure 5-35 Effective negative frequency lower limit

Related parameters:

Table 5–4 Parameters related to the frequency reference limit

Parameter	Parameter Name	Default	Value Range	Descriptions
F1-06 (C4-06)	Rated motor frequency	50.00	0.01 to 599.00	It is used to set the rated motor frequency in the unit of Hz. F1-06 is the mapping of C4-06 (Rated motor frequency) in group F. The two parameters have the same function.
F1-10 (C4-10)	Maximum motor frequency	50.00	F1-06 to 599.00	It is used to set the allowed maximum frequency of the motor in the unit of Hz. F1-10 is the mapping of C4-10 (Maximum motor frequency) in group F. The two parameters have the same function.
F1-11 (C4-11)	Minimum motor frequency	0.00	0.00 to F1-10	It is used to set the allowed minimum frequency of the motor in the unit of Hz. F1-11 is the mapping of C4-11 (Minimum motor frequency) in group F. The two parameters have the same function.
d1-03 (F2-22)	Forward frequency upper limit 1	800.0%	d1-07 to 800.0%	This parameter limits the forward maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. d1-03 and F2-22 are the same parameter. After F2-22 is modified, d1-03 is automatically synchronized.
d1-04 (F2-23)	Reverse frequency upper limit 1	-800.0%	-800.0% to d1-08	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. d1-04 and F2-23 are the same parameter. After F2-23 is modified, d1-04 is automatically synchronized.

Parameter	Parameter Name	Default	Value Range	Descriptions
d1-05 (F2-24)	Forward frequency upper limit 2	0	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter limits the forward maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Value description 0: 800% - Set the forward frequency upper limit to 800%. 2: AI1. - The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2. - The forward frequency upper limit is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse. - The forward frequency upper limit is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. - When multi-reference is used as the forward frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC. - Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The forward frequency upper limit is set through PID. 9: Communication - The forward frequency upper limit is set through communication. The forward frequency upper limit can be input through remote communication. Others: F connector - The forward frequency upper limit is set through the F connector. Additional information: The effective frequency upper limit in the forward direction is the smaller value between d1-03 and d1-05.

Parameter	Parameter Name	Default	Value Range	Descriptions
d1-06 (F2-25)	Source of negative frequency upper limit	1	0: -800% 1: Opposite to the forward frequency upper limit 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Value description 0: -800% - Set the reverse frequency upper limit to -800%. 1: Opposite to the forward frequency upper limit. Opposite to the forward frequency upper limit (d1-03). 2: AI1. - The reverse frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2. - The negative frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse. - The reverse frequency upper limit is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the reverse frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC Simple PLC is a multi-reference used to control the running time and acceleration/deceleration time. Multi-reference parameters are used to set the negative frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID. - The reverse frequency upper limit is set through PID. 9: Communication - The reverse frequency upper limit is set through communication. The reverse frequency upper limit can be input through remote communication. Others: F connector. - The reverse frequency upper limit is set through the F connector. Additional information: The effective frequency upper limit in the reverse direction is the smaller value between d1-06 and d1-07.
d1-05 (F2-24)	Digital setting of positive frequency lower limit	0	0 to d1-04	This parameter limits the minimum operation frequency in the forward direction. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. d1-05 and F2-24 are the same parameter. After F2-24 is modified, d1-05 is automatically synchronized.

Parameter	Parameter Name	Default	Value Range	Descriptions
d1-08 (F2-27)	Digital setting of negative frequency lower limit	0	d1-07 to 0	This parameter limits the minimum operation frequency in the reverse direction. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. d1-08 and F2-27 are the same parameter. After F2-27 is modified, d1-08 is automatically synchronized.

5.2.2.6 Define Running Mode in Case of a Frequency Below Minimum Limit

Scenarios

This function is used to set the status of the AC drive when the given frequency is smaller than the minimum frequency.

Description

The minimum frequency of the motor defines the minimum output frequency.

If the frequency reference of the AC drive is lower than the value of C4-11 (minimum frequency of the motor), you need to set P0-11 to further specify the corresponding action of the AC drive. Four actions are supported: run at the minimum frequency of the motor, stop, run at zero speed, and coast to stop.

- 0: Operating at frequency lower limit
  If the set frequency is lower than the frequency lower limit defined by U6-08 (Min. positive frequency), the drive operates at the frequency defined by U6-08. During reverse run, if the set frequency is lower than the absolute value of the frequency lower limit defined by U6-10 (Absolute value of min. negative frequency), the drive operates at the frequency defined by U6-10.
- 1: Stop
  If the set frequency is below the effective frequency lower limit, the AC drive stops.
- 2: Run at zero speed
  If the set frequency is below the effective frequency lower limit, the AC drive runs at zero speed.
- 3: Coast to stop
  If the set frequency is below the effective frequency lower limit, the AC drive coasts to stop.

Related parameters:

Table 5–5 Related parameters in case of a frequency below minimum limit

Param.	Name	Default	Value Range	Descriptions
P0-11	Operation mode when the frequency reference is less than the minimum motor frequency	0	0: Operating at frequency lower limit 1: Stop 2: Run at zero speed 3: Coast to stop	Defines the operation mode when the frequency reference is lower than the frequency lower limit. Description 0: Operating at frequency lower limit - During forward run, if the set frequency is lower than the frequency lower limit defined by U6-08 (Min. positive frequency), the drive operates at the frequency defined by U6-08. During reverse run, if the set frequency is lower than the absolute value of the frequency lower limit defined by U6-10 (Absolute value of min. negative frequency), the drive operates at the frequency defined by U6-10. 1: Stop - If the running frequency is lower than the frequency lower limit, the AC drive stops. 2: Run at zero speed - If the set frequency is below the effective frequency lower limit, the AC drive runs at zero speed. 3: Coast to stop - If the set frequency is below the effective frequency lower limit, the AC drive coasts to stop.

5.2.2.7 Set Frequency Through Terminal

Scenarios

When controlling the AC drive remotely, the user can set the frequency through the DI terminal rather than communication or analog signal input.

Working Principle

As shown in the following figure, set E0-00 (DI1 function selection) to 6 (Function as UP key for frequency adjustment) and E0-01 (DI2 function selection) to 7 (Function as DOWN key for frequency adjustment). Use P0-87 (UP/DOWN base during operation) to select the base frequency when adjusted by the terminal during running. When P0-87 is set to 0 (running frequency) by default, the target frequency after terminal adjustment is the current running frequency (adjustment amount), that is, the running frequency changes in real time according to the terminal adjustment signal. When DI1 is active at high level, the current frequency increases. When DI2 is active at high level, the current frequency decreases.

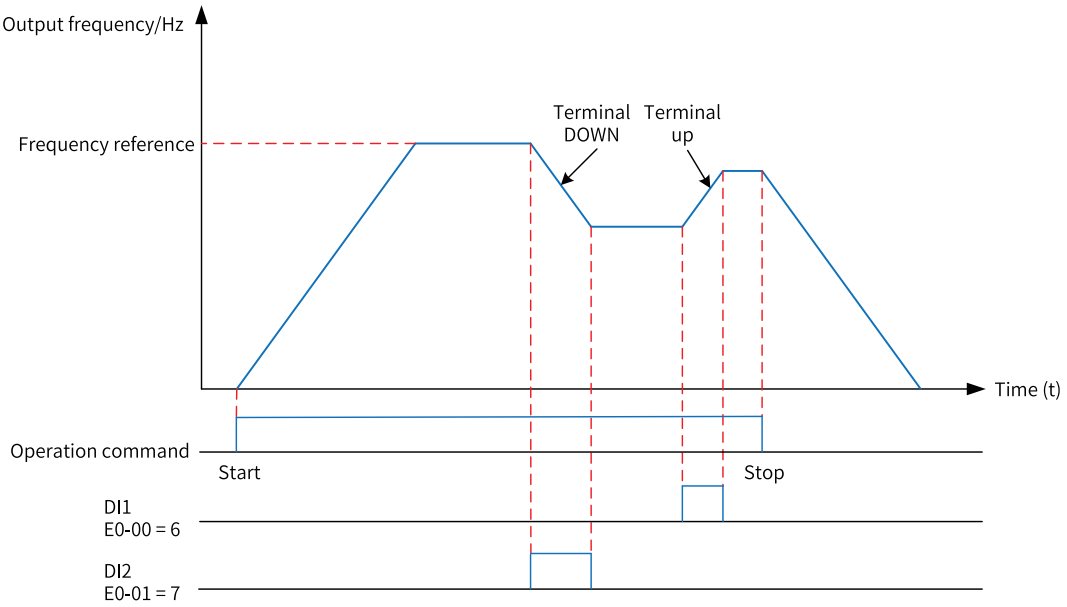


Figure 5-36 Diagram

In addition, the user can set whether the frequency corrected by UPDOWN is retentive when the AC drive stops through P0-88 (UP/DOWN retention selection upon stop). If you want the frequency reference to be retained at power failure, set P0-88 (UP/DOWN retention selection upon stop) to 1 (Retentive) and P0-89 (UP/DOWN retention selection upon power failure) to 1 (Enable).

Related parameters:

Param.	Parameter Name	Default	Value Range	Descriptions
P0-87	UP/DOWN base during operation	0	0: Running frequency 1: Frequency reference	Defines the frequency reference adjusted by UPDOWN key during running. Value description 0: Running frequency - The target frequency increases or decreases from the running frequency adjusted by UP/ DOWN keys. 1: Frequency reference - The target frequency increases or decreases from the set frequency adjusted by UP/DOWN keys.
P0-88	UP/DOWN retention selection upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UPDOWN is retentive when the AC drive stops. Value description 0: Non-retentive Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared when the AC drive stops. 1: Retentive Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is retained when the AC drive stops.
P0-89	UP/DOWN retention selection upon power failure	0	0: Disable 1: Enable	Defines whether the frequency corrected by UP/DOWN is retentive upon power failure. Value description 0: Disable Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared upon power failure. 1: Enable Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is retained upon power failure.s

Instances

Set the running AC drive running frequency as follows.

1. Set b1-00 (Main command source of control channel 1) to 1, which is terminal control.
2. Set b9-00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop as module A.
3. Set b9-01 (Mode of terminal start/stop module A), which is to set the terminal control mode to IN1 start.
4. Select DI1 to control functions of IN1 and set DI2 and DI3 as the frequency adjustment terminals. The following figure shows the setting values and wiring diagram.

Param.	Name	Setting	Description
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	Operation Command
E0-01	DI2 function selection	6: Function as UP key for frequency adjustment	Increase frequency
E0-02	DI3 function selection	7: Function as DOWN key for frequency adjustment	Decrease frequency

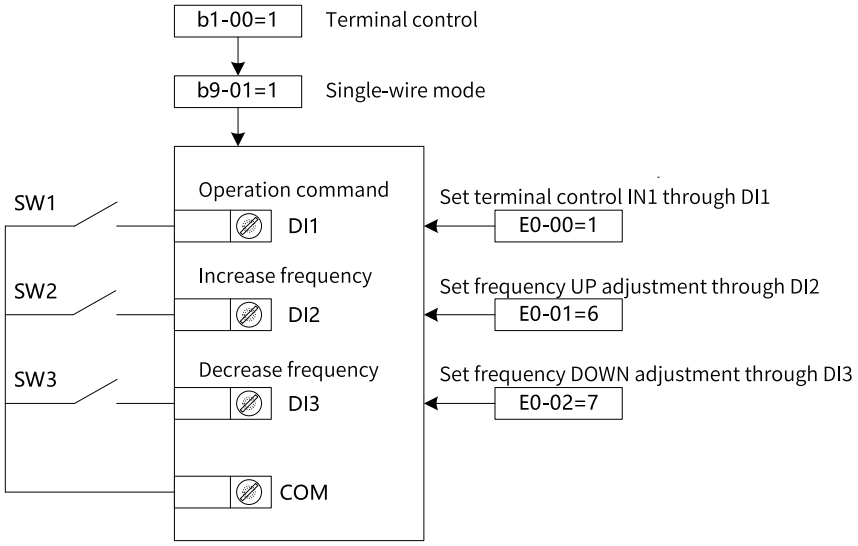


Figure 5-37 Set frequency through terminal

5. Set P0-87 (UP/DOWN base during operation) to 0 (running frequency).

After setting the preceding steps, close DI1 and the AC drive starts running. Close DI3 to decrease the running frequency. Close DI2 to increase the running frequency gradually. When DI2 and DI3 are closed at the same time, the command is invalid and the frequency remains unchanged. After the frequency increases to the upper limit or decreases to the lower limit, the frequency does not change.

5.2.2.8 Frequency Reference Source Selection

The frequency reference for each set channel is defined by the main frequency and auxiliary frequency.

Main frequency reference x main frequency reference gain coefficient = valid main frequency reference

Auxiliary frequency reference x auxiliary frequency reference gain coefficient = valid auxiliary frequency reference.

After the operation of the valid main frequency reference and valid auxiliary frequency reference, the value serves as the input of the ramp function generator. After the acceleration/deceleration time, the actual frequency reference is generated.

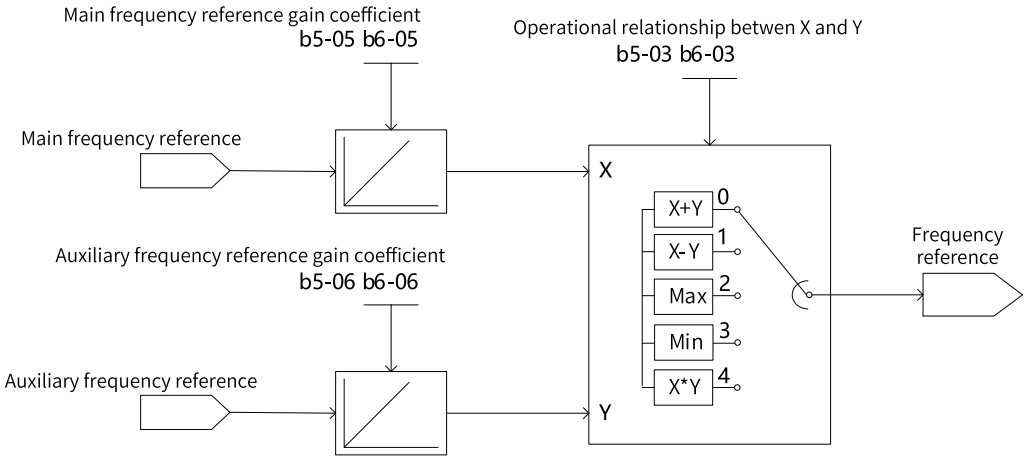


Figure 5-38 Main and auxiliary frequency source selection

Sometimes, a frequency regulation reference that is enabled directly without acceleration/ deceleration time is required for the process. The system provides a supplementary frequency reference, which is enabled only during running. It is added to the ramp function generator (RFG) output frequency when it is being enabled.

5.2.3 Torque Reference

5.2.3.1 Select Torque Reference Source Channel

5.2.3.1.1 Selecting the Torque Reference Setting Channel

Selecting Torque Reference

Set b0- 03 (Set channel selection) to modify the active setting channel of the AC drive. For details, see *" b0-03" on page 175*. When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

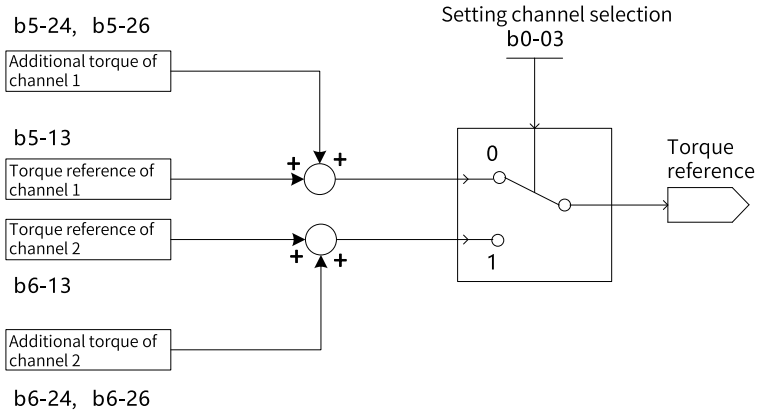


Figure 5-39 Torque reference source

In addition, there is the supplementary torque, which takes effect only during normal operation. The effective value is superimposed directly to the output of torque. For detailed setting method, see *"5.2.3.2 Setting Additional Torque" on page 238*.

Selecting Source for Torque Reference

Set channel 1 is active in default mode. Set the motor control mode to torque control (d0-01 = 1).

Select the torque setting method: Channel 1 is set through b5-13, and channel 2 is set through b6-13. The setting method is similar to the frequency setting. For details, see *" b513/b613" on page 233* and *" b5-19~b5-23, b6-19~b6-23" on page 234*.

The torque reference is in percentage format. Its base value (100%) is determined based on the per-unit base value of frequency (A2-06). For details, see *" A2-06" on page 235*.

Set Torque Reference

Take control channel 1 as the example.

Scenarios	Operation example	Related Parameters and descriptions
Setting torque reference through parameter [b5-13=0]		
Select the value of b5- 14 (Torque reference source) as the torque source.	Set b5-13 (Torque reference source) to 0 [Set by the parameter (b5-14)].	*" b5-14" on page 236*
Setting torque reference through AI [b5-13=2 or 3]		

Scenarios	Operation example	Related Parameters and descriptions
When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V (or 0 mA to 20 mA) corresponds to 0% to 100%": • Set E2-40(F4-28) (minimum input of AI curve 1) to 0.00 V. • Set E2-41(F4-29) (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42(F4-30) (maximum input of AI curve 1) to 10.00 V. • Set E2-43(F4-31) (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through F4-21 (AI1 filter time). 3. Set b5-13 (Torque reference source) = 2 (AI1) to select AI1 as the torque source. After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the torque setting is 50%. When AI1 input voltage is changed, the torque setting changes according to the AI1 curve.	**Notes:** For detailed AI curve setting methods, see *"5.2.10.8 Analog Input Terminal (AI)" on page 334*. **Parameter configuration:** *" Parameter settings when communication is used as the main frequency source" on page 182* **Related parameters:** *" E2-40 to E2-43" on page 182* Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) *" E2-44 to E2-51" on page 183* Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) *" E2-52 to E2-67" on page 185* Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: *" E2-38" on page 188* AI1 fitter time: *" E2-10" on page 188*
Setting torque reference through pulse [b5-13=5]		
This setting method is applicable to scenarios where a high-speed digital input is used as the frequency source, and the pulse frequency determines the input frequency.	Take the two-point HDI curve setting as example: 1. Set E4-00 (HDI terminal type selection) to 0 (HDI use). 2. Select HDI pulse as the source of the torque reference of set channel 1 by setting b0-03 to 0 and b5-13 to 5. In this mode, the HDI pulse reference must be obtained from multi-functional input terminal DI7. 3. To set the relationship between the HDI frequency input and the two-point curve to "4 kHz to 20 kHz corresponds to 20% to 100%": • Set E4-08 to 4.00 kHz. • Set E4-09 to 20.0%. • Set E4-10 to 20.00 kHz. • Set E4-11 to 100.0%. After setting the preceding steps, when the HDI input is 10 kHz, the torque is set to 50%, and when the HDI input frequency is changed, the running frequency is processed according to the HDI curve and the torque is changed.	**Notes:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 323*. **Parameter configuration:** *" Parameter setting when torque reference is set through pulse input" on page 236* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 189* *" E4-32(F4-83)" on page 189*
Setting torque reference through multi-reference [b5-13=6]		

Scenarios	Operation example	Related Parameters and descriptions
This mode is suitable for applications where continuous adjustment of the drive's running frequency is not required, and only a few specific frequency values are needed.	Set b5-13 (Torque reference source) to 6 (multi-reference) to select the multi-reference output as the torque reference. Up to 16 multi-references can be set, which can be selected through b8-03 to b8-06 or the combinations of input signals from the four DI terminals. You can also use fewer than four DIs as the multi-reference source. In this case, missing digits are populated with 0. The relationship between the reference quantity and DI quantity is as follows: • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 to b8-06 are set to 0. • Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0. • Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)	**Notes:** To use multi-reference as the torque reference source, assign functions 12 to 15 to the DI terminals or set b8-03 (multi-reference selection Bit 0) to b8-06 (multi-reference selection Bit 3). For details, see "*Parameter settings when multi-reference is torque source" on page 236*. **Related parameters:** "*b8-03 to b8-24" on page 191*
Setting torque reference through simple PLC [b5-13=7]		
In some industrial applications such as mixture mixing and industrial washing machines, the AC motor only needs to support the functions of start/stop, time- and segment-based speed regulation, and automatic forward and reverse run. the operating speed, direction, and running time can be directly set for each stage through simple PLC.	1. Set b0-03 to 0 and b5-13 to 7 to select simple PLC as the torque reference source of set channel 1. 2. Set the multi-reference value parameters P1-09, P1-12, P1-15, P1-18, P1-21, P1-24, P1-27, P1-30, P1-33, P1-36, P1-39, P1-42, P1-45, P1-48, P1-51, P1-54. The 16 multi-reference values correspond to the frequency set in the 16 stages of the simple PLC. Set the parameters P1-10 to P1-11 (other groups follow the same pattern) to define the running time and acceleration/deceleration time of each speed. 3. Set P1-02 to select the simple PLC operation mode. 4. Set the ones position of the value of P1-03 to configure whether the current STEP and the current STEP running time of the simple PLC are retentive upon power-off. Set the tens position of the value of P1-03 to set the simple PLC module status when the calculation is disabled and the calculation is enabled again. 5. Sets the P1-01 (simple PLC calculation enablement source). • If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the current step. • If the simple PLC calculation is disabled, the output current STEP, current STEP running time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the multi-reference value when the calculation is stopped. 6. Set P1-00 to 1 to enable the simple PLC module. In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP0. The torque is set to the torque set by STEP0, that is, P1-09 (multi-reference 0). After the current STEP is performed by the simple PLC, switch to the next STEP, and the torque setpoint is also switched to the torque set by the PLC.	**Parameter configuration:** "*Setting torque through simple PLC" on page 237* **Related parameters:** "*P1-00 to P1-56" on page 195*
Setting torque reference through PID [b5-13=8]		

<table>
<tr><th>Scenarios</th><th>Operation example</th><th>Related Parameters and descriptions</th></tr>
<tr><td>As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.</td><td>1. Set b0-03 to 0 and b5-13 to 8 to select PID as the torque reference source of set channel 1.
2. Set P2-00 to 1 to enable general PID.
3. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the value of P2-05.
4. Set P2-04 to select the PID feedback source.
5. Set P2-01 to select the PID action direction.
6. Set P2-26 and P2-27 to set the maximum PID output value and minimum output value respectively. The output of PID adjustment is between the maximum and minimum values.
Then the torque of the AC drive is set by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback value. The torque of the AC drive also changes to the PID output.</td><td>Notes:
For details on PID functions, see “5.4.6.2 Process PID Control” on page 601.
Schematic diagram for control:
“Diagram of general PID control” on page 237
Related parameters:
“P2-00 to P2-27 models” on page 201</td></tr>
<tr><td colspan="3">Setting torque reference through communication [b5-13=9]</td></tr>
<tr><td>Select the communication setpoint as the torque source.</td><td>1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 and select the 7310H torque setting configuration.
3. Use the host controller to send a write command to the AC drive.
When the torque source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive.
The following section describes how to set the main frequency through Modbus communication and address 0x7310. For example, to set the torque reference to 100.0% (1000) through communication, send the write command 01 06 73 10 03 E8 92 35. For details, see the following table.
<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>01H (configurable)</td><td>AC drive address</td></tr>
<tr><td>06H</td><td>Write command</td></tr>
<tr><td>7310H</td><td>Torque reference address</td></tr>
<tr><td>03E8H (1000 in decimal)</td><td>Target torque</td></tr>
<tr><td>9235H</td><td>CRC check</td></tr>
</table>
Set n0-14 = 4, then write 1000 to 7310H to set the torque to 10%. The set torque can be viewed through U6-11.</td><td>Notes:
• MD630S-INT: Modbus
• MD630N-INT: EtherCAT, EtherNet/IP, PROFINET
For communication parameters, see “n Communication Configuration” on page 1421.
For communication addresses, see “Communication Address” on page 207.
Related parameters:
“n0-14” on page 206</td></tr>
</table>

Parameter	Name	Default Value	Value Range	Description
b5-13 b6-13	Torque reference source	0	0: Set by the parameter (b5-14) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0: Digital setting - The torque reference source is the "digital setting of torque reference". 2: AI1 - The torque reference is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The torque reference is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The torque reference is set by the pulse frequency input through DI and calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/ deceleration time for each reference and supports up to 16 speeds. 8: PID - The torque reference is set through PID. 9: Communication - The torque reference source is communication. The torque can be input through remote communication. The AC drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector - A parameter number is set for a float connector, and the value of the connector is read as the torque reference. This mode is used for expansion of common sources.

When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

Param.	Description	Default:	Value Range	Descriptions
b5-19 b6-19	Speed limit source in torque mode	0	0: Set by the parameter (b5-20) 1: Speed channel	This parameter sets the speed limit source. **Description** 0：b5-20 - The speed limit source in torque mode is digital setting. The speed limit set by parameter "Digital setting of speed limit" is active. 1：Speed channel - The speed limit in the torque mode is set through the speed channel.
b5-20 b6-20	Digital setting of speed limit in torque control mode	100.0%	-800.0%-800.0%	Defines the digital setting value of the speed limit, which is active when the “Speed limit source” is set to “0：b5-20”.
b5-21 b6-21	Speed limit offset mode in torque mode	0	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control mode	This parameter sets the speed limit offset mode in the torque mode. **Value description** 0: The offset is valid for both directions. 1: The offset is valid only for unidirectional direction. 2: The offset is valid in both directions. The absolute value of the positive and negative speed limit is the speed limit plus the offset.

Param.	Description	Default:	Value Range	Descriptions
b5-22 b6-22	Speed limit offset source in torque mode	0	0: Set by the parameter (b5-23) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the speed limit offset source. **Value description** 0: b5-23 - The speed limit offset source is digital setting. 2: AI1 - The speed limit offset is input by current or voltage signals through AI1 and calculated according to the preset AI curve. 3: AI2 - The speed limit offset is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The speed limit offset is set by using the pulse frequency input through DI4 and calculated according to the corresponding mapping curve. MD630S 6: Multi-reference When multi-reference is used as the speed limit offset source, different combinations of DI terminal states correspond to different speed limit offsets. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/ deceleration time for each reference and supports up to 16 speeds. 8: PID PID is selected as the speed limit offset source. 9: Communication The speed limit offset source is communication. When selecting the source, you can set the speed limit offset through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter number is set for a float connector, and the value of the connector is read as the speed limit offset source. This mode is used for expansion of common sources.
b5-23 b6-23	Digital setting of speed limit offset in torque mode	5.0%	0.0%-800.0%	Defines the speed limit offset as a percentage to the rated speed. This parameter is activated when b5-22 [Speed limit offset source] is set to 0 [b5-23].

When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

Parameter	Description	Default:	Value Range	Descriptions
A2-06	Per-unit base value of torque	0.00	0.0 to 655.35	This parameter indicates the base value of per-unit torque. Base value of per-unit torque = (Rated motor power x 60)/(2PI x Rated motor speed)

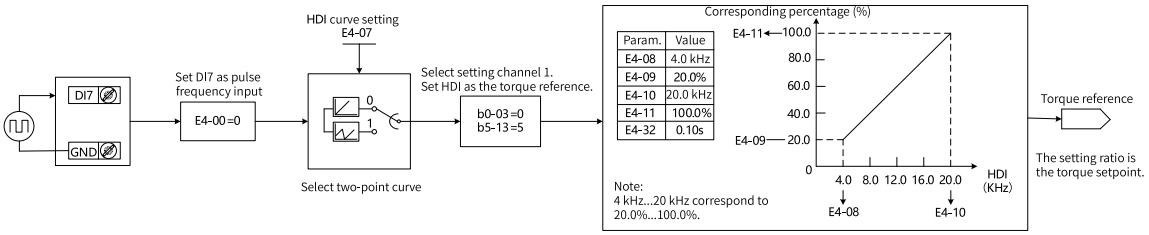


Figure 5-40 Parameter setting when torque reference is set through pulse input

Param.	Description	Default:	Value Range	Descriptions
b5-14	0.0	0.00	-800.0 to 800.0	Defines the digital setting of torque reference.

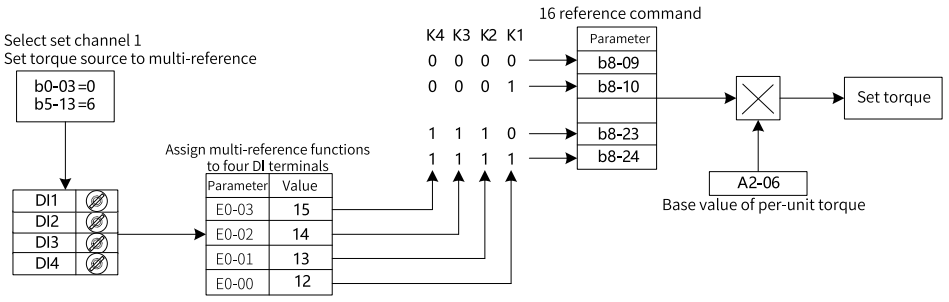


Figure 5-41 Setting torque through multi-reference

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values, as listed in the following table.

Table 5–6 Description of multi-reference function

K4	K3	K2	K1	Reference	Param.
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08=0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21

K4	K3	K2	K1	Reference	Param.
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

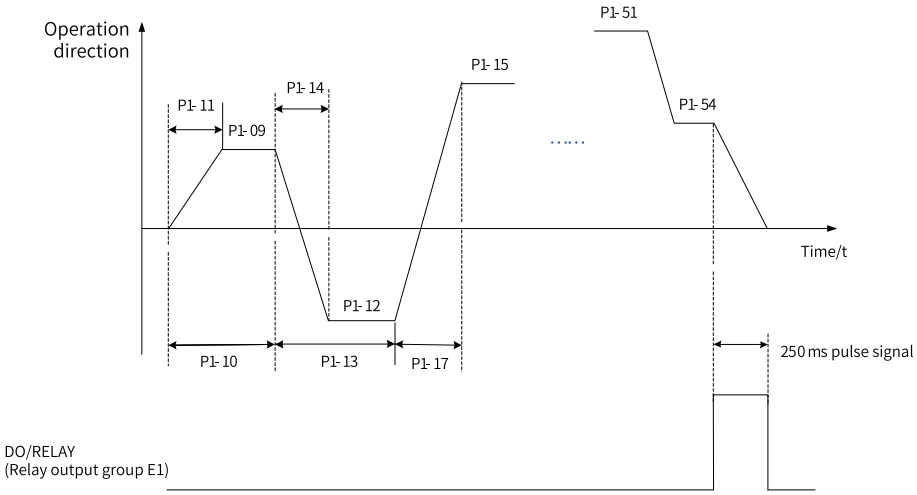


Figure 5-42 Setting torque through simple PLC

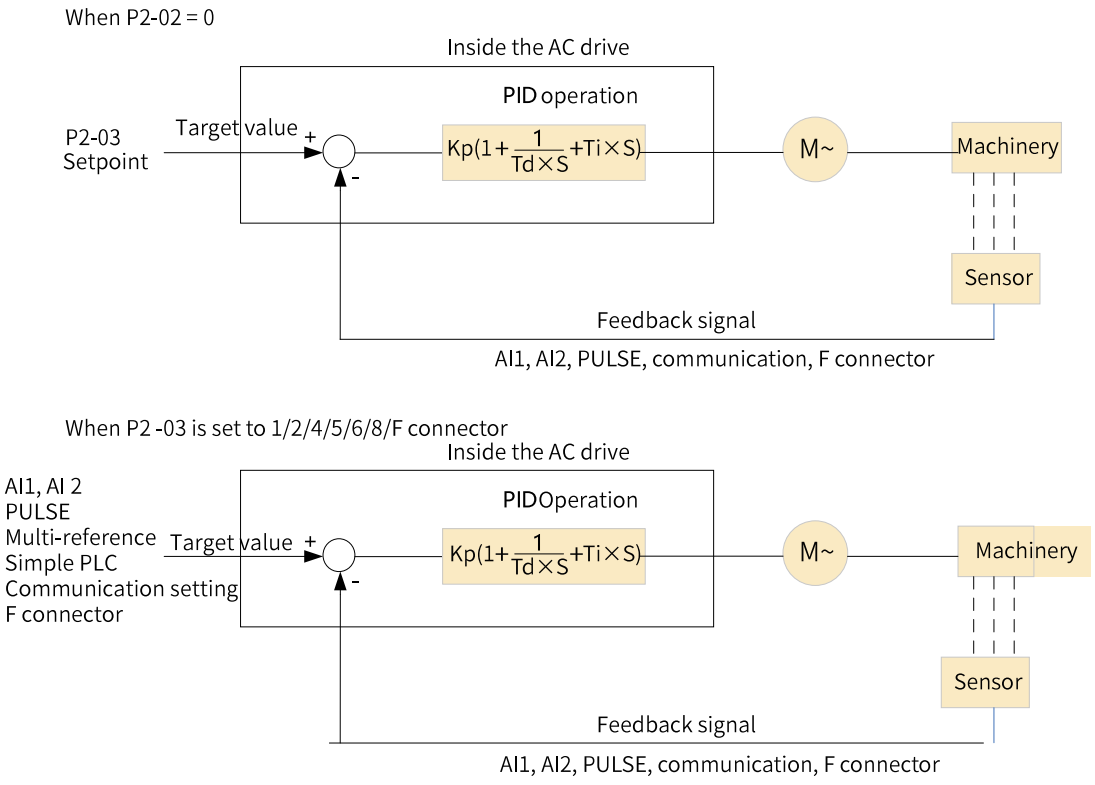


Figure 5-43 Diagram of general PID control

5.2.3.2 Setting Additional Torque

Scenarios

Additional torque (or supplementary torque) is used for scenario that torque adjustment setting is directly effective.

Description

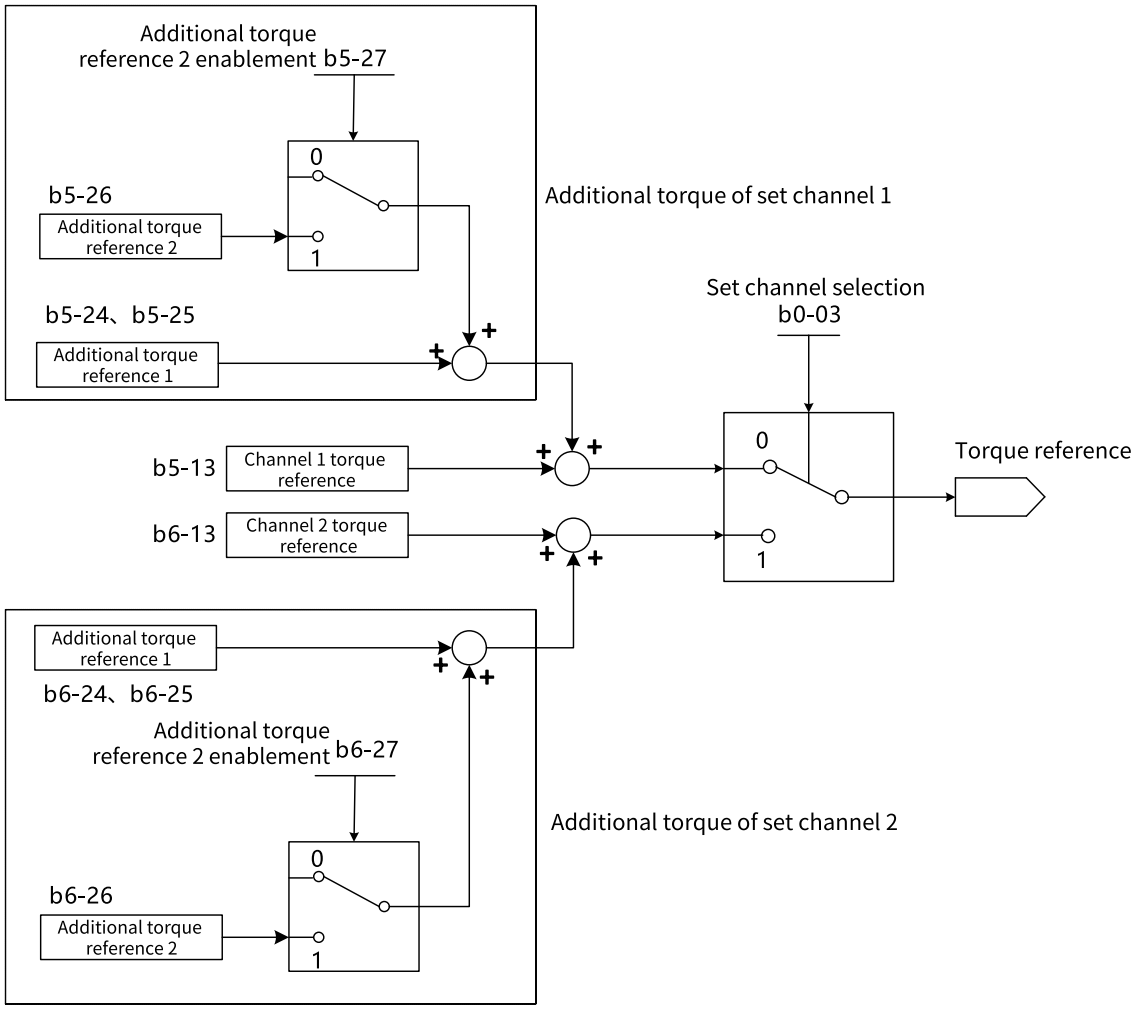


Figure 5-44 Torque reference and supplementary torque

Related parameters

Table 5–7 Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
b5-24	Source of supplementary torque reference 1	0	0: Set by the parameter (b5-25) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of supplementary torque reference 1 Value description 0: b5-25 - The source of additional torque reference 1 is set to "Digital setting of additional torque reference 1". 2: AI1 The supplementary torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The supplementary torque reference 1 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference The supplementary torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the source of supplementary torque reference 1. 9: Communication The source of supplementary torque reference 1 is communication. In this mode, the supplementary torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 1. This mode is used for expansion of common sources.
b5-25	Digital setting of supplementary torque reference 1	0	-400.0% to 400.0%	Defines the digital value of supplementary torque reference 1. The value is effective when the source of supplementary torque reference 1 is set to 0.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-26	Source of supplementary torque reference 2	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of supplementary torque reference 2 Value description 0: 0 The source of supplementary torque reference 2 is set to "0". 2: AI1 The supplementary torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The supplementary torque reference 2 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference The supplementary torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the source of supplementary torque reference 2. 9: Communication The source of supplementary torque reference 2 is communication. When selecting the source, you can set the additional torque reference 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 2. This mode is used for expansion of common sources.
b5-27	Additional torque reference 2 enable	0	0: Disabled 1: Enable 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets whether supplementary torque reference 2 is enabled. When the value is 0, supplementary torque 2 is disabled. When the value is 1, supplementary torque 2 is enabled. Value description 0: Supplementary torque reference 2 is disabled. 1: Supplementary torque reference 2 is enabled. 3 to 9: DI1 to DI7 - Whether supplementary torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-24	Source of supplementary torque reference 1	0	0: Set by the parameter (b6-25) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of supplementary torque reference 1 Value description 0: b6-25 - The source of additional torque reference 1 is set to "Digital setting of additional torque reference 1". 2: AI1 The supplementary torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The supplementary torque reference 1 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference The supplementary torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the source of supplementary torque reference 1. 9: Communication The source of supplementary torque reference 1 is communication. In this mode, the supplementary torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 1. This mode is used for expansion of common sources.
b6-25	Digital setting of supplementary torque reference 1	0	-400.0% to 400.0%	Defines the digital value of supplementary torque reference 1. The value is effective when the source of supplementary torque reference 1 is set to 0.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-26	Source of supplementary torque reference 2	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of supplementary torque reference 2 Value description 0: 0 The source of supplementary torque reference 2 is set to "0". 2: AI1 The supplementary torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The supplementary torque reference 2 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference The supplementary torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the source of supplementary torque reference 2. 9: Communication The source of supplementary torque reference 2 is communication. In this mode, the supplementary torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 2. This mode is used for expansion of common sources.
b6-27	Additional torque reference 2 enable	0	0: Disabled 1: Enable 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets whether supplementary torque reference 2 is enabled. When the value is 0, supplementary torque 2 is disabled. When the value is 1, supplementary torque 2 is enabled. Value description 0: Supplementary torque reference 2 is disabled. 1: Supplementary torque reference 2 is enabled. 3 to 9: DI1 to DI7 - Whether supplementary torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

5.2.3.3 Setting Torque Limit

Scenarios

This function is used to limit the motor from running above or below a certain torque by setting the torque limit.

Description

The torque upper limit refers to the maximum torque setting that the motor torque cannot surpass. The torque upper limit refers to the minimum torque. The motor torque setting cannot be lower than the limit.

The torque upper limit is the smaller value of d109 (Digital setting of torque upper limit 1) and d111 (Source of torque upper limit 2).

The torque lower limit is the larger value of d1-10 (Digital setting of torque lower limit 1) and d1-12 (Source of torque lower limit 2).

Related parameters:

Table 5–8 Param.

Parametor Code	Name	Default	Value Range	Descriptions
d1-09 (F2-30)	Digital setting of torque upper limit 1	200.0	0.0 to 800.0	This parameter limits the positive maximum output torque. It is a per-unit value based on the rated motor torque. **Additional information:** The effective forward torque limit is the smaller value between d1-09 and d1-11.
d1-10 (F2-31)	Digital setting of torque lower limit 1	-200.0	-800.0 to 0.0	This parameter limits the negative maximum output torque. It is a per-unit value based on the rated motor torque. **Additional information:** The effective negative torque limit is the lower value between d1-10 and d1-12.

Parametor Code	Name	Default	Value Range	Descriptions
d1-11 (F2-32)	Torque upper limit 2 selection	0	0: -800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Used to set the torque upper limit 2. It is the per unit value based on the rated torque of the motor. F2-32 is the mapping of d1-11 [Selection of torque upper limit 2] in group F. The two parameters have the same function. **Description** 0: -800% Set the reverse torque limit to -800%. 2: AI1 - The positive torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The positive torque limit is input by current or voltage through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The positive torque limit is set through the pulse frequency of the DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference When multi-reference is used as the forward torque limit source, combinations of different DI states correspond to different forward torque limits. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The positive torque limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The positive torque limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication - The positive torque limit is set through communication. When selecting the source, you can set the positive torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources. Note: The effective positive torque limit is the lower one between F2-30 and F2-32.

Parametor Code	Name	Default	Value Range	Descriptions
d1-12 (F2-33)	Torque lower limit 2 selection	1	0: -800% 1: Opposite to the source of torque lower limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Used to set the torque lower limit 2. It is the per-unit value based on the rated torque of the motor. F2-33 is the mapping of d1-12 [Selection of torque lower limit 2] in group F. The two parameters have the same function. **Description** 0: -800% Set the reverse torque limit to -800%. 1: Inverted value of torque lower limit 2 - The value of d1-11 is inverted. 2: AI1 - The negative torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The negative torque limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The negative torque limit is set through the pulse frequency of DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the reverse torque limit, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The reverse torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID - The negative torque limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication - The negative torque limit is set through communication. When selecting the source, you can set the forward torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources. Note: The effective negative torque limit is the lower one between F2-31 and F2-33.

5.2.4 Start/Stop Mode

5.2.4.1 Startup Mode

The AC drive supports two start modes: direct start and flying start. Set d0-02 to select a start mode of the AC drive.

Related parameters

Param.	Name	Default	Value Range	Descriptions
d0-02 (F2-15)	Start mode	0	0: Direct start 1: Flying start	This parameter is used to set the start mode of the motor. Value description 0: Direct start - The AC drive starts directly. This mode applies to scenarios where the motor starts from a standstill state. 1: Flying start - In this mode, the drive first determines the motor rotation speed and direction, and then starts at the detected frequency of the motor. Select this mode when the motor is started during rotation. For other scenarios, select direct start.

5.2.4.1.1 Flying Start

Scenarios

If a motor in rotation is started in direct start mode, an overcurrent fault may be caused due to inrush current upon startup. When d0-02 (Startup mode) is set to 1, the AC drive uses the flying start mode. In this mode, the drive first determines the motor rotation speed and direction, and then starts at the detected frequency of the motor.

The flying start function is applicable when no encoder is used to measure the motor speed and the startup and running of motors in rotation must be tracked. It is typically used for driving high-inertia mechanical loads.

To restart the motor when it is running, select the flying start mode. Flying start is applicable to V/f and SVC control modes.

Working principle

In this mode, the AC drive can automatically track the motor speed and direction to start the rotating motor smoothly without impact.

As shown in the following figure, after startup, the motor synchronous frequency tracks the motor speed, after which the motor enters the normal operation mode.

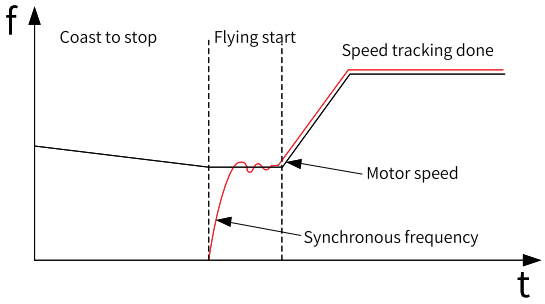


Figure 5-45 Flying start process

Note: It is recommended that the AC drive be equipped with a motor for parameter auto-tuning when magnetic field oriented flying start is selected.

Related parameters

Param.	Name	Default	Setting range	Description
d0-03 (F2-16)	Flying start mode	4	0: Start from the stop frequency 1: Start from the power frequency 2: Start from the maximum frequency 4: Magnetic field oriented flying start	It is used to set the flying start mode when the AC drive starts. Value description: 0: Start from the stop frequency - The current speed is searched from the last stop frequency. If external force drives the motor to a speed higher than the speed at stop, this mode is not applicable. 1: Start from the power frequency - The current speed is searched from the power frequency of 50 Hz. This mode is applicable to scenarios where the motor is restarted after stop for a long time. 2: From the maximum frequency - The current speed is searched from F1-10 (Maximum motor frequency). It is generally used for generating loads. 4: Magnetic field oriented flying start - The current speed is searched using magnetic field oriented flying start. The search speed is faster than the first three modes, but motor parameters need to be tuned. It is applicable for fast flying start in the V/f mode.

Precautions

1. In the V/f control mode of the asynchronous motor, four flying start modes can be selected. In the SVC control mode, only magnetic field oriented flying start is available.
2. In the V/f control mode of the asynchronous motor, setting parameter d0-03 (flying start mode) to 0, 1, or 2 may result in a longer flying start time. But in this case, the requirements on the motor parameter are low.
3. For synchronous motor flying start, there is no need to adjust the flying start mode.
4. The motor starts after speed tracking, and there is no pre-start self-test.

Application example

- After the fan stops, the air inside the air duct will blow the fan blades, causing the motor to rotate.
- After the water pump stops, the water still flows, which will impact the blades of the water wheel, causing the motor to rotate.
- The stop time of large equipment lasts for up to several tens of minutes. In order to stop in time, the motor may still be rotating when the next motor starts.

Speed tracking startup is required in applications such as fan water pump, air conditioner, and air compressor. In the preceding scenario, the motor is rotating, and the motor needs to be started through flying start. Set d0-02 (Start mode) to 1 (Flying start) and click Start. The AC drive will observe the current motor speed and start the motor smoothly again from the current speed.

5.2.4.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)

Application scenarios

Applicable scenarios for pre-excitation based on time: For applications with multiple asynchronous motors and motors are expected to be started simultaneously, pre-excitation based on time can be used to start and complete pre-excitation of multiple asynchronous motors at the same time.

After receiving the start command, the motor speed is set to the RFG output, and accelerates according to the acceleration time. This startup mode is applicable to most load applications.

Operation principles

In V/f control mode, set the parameter d0-02 (Start mode) to 0 (Direct start). After receiving the start command, the motor speed is set to the RFG output.

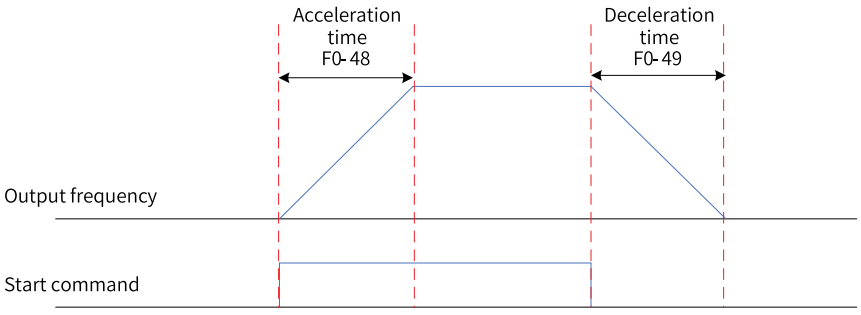


Figure 5-46 Direct start

In the SVC mode of asynchronous motor, set d0-02 (Start mode) = 0 (Direct start) and set pre-excitation parameters. The motor needs to enter the pre-excitation state before generating the rotor magnetic field to better control the output torque of the motor. You can select time or current-based excitation. Set the pre-excitation function through d0-17 (Pre-excitation mode) to d0-20 (Demagnetization time).

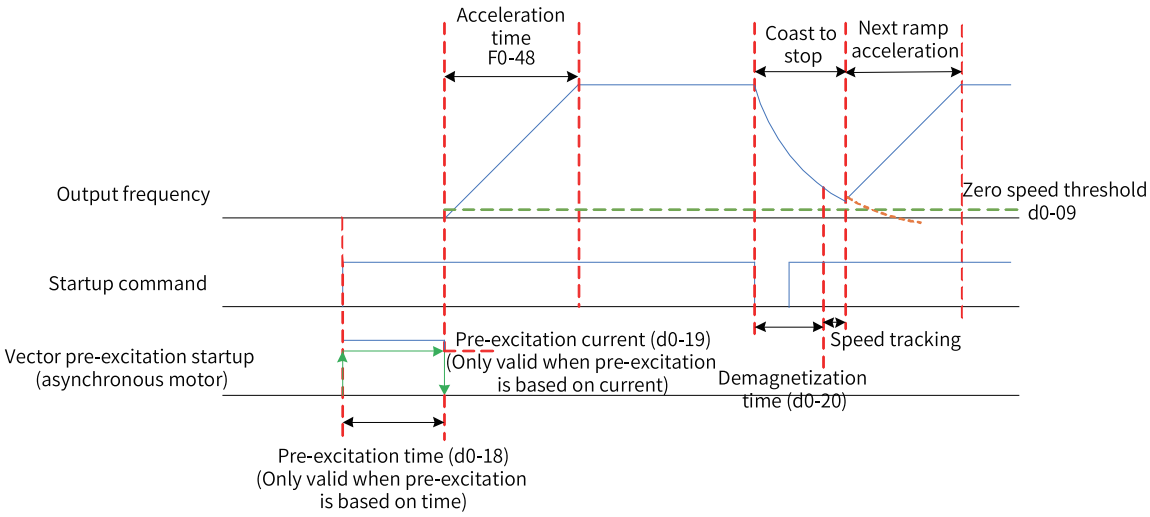


Figure 5-47 Pre-excitation

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-17	Pre-excitation mode	1	0: Pre-excitation based on time 1: Pre-excitation based on the current reference 2: Pre-excitation based on the maximum current	This parameter selects a pre-excitation mode for an asynchronous motor in the vector control mode. Value description 0: Pre-excitation based on time After the excitation time before start reaches the time set by d018, the drive enters the normal running state. The excitation current reference is calculated by the system automatically. 1: Pre-excitation based on the current reference Excite according to the current set by d019 before start. After the magnetic flux reaches the target value, the drive enters the normal running state. 2: Pre-excitation based on the maximum current Before start, the system calculates the maximum current based on the rated drive current and the rated motor current. Excitation according to the maximum current can realize fast excitation and start.
d0-18	Pre-excitation time	1000 ms	1 ms to 30000ms	This parameter sets the pre-excitation time for the asynchronous motor in the vector control mode. Additional information: This parameter is valid when d017 is set to 0.

Parameter	Parameter name	Default value	Value range	Description
d0-19	Pre-excitation current	100%	1% to 800%	This parameter sets the pre-excitation current for the asynchronous motor in the vector control mode. Additional information: 1: Rated motor current as the base value in percentage 2: Active when d0-17 is set to 1 (Pre-excitation based on the current reference)
d0-20	Demagnetization time	0.5s	0s to 5s	This parameter sets the demagnetization time for the asynchronous motor. Additional information: If you want to restart the motor after the motor coasts to stop, wait for the time set by d0-20. Then the motor can be restarted. If the time set of d0-20 is too short, abnormalities such as flying start failure may occur.

Precautions

1. Pre-excitation start is applicable only to the asynchronous motors in FVC and SVC control modes.
2. This mode is the quick pre-excitation start mode.
3. The excitation time is set by d0-18 only when the pre-excitation mode is set to based on time (d0-17 = 0). The excitation current is calculated dynamically based on the excitation time. After the excitation time is reached, pre-excitation is done.
4. The excitation current is set by d0-19 only when the pre-excitation mode is set to based on current (d0-17 = 1). In this case, pre-excitation time changes.
5. If the pre-excitation is enabled, speed drop will not occur upon motor startup. For asynchronous motors in V/f control mode expected to achieve performance equivalent to that of pre-excitation, set the DC braking at start and time for DC braking.

Application examples

Applicable scenarios for pre-excitation based on time: For applications with multiple asynchronous motors and motors are expected to be started simultaneously, select pre-excitation based on time (d0-17 = 0) and set the pre-excitation time to a same value through d0-18 so that pre-excitation of multiple asynchronous motors can be completed and started simultaneously. Ensure that the pre-excitation time for each motor is the same. Failure to comply will result in inconsistency in motor startup.

5.2.4.1.3 Synchronous Motor Direct Startup (Magnetic Pole Position Auto-Tuning)

Scenarios

Before initiating a direct start, it's essential for the synchronous motor to identify the current rotor's magnetic pole position to ensure the motor starts in the correct direction. Otherwise, overcurrent, overload, or motor startup stuck may occur.

Working principle

Direct starting of a synchronous motor in SVC mode involves magnetic pole position auto-tuning to obtain the rotor position of the synchronous motor, so that the motor can start running in the correct direction. Auto-tuning helps prevent start-up issues such as reverse start-up, oscillation, or out-of-step caused by excessive deviation between the initial wave phase angle and the actual position of the motor's rotor. if an incremental encoder is used when the synchronous motor is in FVC mode, magnetic pole position auto-tuning is performed upon initial power-on and first restart after the fault. If an absolute encoder is used, magnetic pole position auto-tuning is not required. The incremental encoders supported by MD630-INT include ABZ encoders, sine-cosine encoders; and absolute encoders supported include resolvers, SSI encoders, 23-bit encoders, sine-cosine encoders, EnDat encoders, and BISS encoders.

The synchronous motors can be classified into salient pole motors and surface-mounted motors. The time for magnetic pole position auto-tuning of salient pole motors is within 250 ms, and the time for magnetic pole position auto-tuning of surface-mounted motors is within 50 ms. The drive automatically identifies the motor type and switches the magnetic pole position auto-tuning solution accordingly.

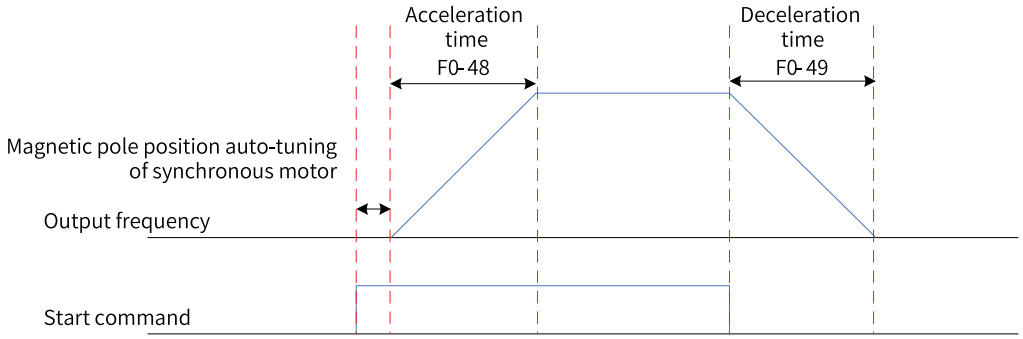


Figure 5-48 Magnetic pole position auto-tuning

Related parameters

Param.	Name	Default	Setting range	Description
d0-70	Magnetic pole position detection upon start of synchronous motor in SVC mode	0	0: Detection upon each running 1: No detection 2: Detection upon initial power-on	Defines the detection mode of the initial position of the synchronous motor before start. Value description: 0: Detection upon running 1: No detection 2: Detection upon initial power-on
d0-71	Defines the initial position detection method of the synchronous motor before start.	2	0: Voltage pulse 1: High frequency injection 2: Adaptive mode 3: Pre-positioning	Defines the initial position detection method of the synchronous motor before start. Value description: 0: Voltage pulse - The magnetic pole position is auto tuned with voltage pulse before start. 1: High-frequency injection - The magnetic pole position is auto-tuned with high-frequency injection before start. 2: Adaptive mode - Whether to enable high-frequency injection depends on the motor inductance. 3: Pre-positioning - Used to drive the motor to a fixed angle before start.
d0-75	Initial position detection current of synchronous motor	80	50% to 180%	Defines the target current for magnetic pole position auto-tuning of the synchronous motor. A lower current setting means lower noise during detection. However, an excessively low setpoint may cause inaccurate position detection. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
d0-76	Initial position compensation angle	0	0.0° to 359.9°	For a synchronous motor, after auto-tuning of the initial magnetic pole position, set this compensation angle properly to avoid reverse rotation upon start. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.

Precautions

1. For direct starts of synchronous motors, it is strongly recommended to keep the magnetic pole position auto-tuning feature enabled. Otherwise, reverse start-up, acceleration/deceleration oscillation, or step loss may occur.
2. When d0-70 is set to 2 (Detected upon initial operation after power-on), if the motor speed at coast-to-stop is higher than the zero speed threshold, the position is considered lost and the position will be re-tuned during the next direct start.

3. The voltage pulse method is typically used for non-salient pole motors, while high-frequency injection is suitable for salient pole motors. The pre-positioning is applicable to applications where the motor rotates slightly before starting.
4. It is normal for synchronous motors to exhibit an obvious noise during voltage pulse auto-tuning. A "sizzling" noise occurs before starting in high-frequency injection mode. In noise-sensitive environments, carefully select the magnetic pole position auto-tuning mode based on the motor's characteristics to minimize noise.
5. By default, magnetic pole position auto-tuning is performed every time for the synchronous motor starts up in SVC control mode.
6. The time for voltage pulse auto-tuning is about 15 ms.
7. The time for high-frequency injection auto-tuning is about 120 ms.
8. The pre-positioning time is about 2s.

5.2.4.2 Stop Mode

Application scenarios

Stop modes specify the actions upon corresponding stop commands, including decelerate to stop, coast to stop, stop at maximum capability,and quick stop. In some special applications, the DC braking at stop is also required.

Operation principles

The drive has three start/stop commands: ON_OFF1 (Start/stop), OFF2 (Coast to stop), and OFF3 (Quick stop).

- ON_OFF1 (Start/Stop): Invalid when the value is 0, valid when the value is 1. The AC drive starts and stops controlled by OFF2 in combination with ON_OFF1 and OFF3. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered during the rising edge from 0 to 1. When the stop command is triggered by the falling edge from 1 to 0, the AC drive stops in the mode set by d004 (OFF1 stop mode).
- OFF2 (Coast to stop): Inactive when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF3. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d005 (OFF2 stop mode).
- OFF3 (Quick stop): Invalid when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF2. When ON_OFF1 is active and the OFF2 command is inactive and no fault occurs, the OFF3 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d006 (OFF3 stop mode).

Operation mode	Command	Value Range	Result
Start	Normal start	ON_OFF1: 0 to 1	The AC drive starts normally.
		OFF2: 1	
		OFF3: 1	
At stop	OFF1 stop command	ON_OFF1: 1 to 0	The drive stops according to the OFF1 setting. The OFF1 stop modes include decelerate to stop, coast to stop, and stop at maximum capability.
		OFF2: 1	
		OFF3: 1	
	OFF2 stop command	ON_OFF1: 1	The drive stops according to the mode set by OFF2 (Coast to stop).
		OFF2: 1 to 0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The AC drive stops according to the OFF1 setting. The OFF1 stop mode includes quick stop and stop with maximum capability.
		OFF2: 1	
		OFF3: 1 to 0	

As shown in the preceding table, the stop modes of OFF1 to OFF3 can be set for different commands. The different stop modes are defined as follows:

- Decelerate-to-stop
  d0-04 (OFF1 stop mode) generally selects deceleration to stop. Once the deceleration to stop command is input, the AC drive decreases the output frequency to 0 and then stops based on the RFG deceleration time.

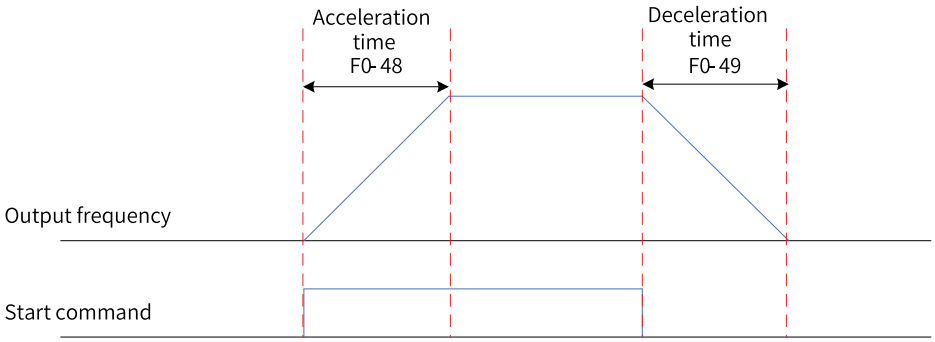


Figure 5-49 Decelerate-to-stop

- Coast to stop
  d0-05 (OFF2 stop mode) is fixed to coast-to-stop. When coast-to-stop is selected, the IGBT output is blocked directly and the motor coasts to stop. For devices with large inertia, it takes long time to be fully stopped. Most faults and OFF2 stop mode can trigger the coast-to-stop mode.

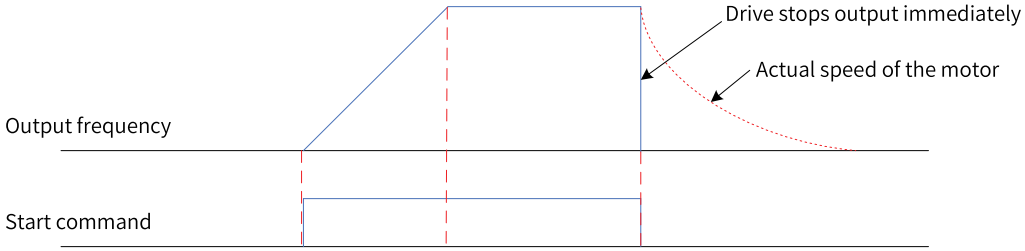


Figure 5-50 Coast to stop

- Stop-at-maximum-capability

After the stop at maximum capability mode is activated, the speed reference of the motor is forced to be 0. The motor decelerates to 0 based on the maximum output capability. During deceleration, the motor torque or current may reach the limit.

- Quick stop
  d0-06 (OFF3 stop mode) is set to quick stop in general case. The quick stop mode is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34/b7-35/b7-36.

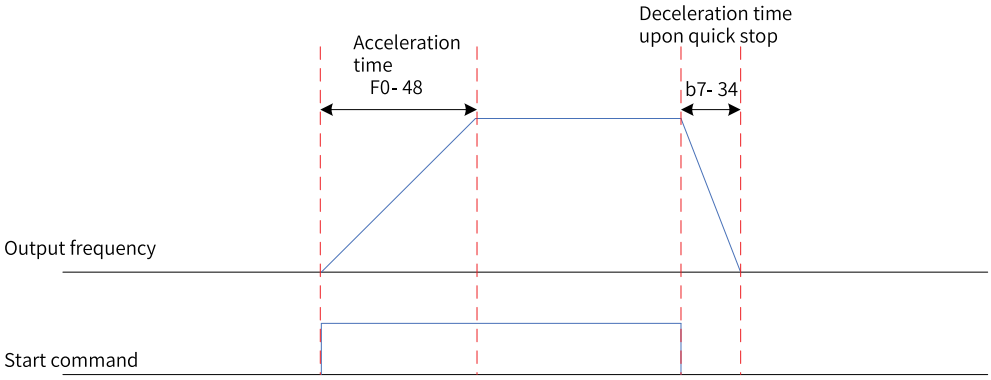


Figure 5-51 Quick stop

If the motor reaches the torque and current limit during deceleration, the corresponding deceleration time will be longer.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-04 (F2-17)	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	Defines the OFF1 stop mode. Value description 0: Decelerate to stop The stop mode is determined by the valid ramp setting. 1: Coast to stop The drive stops output to shut down. At this time, the power supply of the motor is cut off and the driving system is in the coast-to-stop state. 2: Stop at maximum capacity In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.
d0-05	OFF2 (Coast to stop) stop mode	0	0: Coast to stop	This parameter displays the OFF2 stop mode. The default value is coast to stop.

Parameter	Parameter name	Default value	Value range	Description
d0-06	OFF3 (Quick stop) stop mode	0	0: Quick stop 1: Stop at maximum capability	Defines the OFF3 (Quick stop) stop mode. Value description 0: Quick stop It is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b734/b7-35/b7-36. 1: Stop at maximum capacity In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.
d0-07	Stop mode during operation	1	0: OFF1 stop 1: OFF2 (coast to stop) stop mode 2: OFF3 (quick stop) stop mode	This parameter specifies the stop mode after the operation enable signal is deactivated. It is equivalent to the operation pause or operation enable function of the terminal. Value description 0: OFF1 stop mode The stop mode is determined by d0-04. 1: OFF2 (coast to stop) stop mode The stop mode is coast-to-stop. 2: OFF3 (quick stop) stop mode The stop mode is determined by d0-06.
d0-08	Stop mode in torque control	1	0: Forced coast-to-stop 1: Switched to speed control mode and then stop 2: Maintaining torque control mode until zero speed and then block	Defines the stop mode in torque control. Value description 0: Coast to stop forcibly, and the drag system is in the free braking state. 1: Switch to speed mode and stop according to the stop mode active in the current speed mode. 2: The speed limit in the torque mode is reduced to 0 according to the set deceleration time, but the motor is still running in the torque mode. When the actual motor speed reaches 0, the motor stops.

5.2.4.3 Starting frequency

Application scenarios

When starting torque is required or the motor is driven smoothly at start-up, you can set the start frequency or keep the set start frequency for a certain time.

Operation principles

Set the start frequency function through d0-23 (Start frequency) and d0-24 (Start frequency holding time). When d0-24 is set to 0, the startup frequency function is disabled. When d0-24 (Start frequency holding time) is not set to 0, the AC drive directly outputs the value of d0-23 (Start

frequency) after receiving the start command and keeps the time set by d0-24 (Start frequency holding time) unchanged. Then accelerate the running.

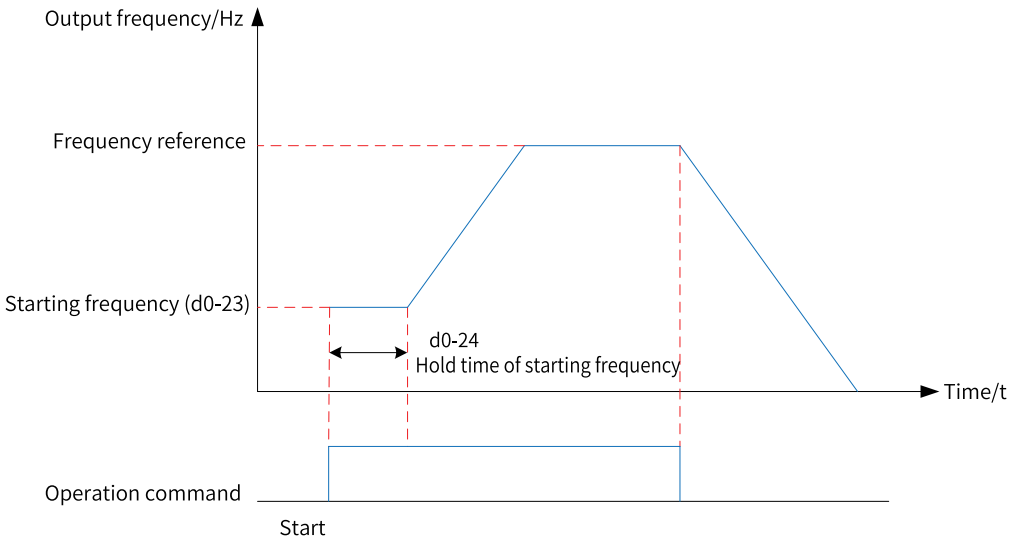


Figure 5-52 Startup frequency

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-23	Startup frequency	0	0.00 Hz to 10.00 Hz	This parameter sets the start frequency. Additional information: The start frequency is output once the system is started. After the start frequency remains unchanged for the time defined by d0-24, the drive accelerates.
d0-24	(Startup frequency holding time)	0	0.0s to 1000.0s	This parameter sets the start frequency holding time. Additional information: When it is set to 0, the startup frequency holding function is not available.

Note: Only the first group of motor parameters are described here. For other groups of motors, refer to this section.

5.2.4.4 DC Braking

5.2.4.4.1 DC Braking at Startup

Application scenarios

The setting of DC braking time at startup before start applies to applications where the motor may rotate at start.

When the asynchronous motor (V/f) is started, the DC braking function can help increase the startup torque.

Operation principles

The DC braking function supplies a DC current to the motor's stator winding, generating a braking force that brings the motor to a halt. Set the start DC braking function by d0-25 (DC braking time upon start) and d0-26 (DC braking current upon start). This function is disabled when d0-25 is set to 0. You can also adjust the current loop during DC braking by d0-31 (DC braking current loop Kp adjustment) and d0-32 (DC braking current loop Ti adjustment).

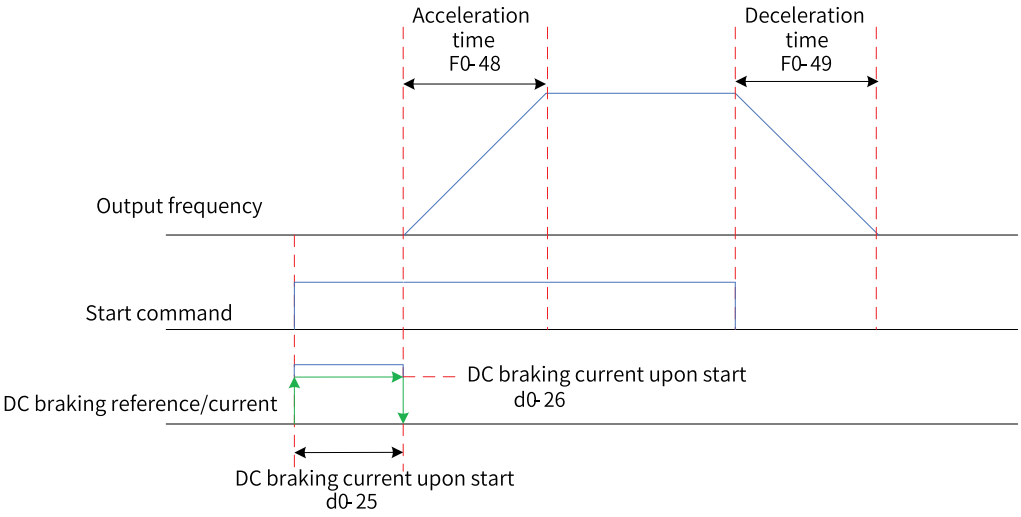


Figure 5-53 Figure displaying how to start DC braking

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-25	Start DC braking time	0s	0s to 100s	Defines the DC braking time. Additional information: Valid when d0-02 is 0 (Direct start mode). Set to 0 to disable this function. If it is not 0, the AC drive will continuously output DC current d0-26 before starting the motor to generate braking force. After reaching the time set by d0-25, the AC drive enters normal operation state.
d0-26	Start the DC braking current	50%	0% to 800%	Defines the DC braking current for startup. The higher the current, the stronger the braking force. Supplementary explanation: The percentage is based on the rated motor current.
d0-31	DC braking current loop Kp adjustment	100.0%	0.1% to 800.0%	Defines the Kp adjustment coefficient of the current loop during DC braking.
d0-32	DC braking current loop Ti adjustment	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

Precautions

1. The current and action time of DC braking should be smaller than the overload limit of the motor and AC drive.
2. Long-term braking ensures that the asynchronous motor stays at zero speed, but may cause severe motor heat.
3. Do not use the DC braking function to replace the brake function of the mechanical device.

Warning

Do not use DC braking on traction loads. Pulling the load can cause the motor to rotate, which may result in personal injury or death.

Application examples

The V/f operation accelerates sharply. The process does not meet the requirements because there is no obvious deviation in the actual speed of the flux motor during the initial start phase. All motors can be set to V/f start DC braking, which can significantly reduce the speed deviation of direct start.

5.2.4.4.2 DC Braking at Stop

Application scenarios

In special applications, add DC current to brake at stop to ensure that the load stops after stop.

Operation principles

The DC braking function supplies a DC current to the motor's stator winding, generating a braking force that brings the motor to a halt.

During deceleration to stop, when the running frequency decreases to d0-27 (Stop DC braking start frequency), the drive blocks the output for the duration of d0-28 (Stop DC braking waiting time). Enter the stop state after the current set by d0-30 (Stop DC braking current) is output and lasts for d0-29 (Stop DC braking time).

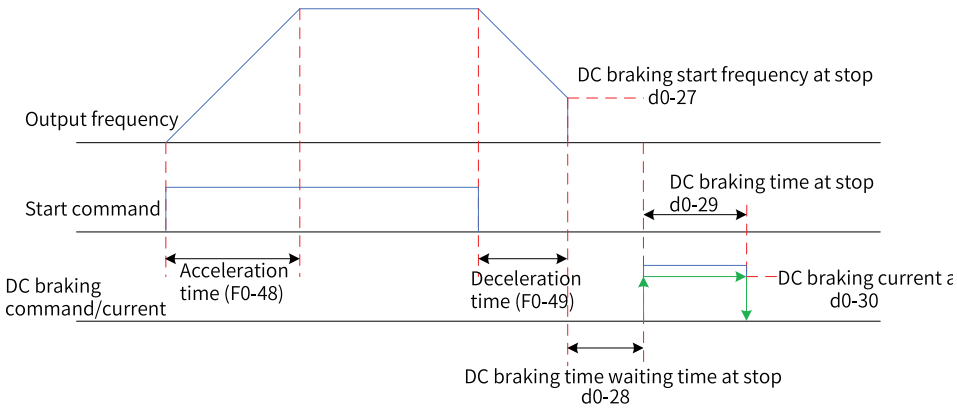


Figure 5-54 DC braking at stop

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-27	Start frequency of DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz	Defines the start frequency of DC braking at stop. Additional information: 1. During deceleration to stop, when the running frequency drops to d0-27, the drive blocks the output. After d0-28, the DC braking current set by d0-30 is output and the current lasts for d0-29. The system enters the stop state. 2. Do not set the frequency point too high. Otherwise, the AC drive may overcurrent.
d0-28	DC braking waiting time at stop	0.0s	0.0s to 100.0s	This parameter sets the waiting time of DC braking for stop. Additional information: 1. During deceleration to stop, when the running frequency drops to d0-27, the drive blocks the output. After d0-28, the DC braking current set by d0-30 is output and the current lasts for d0-29. The system enters the stop state. 2. This time is for the asynchronous motor to degauss. If the waiting time is too short, the AC drive may be overcurrent.
d0-29	DC braking time at stop	0.0s	0.0s to 100.0s	This parameter sets the DC braking time for stop. Additional information: During deceleration to stop, when the running frequency decreases to d0-27, the AC drive will block the output. After the duration of d0-28, the AC drive outputs the DC braking current set by d0-30 for the duration of d0-29. Enter the stop state. The stop DC braking function is disabled when it is set to 0.
d0-30	DC braking current at stop	50%	0% to 800%	Set the DC braking current at stop. Additional information: 1. During deceleration to stop, when the running frequency drops to d0-27, the drive blocks the output. After d0-28, the DC braking current set by d0-30 is output and the current lasts for d0-29. The system enters the stop state. 2. The current percentage is based on the rated motor current. The larger the setting, the stronger the braking force.
d0-31	DC braking current loop Kp adjustment	100.0%	0.1% to 800.0%	Defines the Kp adjustment coefficient of the current loop during DC braking.
d0-32	DC braking current loop Ti adjustment	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

Precautions

1. The starting frequency for DC braking at stop must not be set too high; otherwise, overcurrent may occur on the AC drive.
2. If the DC braking waiting time is too short during asynchronous operation, the AC drive may be overcurrent.

3. The current and action time of DC braking should be smaller than the overload limit of the motor and AC drive.

5.2.4.5 Timed Automatic Stop

Application scenarios

If you want the drive to stop automatically after operation of a certain period, set the timed operation time for the drive through P0-13 (Timing function) to P0-15 (Timed operation duration). The timer starts from 0 upon startup of the drive. When the timing duration expires, the drive automatically stops.

When the RO or DO function is set to 30 (Timing reached) and the operation time of the drive reaches the set time, the RO or DO outputs an active signal.

Operation principles

Set whether to enable timed operation of the drive through P0-13 (Timing function). When timed operation is enabled, the timer starts from 0 upon startup of the drive. When the timing duration expires, the drive automatically stops. The remaining operation time can be viewed through U0-20 (Remaining time of timed operation).

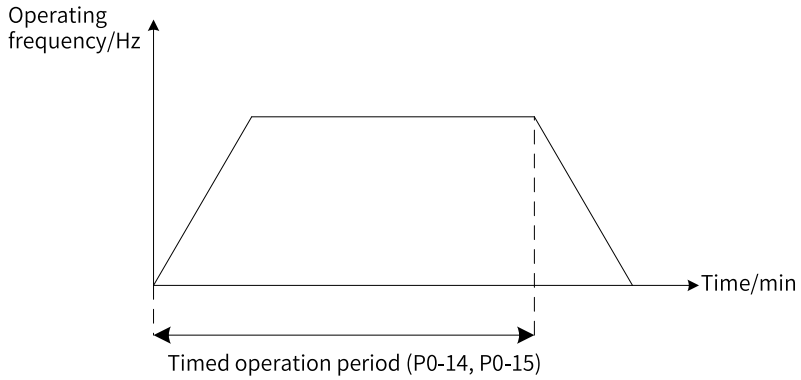


Figure 5-55 Timed operation

Specifically, set the timed operation duration (min) through P0-14 (Timed operation duration source) and P0-15 (Digital setting of timed operation duration). When the timed operation duration is set to 0, the timed operation is not active. Set the source of timed operation duration through P0-14.

1. When P0-14 (Timed operation duration source) is set to 0 (Set by P0-15), the timed operation duration is determined by the value of P0-15.
2. When P0-14 (Timed operation duration source) is set to 1 (AI1) or 2 (AI2), the timed operation duration equals the result of (AI voltage/10 V) x P0-15.
3. When P0-14 (Timed operation duration source) is set to Other (F connector), the timed operation duration equals the result of floating point connector value x P0-15.

By default, P0-14 (Timed operation duration source) is set to 0 (Set by P0-15). Set the timed operation duration through P0-15.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-13	Timing function	0	0: Inactive 1: Active	Used to set whether the timed operation of the drive is active. Value description 0: Inactive 1: Enable. The timer starts upon startup of the AC drive. When the set timing duration is reached, the AC drive stops automatically and meanwhile the corresponding multi-function DO outputs ON signal. Additional information: 1. The timing duration is set by P0-14 and P0-15 in the unit of minute. 2. The AC drive starts timing from 0 each time it starts up and the remaining timing duration can be viewed in U0-20.
P0-14	Timed operation duration source	0	0: P0-15 1: AI1 2: AI2 Others: F connector	Defines the source of the timed operation time. Value description 0: Set by P0-15 The timing operation duration is set by P0-15. 1: AI1 The timing operation duration is set by AI1 input voltage and P0-15. 2: AI2 The timing operation duration is set by AI2 input voltage and P0-15. Others: F connector The timing operation duration is set by the F connector value and P0-15. Additional information: When this parameter is set to 1, the timing operation duration equals the result of (AI voltage/10 V) x P0-15. 100% of the analog input range corresponds to P0-15.
P0-15	Digital setting of timing operation duration	0.0 min	0.0 min to 6500.0 min	Set the local digital value of the timed operation time.
U0-20	Timed remaining running time	0.0	0.0 to 6553.5	This parameter indicates the remaining time for timing operation in the unit of minute.

5.2.4.6 Hibernation and Wakeup

Application scenarios

Hibernation enables you to set any time period within 24 hours, during which the AC drive stops running and hibernates.

Wakeup is a process that the AC drive wakes up from the hibernation state and starts to run.

Operation principles

To use the hibernation and wakeup functions, set the hibernation frequency and wakeup frequency. As shown in the following figure, set the hibernation function through P0-24 (Hibernation frequency)

and P0-25 (Hibernation delay). If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop. Set the wakeup function through P0-22 (Wakeup frequency) and P0-23 (Wakeup delay). In hibernating state, when the frequency reference is equal to or greater than P0-22 (Wakeup frequency), the drive wakes up after delay set by P0-23 (Wakeup delay).

Generally, set the wakeup frequency (P0-22) equal to or higher than the hibernation frequency (P0-24). The hibernation and wakeup function is disabled if both the wakeup frequency and hibernation frequency are set to 0.0 Hz.

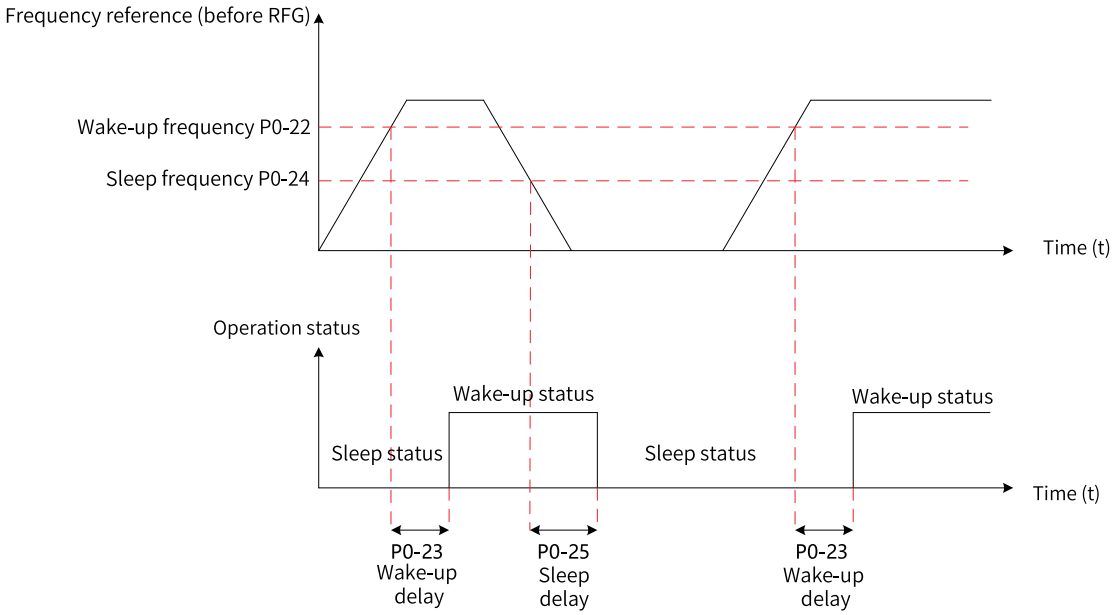


Figure 5-56 Hibernation and wakeup settings

Note:

(1) The upper limit of the hibernation frequency can be set to wakeup frequency. You need to set P0-22 (Wakeup frequency) first and then P0-24 (Hibernation frequency).

(2) When hibernation is enabled during PID operation, you can set P2-33 (selection of PID operation at stop) to 1 to continue the PID operation or to 0 to stop PID operation.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-22	Wakeup frequency	0.00 Hz	P0-24 to A2-17	Sets the wakeup frequency of the drive to exit the hibernation state. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
P0-23	Wakeup delay	0.0s	0.0s to 6500.0s	Defines the wakeup delay time of the drive. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
P0-24	Hibernation frequency	0.00 Hz	0.00 Hz to P0-22	Sets the hibernating frequency of the drive. The drive enters the hibernation state when the frequency reference in the running state is lower than the hibernating frequency. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.
P0-25	Hibernation delay	0.0s	0.0s to 6500.0s	Defines the hibernation delay of the drive. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.

5.2.4.7 Start safety protection

Application scenarios

The startup safety protection of the AC drive prevents the motor from responding to running commands without knowledge. The startup protection can protect the following situations:

1. If the running command is valid when the AC drive is powered on (for example, an input terminal is ON before power-on), the AC drive does not respond to the command. The AC drive responds only after the running command is canceled and becomes valid again.
2. If the running command is valid when the AC drive fault is reset, the AC drive does not respond to the running command. The startup protection can be disabled only after the running command is canceled. The AC drive starts to run when the running command is valid again.

Operation principles

This device uses P0-21 to set whether the startup safety protection function is active. When P0-21 is set to 1, the function is active. The running command is valid when the AC drive is powered on or fault reset. The AC drive does not respond to the running command. The running command must be removed before the running protection state can be eliminated. The running command is valid again before the AC drive starts running.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-21	Start protection selection	1	0: Disable 1: Protection	Set the startup protection function of the AC drive. Value description: 0: Disable 1: Protection Additional information: 1. When the parameter is set to 1, if the running command is active when the device is powered on (for example, the terminal running command is closed before power-on), The drive does not respond to the running command. The running command must be removed once, and the running command becomes valid again before the drive responds. 2. When the parameter is set to 1, the drive does not respond to the running command when the fault is reset. The running protection state can be eliminated only after the running command is removed.

Note: This parameter is invalid when the fault is reset. The protection is always active.

5.2.5 Jog

5.2.5.1 Jog

Jog

In some applications, the AC drive needs to run at a low speed temporarily to facilitate equipment testing. In this case, jogging is applied.

Operation principles

The MD630-INT supports up to two jog commands. Take set channel 1 and control channel 1 as an example. Set jog 1 frequency through b5-07 (Jog 1 frequency source selection) and b5-08 (Jog 1 frequency reference). Set jog 2 frequency through b5-09 (Jog 2 frequency source selection) and b5-10 (Jog 2 frequency reference). Set whether jog 1 command is valid through b1-06 (user-defined jog 1 command source) and whether jog 2 command is valid through b1-07 (user-defined jog 2 command source).

Set the base frequency through b7-01 (ramp acceleration/deceleration time base frequency). Set jog acceleration/deceleration time source through b7-31 (jog ramp source). When b7-31 is set to 0, the jog acceleration/deceleration time is the same to that during normal operation. When b7-31 is set to 1, the jog acceleration/deceleration time depends on b7-32 (jog ramp acceleration time) and b7-33 (jog ramp deceleration time). The following figure shows the relationship between the output frequency and acceleration/deceleration time during jogging.

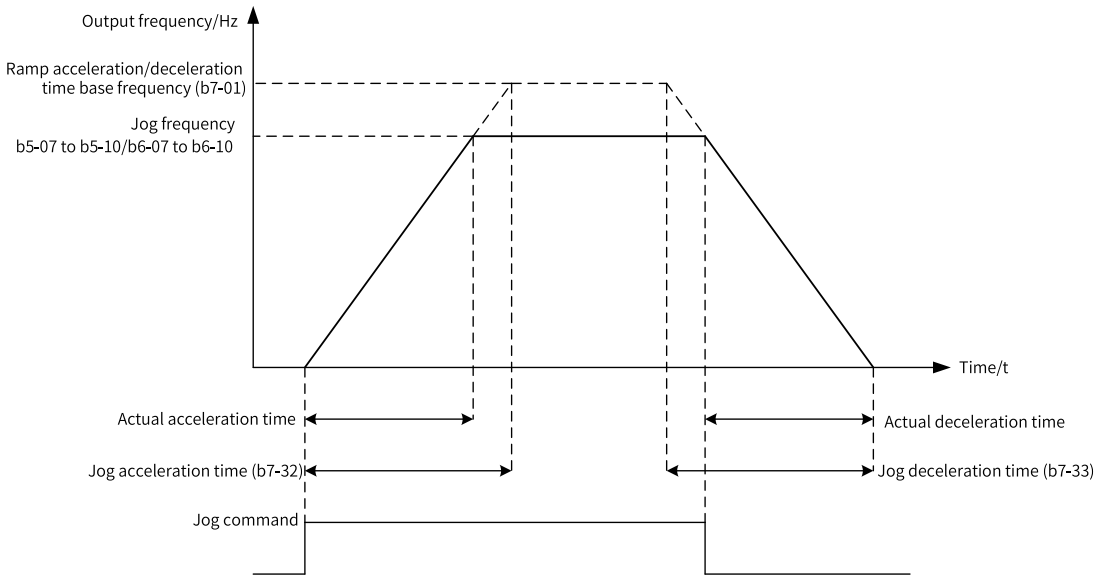


Figure 5-57 Jog

When the jog 1 command and jog 2 command are set simultaneously, the drive responds to jog 1 command first. As shown in the following figure, when the jog 1 command and jog 2 command are simultaneously input, the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). If the jog 1 command is canceled, the drive starts at the frequency set by jog 2 through b5-09 (jog 2 frequency source) and b5-10 (jog 2 frequency reference).

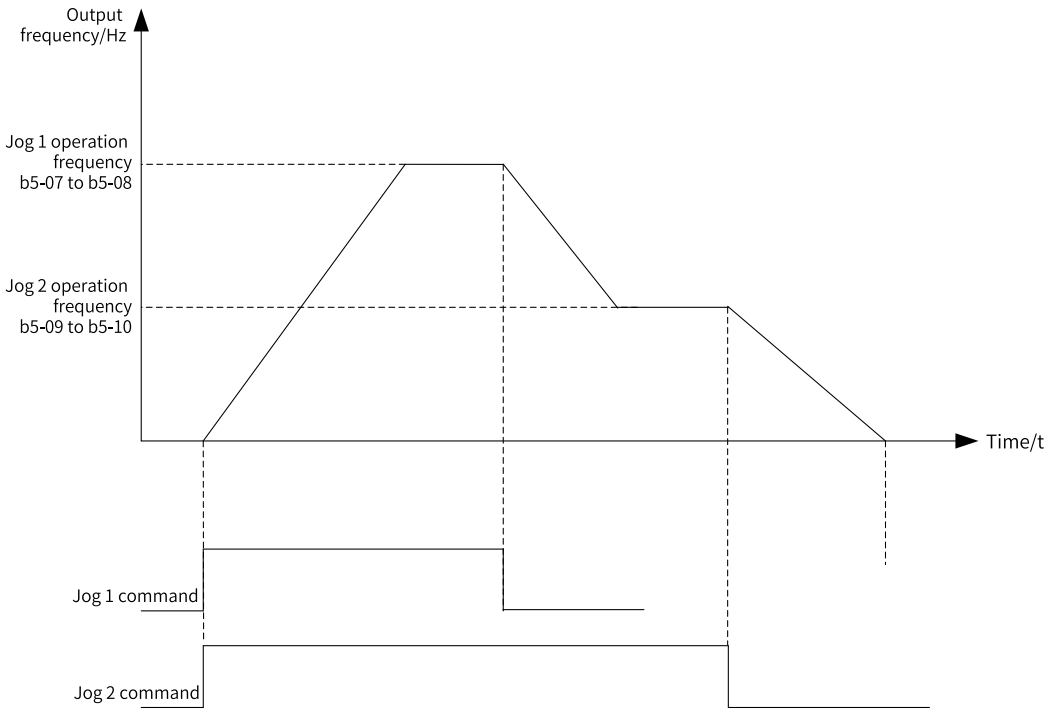


Figure 5-58 Relationship between jog 1 command and jog 2 command

Additionally, you can set the priority of jog command and normal operation command through b1-09 (JOG/ON_OFF1 priority mode selection).

- When b1-09 is set to 0, the priority is not differentiated. The drive responds to the command that arrives first and does not respond to the command that arrives later. As shown in the following figure, the jog 1 command is input first. Therefore, the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). In this case, while ON_OFF1 (normal operation command) is active, the drive does not respond.

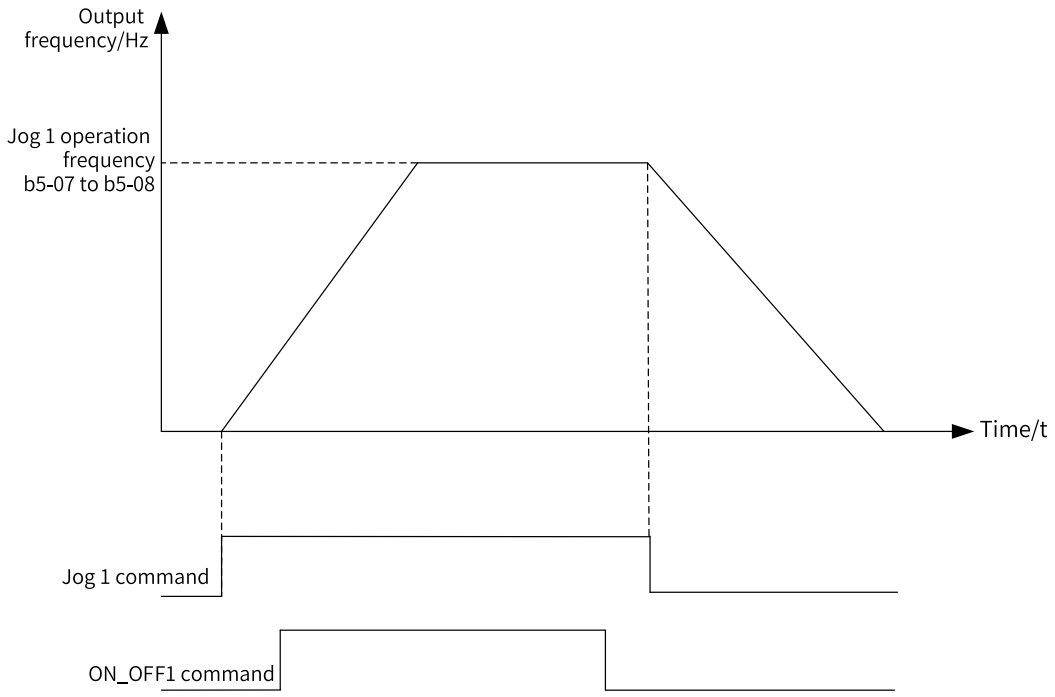


Figure 5-59 Relationship of jog 1 command (input first) and ON_OFF1 command

As shown in the following figure, ON_OFF1 (normal operation command) is input first. Therefore, the drive starts at the frequency set by ON_OFF1 through b5-00 to b5-06. In this case, while the jog 1 command is active, the drive does not respond.

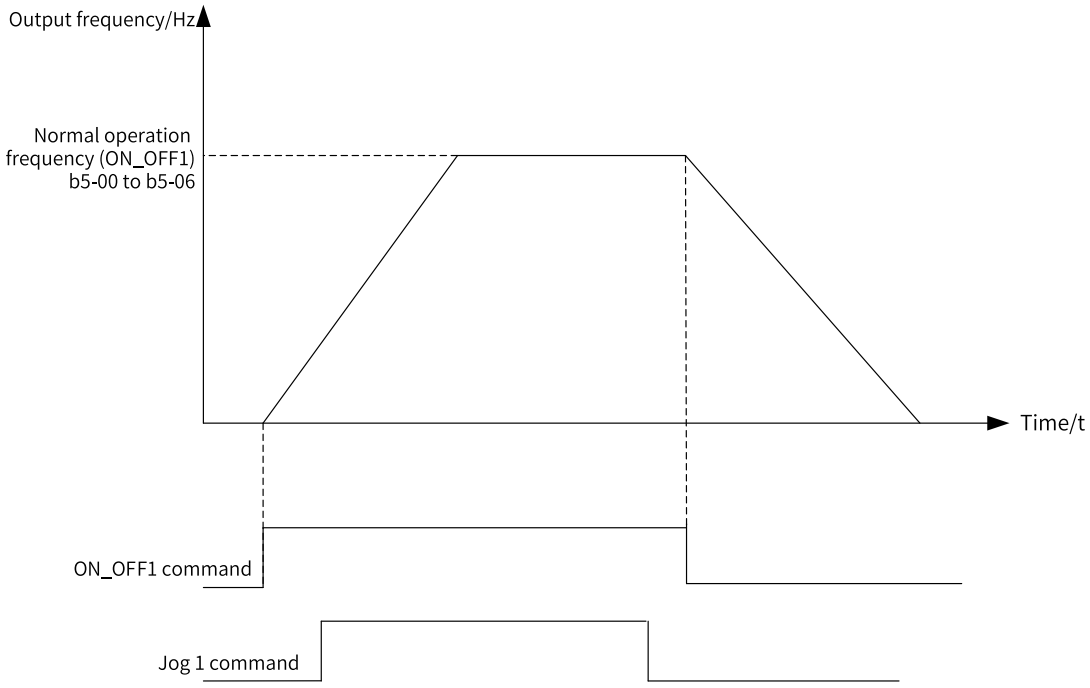


Figure 5-60 Relationship of jog 1 command and ON_OFF1 command (input first)

- When b1-09 is set to 1, jog commands are preferred. Normal operation can be interrupted by the jog command. That is, as long as the jog command is active, the drive runs at the jog frequency set through b5-07 (Jog 1 frequency source) and b5-08 (Jog 1 frequency reference).

As shown in the following figure, the ON_OFF1 command is active and the drive starts at the frequency set through b5-00 to b5-06. However, if the jog 1 command is activated during normal operation, the drive responds immediately and switches to the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference) until the jog 1 command is canceled.

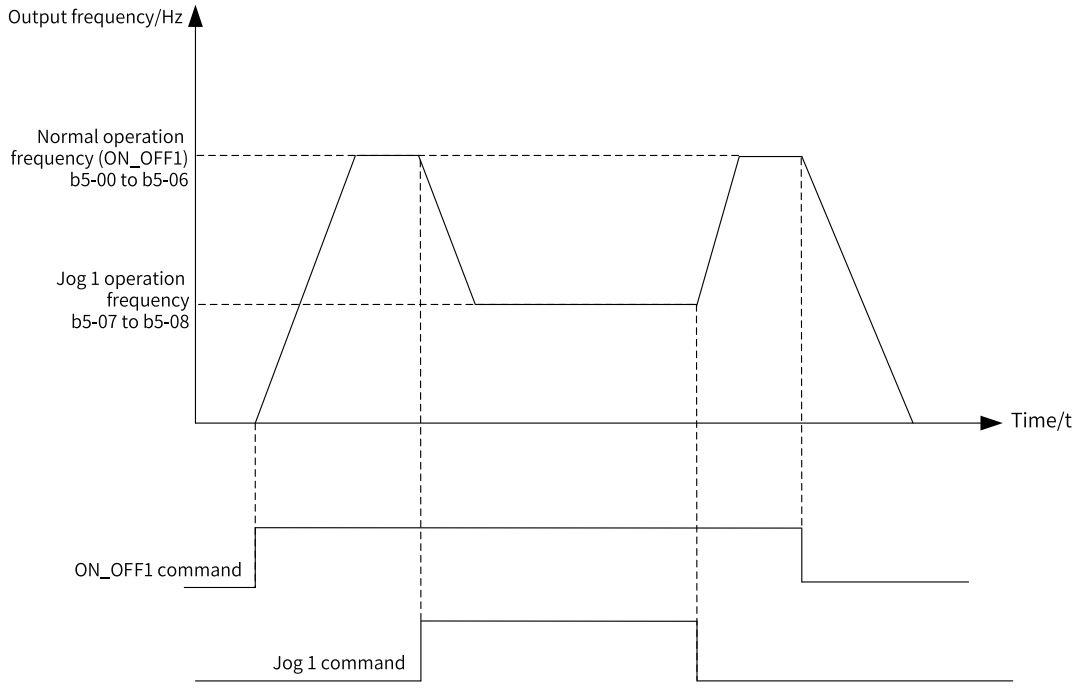


Figure 5-61 Relationship of jog 1 command (prioritized) and ON_OFF1 command

- When b1-09 is set to 2, normal operation commands are preferred. Normal operation can be interrupted by the jog command. That is, as long as the ON_OFF1 command is active, the drive runs at the frequency set through b5-00 to b5-06.
  As shown in the following figure, the jog 1 command is active, and the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). However, if the ON_OFF1 command is activated during jog operation, the drive responds immediately and switches to the frequency set by ON_OFF through b5-00 to b5-06 until the ON_OFF1 command is canceled.

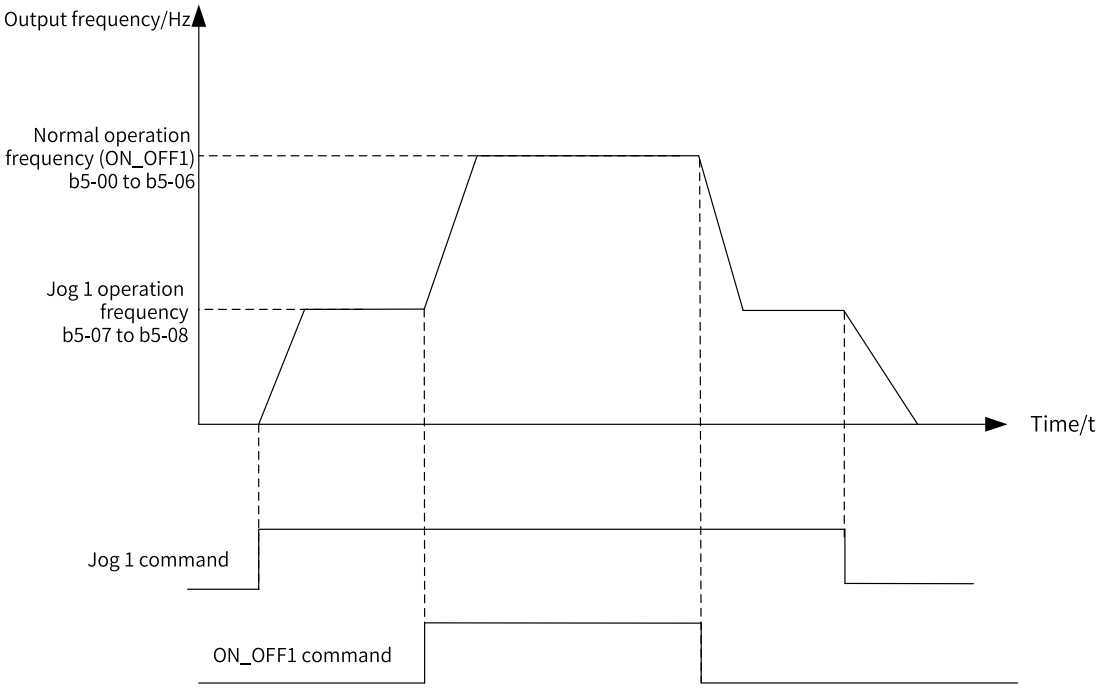


Figure 5-62 Relationship of jog 1 command and ON_OFF1 command (prioritized)

Related parameters

Param.	Name	Default	Value Range	Description
b7-01 (F0-46)	Base for ramp acceleration/ deceleration time	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Sets ramp acceleration/deceleration time base frequency. Value description 0: Rated frequency - The rated frequency is used as the acceleration/deceleration time base. 1: Maximum frequency - The maximum frequency is used as the acceleration/deceleration time base. 2: 100 Hz - 100 Hz is used as the acceleration/deceleration time base. 3: Frequency reference - The frequency reference is used as the acceleration/deceleration time base. Note: This parameter selects a base frequency for the acceleration/ deceleration time. Acceleration time refers to the time required to accelerate from 0 to the base frequency. Similarly, deceleration time refers to the time required to decelerate from the base frequency to 0.
b7-31 (F0-62)	Jog ramp source	0	0: Ramp time of normal running 1: Ramp time of jogging	Sets the jogging ramp source. Value description 0: Ramp time during normal operation - The ramp time for jogging and normal operation is the same. 1: Jog ramp time - The jog ramp time is set separately (b7-32 and b7-33).

Param.	Name	Default	Value Range	Description
b7-32 (F0-63)	Jog ramp acceleration time	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to rise from 0 to b7-01 (base frequency for acceleration/deceleration) in jog mode. It determines the frequency rise rate in jog mode.
b7-33 (F0-64)	Jog ramp deceleration time	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to fall from b7-01 (base frequency for acceleration/deceleration) to 0 in jog mode. It determines the frequency fall rate in jog mode.
b5-07/b6-07	Jog 1 frequency source	0	0: Set by the parameter (b5-08) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 1 frequency. Value description 0: Set by the b5-08 - The jog 1 frequency source is "jog 1 frequency reference". 2: AI1 - The jog 1 frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The jog 1 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 1 frequency is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (Only valiud for MD630S) 6: Multi-reference - When multi-reference is used as the jog 1 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the jog frequency 1 source. 9: Communication - Communication is selected as the jog 1 frequency source. The jog 1 frequency is input through remote communication. The AC drive must be equipped with a communication card to realize communication with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b5-08/b6-08	Jog 1 frequency	2.00	-50.00 to 50.00 Hz	This parameter defines the digital setting of jog 1 frequency. Parameter b5-08 is activated when b5-07 is set to 0.

Param.	Name	Default	Value Range	Description
b5-09/b6-09	Jog 2 frequency source	0	0: Set by the parameter (b5-10) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 2 frequency. Value description 0: Set by the b5-10 - The jog 2 frequency source is "jog frequency 2 reference", 2: AI1 - The jog 2 frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The jog 2 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 2 frequency is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (Only valiud for MD630S) 6: Multi-reference - When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the jog 2 frequency source. 9: Communication - Communication is selected as the jog 2 frequency source. The jog 2 frequency is input through remote communication. The AC drive must be equipped with a communication card to realize communication with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog 2 frequency. This mode is used for expansion of common sources.
b5-10/b6-10	Jog 2 frequency	-2.00	-50.00 to 50.00 Hz	This parameter defines the digital setting of jog 2 frequency. Parameter b5-10 is activated when b5-09 is set to 0.

Param.	Name	Default	Value Range	Description
b1-06, b3-06	User-defined jog 1 source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets user-defined jog 1 source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 9: DI1 to DI7 - Indicates that the jog 1 source depends on the state of the DI terminal. Other: B connector - Whether the jog is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-07/b3-07	User-defined jog 2 source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets user-defined jog 2 source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 9: DI1 to DI7 - Indicates that the jog 2 source depends on the state of the DI terminal. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-09, b3-09	JOG/ON_OFF1 priority mode selection	0	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	This parameter is used to select the priority level of jog and normal operation commands. Value description 0: No priority - The AC drive responds only to the command that arrives first. 1: Jog preferred - The jog command can interrupt normal operation. 2: ON_OFF1 (start/stop) preferred - The normal operation command can interrupt jog operation.

5.2.5.2 Jog Frequency Set Channel

The MD630-INT supports two frequency references for jog 1 and jog 2 and can be controlled independently. The jog frequency is derived from two set channels, as shown in the following figure.

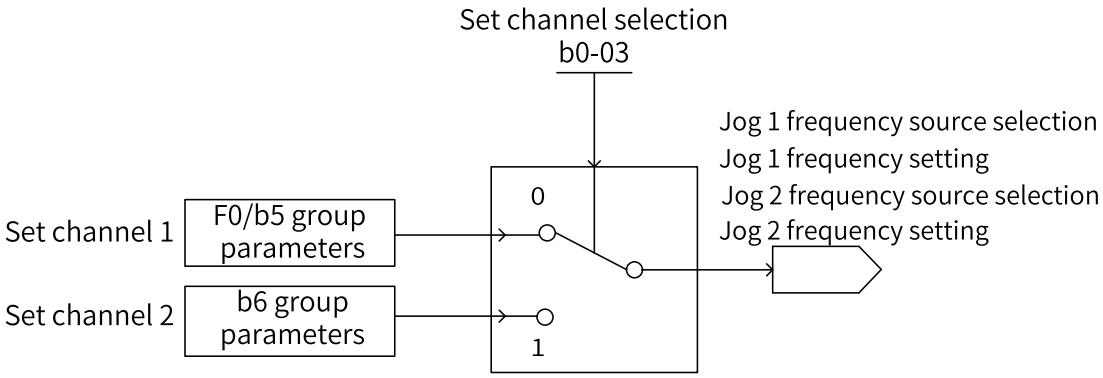


Figure 5-63 Jog frequency channel

5.2.6 Acceleration/Deceleration Time

5.2.6.1 Acceleration/Deceleration Time Setting

Scenarios

In scenarios where gradual acceleration/deceleration is required, set the acceleration/deceleration time to a high value; in scenarios where quick acceleration/deceleration is required, set the acceleration/deceleration time to a low value.

Operation principles

The acceleration time indicates the time required for the AC drive to accelerate from 0 Hz to b7-01 (ramp acceleration/deceleration time base frequency). The deceleration time indicates the time required for the AC drive to decelerate from b7-01 (ramp acceleration/deceleration time base frequency) to 0 Hz. To set the acceleration/deceleration time properly, set b7-01 (Ramp acceleration/deceleration time base frequency) first. Then, set the acceleration/deceleration time. By default, the acceleration/deceleration time is set by b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time).

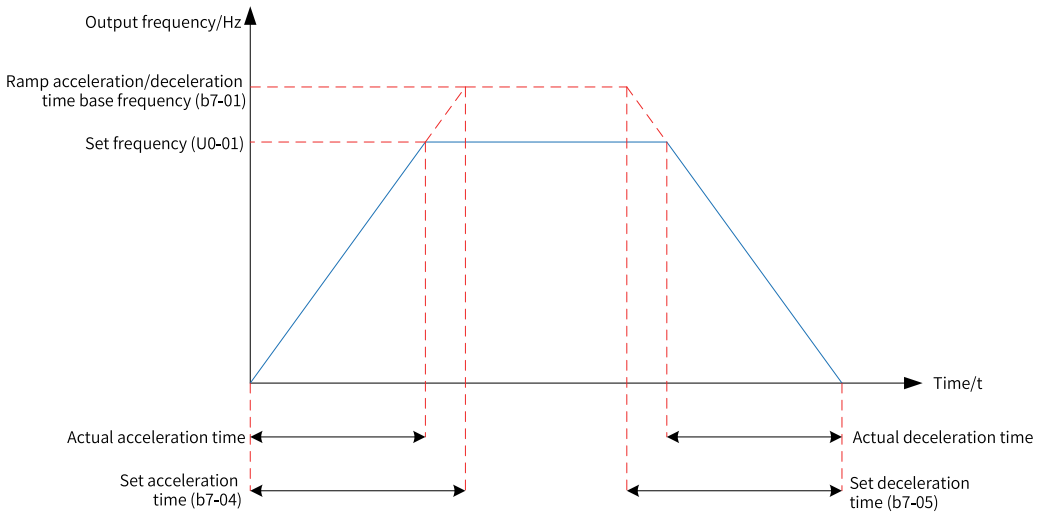


Figure 5-64 Acceleration/deceleration time base frequency

For example, set b7-01 (ramp acceleration/deceleration time base frequency) to 50 Hz (maximum frequency) and b7-04 (ramp 1 acceleration time) to 10s. In this case, the accelerated speed during acceleration is 5 Hz/s (50 Hz/10s). Set b7-05 (ramp 1 deceleration time) to 25s. In this case, the accelerated speed during deceleration is 2 Hz/s (50 Hz/25s).

Set the frequency to 25 Hz and start the AC drive. The drive will accelerate to 25 Hz at the speed of 5 Hz/s and then run at the frequency of 25 Hz. The actual acceleration time is 5s. Stop the AC drive. The drive will decelerate to zero frequency at the speed of 2 Hz/s and then stop. The actual deceleration time is 12.5s.

Acceleration/Deceleration time selection

The MD630-INT supports up to four groups of acceleration/deceleration time, which is defined by the following parameters:

1. Group 1: b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time), time unit: 0.1 s.
2. Group 2: b7-10 (ramp 2 acceleration time) and b7-11 (ramp 2 deceleration time), time unit: 0.1 s.
3. Group 3: b7-16 (ramp 3 acceleration time) and b7-17 (ramp 3 deceleration time), time unit: 0.01 s.
4. Group 4: b7-22 (ramp 4 acceleration time) and b7-23 (ramp 4 deceleration time), time unit: 0.01 s.

You can select the effective acceleration/deceleration time by b7-02 (Ramp selection bit0) and b7-03 (Ramp selection bit1). The parameter setting and corresponding acceleration/deceleration time are shown below.

b7-02: Ramp selection bit 0	b7-03: Ramp selection bit 1	Acceleration/Deceleration time selection
0	0	Group 1 (b7-04, b7-05)
1	0	Group 2 (b7-10, b7-11)
0	1	Group 3 (b7-16, b7-17)
1	1	Group 4 (b7-22, b7-23)

Related parameters

Param.	Name	Default	Value Range	Description
b7-01 (F0-46)	Base for ramp acceleration/ deceleration time	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Used to set the base frequency for the ramp acceleration/ deceleration time. Value description 0: Rated frequency - The rated frequency is used as the acceleration/deceleration time base. 1: Maximum frequency - The maximum frequency is used as the acceleration/deceleration time base. 2: 100 Hz - 100 Hz is used as the acceleration/deceleration time base. 3: Frequency reference - The frequency reference is used as the acceleration/deceleration time base. Note: This parameter selects a base frequency for the acceleration/ deceleration time. Acceleration time refers to the time required to accelerate from 0 to the base frequency. Similarly, deceleration time refers to the time required to decelerate from the base frequency to 0.
b7-02	Ramp selection Bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Defines ramp selection bit0. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Four groups of acceleration/deceleration time are available, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: 0 - Indicates that the value of ramp selection Bit 0 is 0. 1: 1 - Indicates that the value of ramp selection Bit 0 is 1. 3 to 9: DI1 to DI7 - Indicates that the value of ramp selection Bit 0 depends on the states of terminals DI1 to DI7. Other: B connector - Indicates that the value of ramp selection Bit 0 depends on other B connector, which can be selected through the pop-up window. Note: When the value of b7-28 is 1 and the value of b7-29/b7-30 is not 0, this parameter is invalid.

Param.	Name	Default	Value Range	Description
b7-03	Ramp selection Bit1	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets ramp selection bit 1. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Four groups of acceleration/deceleration time are available, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: 0 - Indicates that the value of ramp selection Bit 1 is 0. 1: 1 - Indicates that the value of ramp selection Bit 1 is 1. 3 to 9: Same as b7-02 Others: Same as b7-02 Note: Same as b7-02
b7-04 (F0-48)	Ramp 1 acceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 1 acceleration time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp acceleration/deceleration time base frequency (b701). The time is used to set the accelerated speed during acceleration. The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the first group of acceleration time.
b7-05 (F0-49)	Ramp 1 deceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 1 deceleration time. Note: It indicates the time required for the output frequency to decrease from the ramp acceleration/deceleration time base frequency (b7-01) to 0. The time is used to set the accelerated speed during deceleration. The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the first group of deceleration time.
b7-10	Ramp 2 acceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 2 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the second group of acceleration time.

Param.	Name	Default	Value Range	Description
b7-11	Ramp 2 deceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 2 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter specifies the second group of deceleration time.
b7-16	Ramp 3 acceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 3 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the third group of acceleration time.
b7-17	Ramp 3 deceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 3 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the 3rd group of deceleration time.
b7-22	Ramp 4 acceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 4 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the fourth group of acceleration time.
b7-23	Ramp 4 deceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 4 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the fourth group of deceleration time.

Note: F0-46, F0-48, and F0-49 are the mapping of parameters b7-01, b7-04, and b7-05. The settings of the two groups of parameters are equivalent.

Application instances

The following example uses DI1 and DI2 as the acceleration/deceleration switchover terminals to describe how to set the acceleration/deceleration time.

1. Set E0-00 (DI1 function selection) and E0-01 (DI2 function selection) to select DI1 and DI2 as the acceleration/deceleration switchover terminals.

Param.	Name	Value Range	Description
E0-00	DI1 function selection	16	Acceleration/Deceleration selection terminal 1
E0-01	DI2 function selection	17	Acceleration/Deceleration selection terminal 2

2. Set b7-01 (ramp acceleration/deceleration time base frequency) to 1 (maximum frequency).
3. Set the four groups of acceleration/deceleration time parameters (b7-04 to b7-23) separately.
4. Select the effective acceleration/deceleration time by switching the DI terminal state.

DI1 State	DI2 State	Acceleration/Deceleration time selection
OFF	OFF	Group 1 (b7-04, b7-05)
ON	OFF	Group 2 (b7-10, b7-11)
OFF	ON	Group 3 (b7-16, b7-17)
ON	ON	Group 4 (b7-22, b7-23)

5.2.6.2 Acceleration/Deceleration Mode Setting

Application scenarios

In linear acceleration/deceleration mode, the output frequency increases or decreases linearly. This mode applies to most working conditions.

In S-curve acceleration/deceleration mode, the target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth running and quick response in real time.

Operation principles

Set b7-00 (Ramp acceleration/deceleration mode) to select the frequency change mode during the start and stop process of the AC drive.

When b7-00 (Ramp acceleration/deceleration mode) is set to 0 (Linear acceleration/deceleration), the output frequency changes linearly according to the set acceleration/deceleration time.

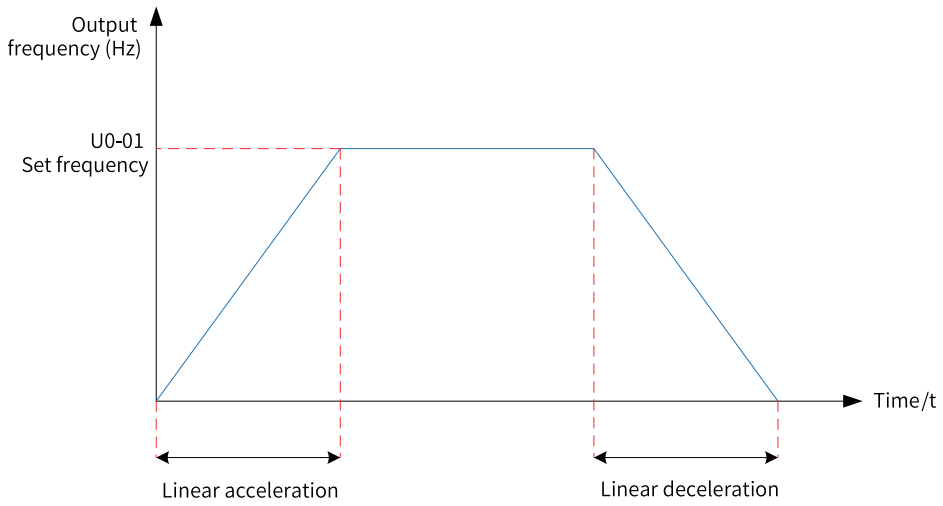


Figure 5-65 Linear acceleration/deceleration

When b7-00 (Ramp acceleration/deceleration mode) is set to 1 (S-curve), the output frequency increases or decreases based on the S-curve. You can set S-curve parameters for each group of acceleration/deceleration time. Take the first group of acceleration/deceleration time as an example. Set the S-curve change time through b7-06 (Ramp 1 acceleration start arc) to b7-09 (Ramp 1 deceleration end arc).

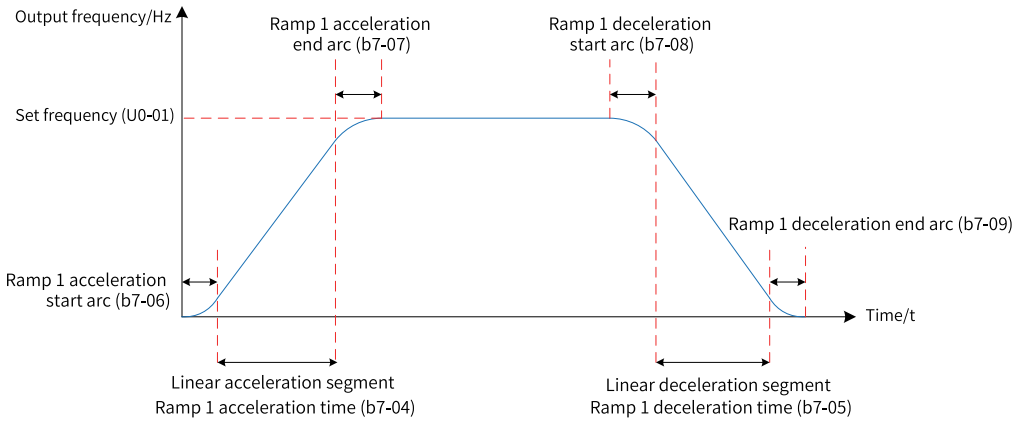


Figure 5-66 S-curve acceleration/deceleration

You can select the arc type through b7-43 (Ramp arc mode). b7-43 set to 0 (Incontinuous smoothing): When the acceleration/deceleration trend changes, the curve switches to the new target direction immediately. b7-43 set to 1 (Continuous smoothing): When the acceleration/deceleration trend changes, the curve follows the end arc of current acceleration/deceleration and then switches to the reference direction.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-00 (F0-45)	Ramp acceleration/ deceleration mode	0	0: Linear acceleration/ deceleration 1: S Curve	Defines the ramp acceleration/deceleration mode. Value description: 0: Linear acceleration/deceleration The output frequency increases or decreases linearly. 1: S-curve acceleration/deceleration The target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth running and quick response in real time.
b7-06	Ramp 1 acceleration start arc	0.00s	0.00 to 650.00s	Defines the motion time of the ramp 1 acceleration start arc. Additional information: The acceleration start arc time of the output frequency determines the jerk of the set acceleration start arc. It is the first group of acceleration start arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and the actual acceleration time to the set frequency is 10s, the first 2s is in arc motion phase and the last 8s is in linear motion phase. In addition, the linear motion is executed according to the set linear acceleration/deceleration time.
b7-07	Ramp 1 acceleration end arc	0.00s	0.00 to 650.00s	Defines the motion time of the ramp 1 acceleration end arc. Additional information: The acceleration end arc time of the output frequency determines the jerk of the acceleration end arc. It is the first group of acceleration end arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in accelerating to the set frequency, then the linear motion applies in the first 8s and arc motion applies in the last 2s during acceleration. In addition, the linear motion is executed according to the set linear acceleration/deceleration time.

Parameter	Parameter name	Default value	Value range	Description
b7-08	Ramp 1 deceleration start arc	0.00s	0.00 to 650.00s	Defines the motion time during increasing deceleration start arc of ramp 1. Additional information: The deceleration start arc time of the output frequency determines the jerk of the deceleration start arc. It is the first group of deceleration start arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in decelerating from the set frequency to 0, then the arc motion applies in the first 2s and linear motion applies in the last 8s during deceleration. In addition, the linear motion is executed according to the set linear acceleration/ deceleration time.
b7-09	Ramp 1 deceleration end arc	0.00s	0.00 to 650.00s	Defines the motion time of increasing deceleration end arc of ramp 1. Additional information: The deceleration end arc time of the output frequency determines the jerk of the deceleration end arc. It is the first group of deceleration end arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in decelerating from the set frequency to 0, then the linear motion applies in the first 8s and arc motion applies in the last 2s during deceleration. In addition, the linear motion is executed according to the set linear acceleration/ deceleration time.
b7-43	Ramp arc mode	0	0: Incontinuous smoothing 1: Continuous smoothing	Defines the ramp arc mode. This means that the arc acceleration changes when the acceleration/ deceleration trend changes. Value description: 0: Incontinuous smoothing When the acceleration/ deceleration trend changes, the curve switches to the new target direction immediately. 1: Continuous smoothing When the acceleration/ deceleration trend changes, the curve follows the end arc of current acceleration/deceleration and then switches to the reference direction. Additional information: This parameter is an expansion parameter. It is displayed only when A0-10 (Parameter access level) is set to a level higher than “expansion” .

Note:

1. F0-45, F0-48, and F0-49 are the mapping of parameters b7-00, b7-04, and b7-05. The settings of the two groups of parameters are equivalent.

2. Set the second, third, and fourth groups of S-curve arc parameters in the same way in which the first group is set. It is active when corresponding acceleration/deceleration time group is selected.

5.2.6.3 Low-speed gain

Application scenarios

In case of a heavy load and high acceleration, acceleration at a high speed is normal but step loss may occur due to insufficient torque at a low speed. Alternatively, the acceleration rate is reduced to ensure stable running at a low speed, but the acceleration time is prolonged.

Operation principles

Set b7-42 (Low-speed segment judgment threshold). When the operating frequency of the AC drive is lower than this threshold, the AC drive is considered to be in the low-speed segment. In this case, the value of b7-41 (Gain coefficient for low-speed acceleration time) takes effect. The acceleration time for low-speed acceleration is the value of the original acceleration time x gain coefficient (b7-41). The default value of b7-41 is 100%. The acceleration time remains unchanged when the speed is in the low speed segment. When the output frequency is higher than b7-42 (low-speed segment threshold), the acceleration time returns to the original setting, and the AC drive accelerates to the set frequency normally.

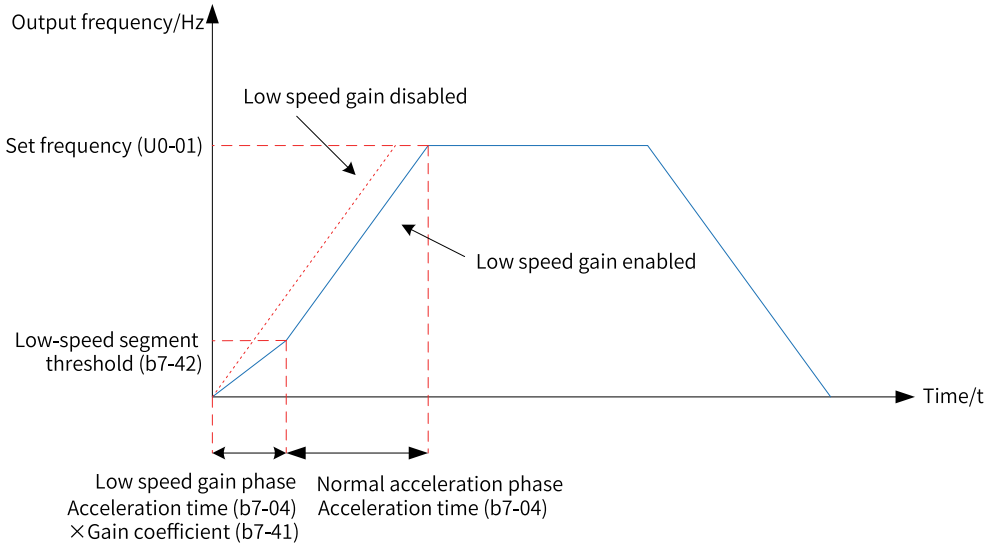


Figure 5-67 Low-speed gain

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-41	Low-speed acceleration time gain coefficient	100.0%	1.0% to 1000.0%	Defines the gain coefficient of the acceleration time in the low-speed segment. Additional information: When the output frequency is lower than b7-42 (low-speed threshold), b7-41 takes effect. The time after b7-41 is used as the actual acceleration time of the low-speed segment.
b7-42	Low-speed segment threshold	15.00%	0.00% to 100.00%	Set the low-speed segment judgment threshold. Additional information: When the output frequency is lower than this threshold, b7-41 (Acceleration time gain coefficient in low-speed segment) takes effect.

5.2.6.4 Automatic Switchover of Acceleration/Deceleration Time Based on Running Frequency

Application scenarios

This function enables selection of different acceleration/deceleration time based on the running frequency during running of the AC drive.

Operation principles

Set whether to enable automatic switchover of acceleration/deceleration time through b7-28 (Ramp 1/2 frequency switchover enable). Set the frequency threshold for acceleration/deceleration time switchover through b7-29 (Frequency for ramp 1/2 acceleration switchover) and b7-30 (Frequency for ramp 1/2 deceleration switchover).

Acceleration/deceleration time switchover

During acceleration, if the operating frequency is lower than b7-29 (Frequency for ramp 1/2 acceleration switchover), b7-10 (Ramp 2 acceleration time) is selected. If the operating frequency is higher than b7-29 (Frequency for ramp 1/2 acceleration switchover), b7-04 (Ramp 1 acceleration time) is selected.

During deceleration, if the operating frequency is higher than b7-30 (Frequency for ramp 1/2 deceleration switchover), b7-05 (Ramp 1 deceleration time) is selected. If the operating frequency is lower than b7-30 (Frequency for ramp 1/2 deceleration switchover), b7-11 (Ramp 1 deceleration time) is selected.

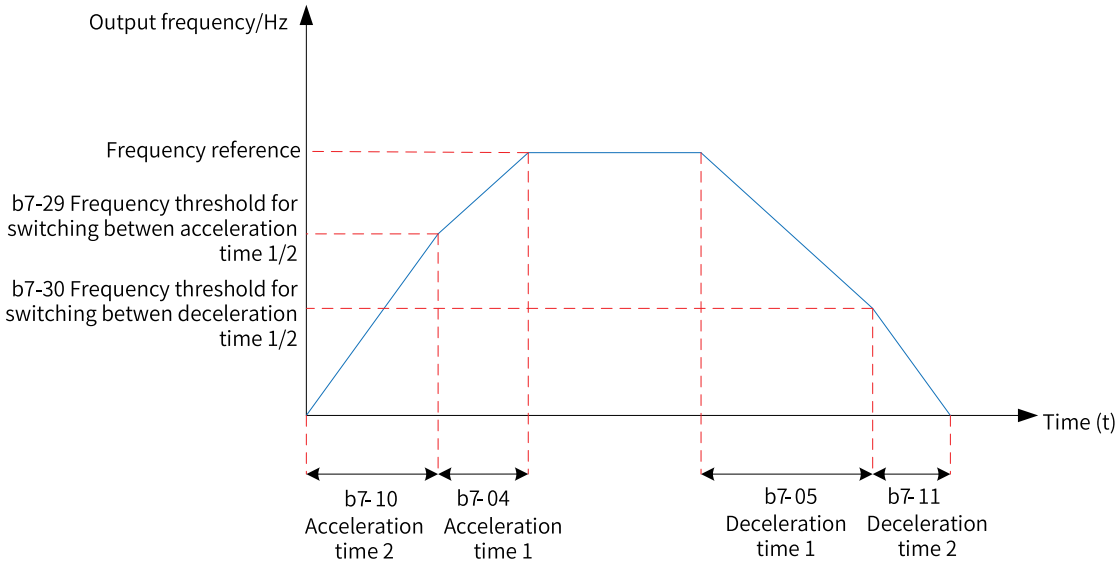


Figure 5-68 Automatic switchover of acceleration/deceleration time

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-28	Ramp 1/2 frequency switchover enable	0	0: Disabled 1: Enabled	Defines whether ramp 1/2 frequency switchover is enabled. When this function is enabled, ramp selection bit 1/bit 0 (b7-02/-03) are invalid. Additional information: This parameter is used together with b7-29 and b7-30 to use different acceleration/deceleration time during acceleration/deceleration.
b7-29	Frequency for switching between acceleration time 1 and acceleration time 2	0.0 Hz	0.0 Hz to A2-18	Defines ramp 1/2 acceleration switchover frequency. During acceleration, if the output frequency is greater than or equal to the value of b7-29, ramp 1 acceleration time is valid; otherwise, ramp 2 acceleration time is valid.
b7-30	Frequency threshold for switching between deceleration time 1 and deceleration time 2	0.0 Hz	0.0 Hz to A2-18	Defines ramp 1/2 deceleration switchover frequency. During the deceleration stage, if the output frequency is greater than or equal to this set point, the current effective ramp is ramp 1 deceleration. Otherwise, the current effective ramp is ramp 2 deceleration.
b7-04	Ramp 1 acceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 1 acceleration time. Additional information: It indicates the time required for the output frequency to increase from 0 to the ramp acceleration/deceleration time base frequency (b7-01). The time is used to set the accelerated speed during acceleration. The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the first group of acceleration time.

Parameter	Parameter name	Default value	Value range	Description
b7-05	Ramp 1 deceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 1 deceleration time. Additional information: It indicates the time required for the output frequency to decrease from b7-01 [Acceleration/Deceleration base frequency] to 0. The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the first group of deceleration time.
b7-10	Ramp 2 acceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 2 acceleration time. Additional information: Same as b7-04 The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second group of acceleration time.
b7-11	Ramp 2 deceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 2 deceleration time. Additional information: Same as b7-05 The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the second group of deceleration time.

5.2.6.5 Ramp tracking enable

Application scenarios

In certain conditions, the actual motor speed cannot match the output speed of the ramp function generator (set target speed) due to the large load torque during acceleration. The ramp tracking function needs to be enabled.

Operation principles

In case of large load torque, when the motor decelerates, the output speed of the ramp function generator is greatly different from the actual speed. Therefore, it takes a long time before the motor decelerates. If the tracking function of the ramp function generator is disabled, t The speed is set to $n_{2\ at\ 0}$. At t 1, the speed setpoint is reduced from n 2 to n 1. The motor still accelerates to t_2. The deceleration command is given at t1. However, deceleration must be started after Δt = t 2 - t 1. See *"Figure 5-69 Output speed of ramp function generator (ramp tracking disabled)" on page 288*.

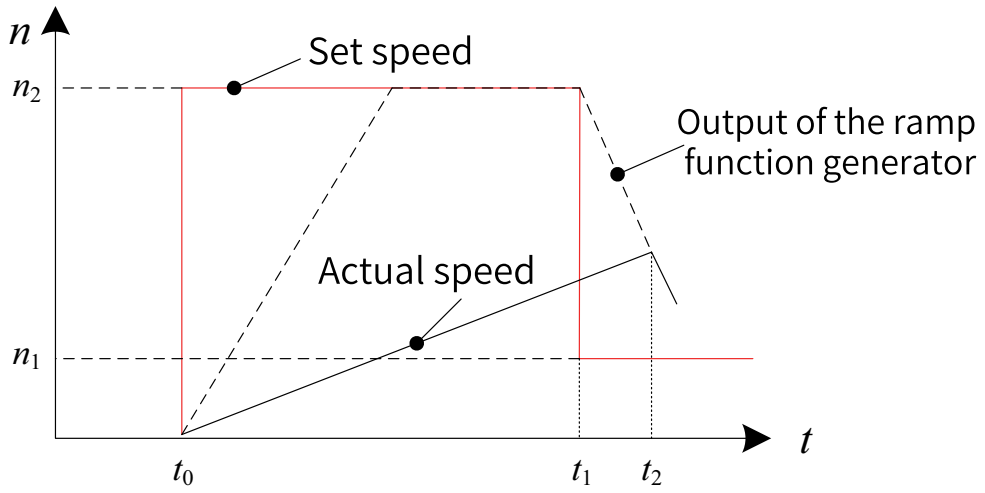


Figure 5-69 Output speed of ramp function generator (ramp tracking disabled)

*"Figure 5-70 Output speed of ramp function generator (ramp tracking enabled)" on page 289*As shown in, when the ramp function generator tracking function is enabled, the ramp function generator output speed actively follows the actual speed when the deviation between the output speed and the actual speed reaches the set error value.

When b7-46 is set to 1 (Enable), the ramp function generator tracking function is activated when the actual speed is lower than the output speed of the ramp function generator Δn (Δn can be set according to actual conditions). The ramp function generator output speed is forced to the actual speed + Δn speed. If the condition is not met, the tracking state is exited.

When b7-46 is set to 2 (Torque limit reached), the ramp function generator tracking function is activated only when the torque reaches the limit. The output speed of the ramp function generator is forced to the actual speed + Δn. If the condition is not met, the tracking state is exited.

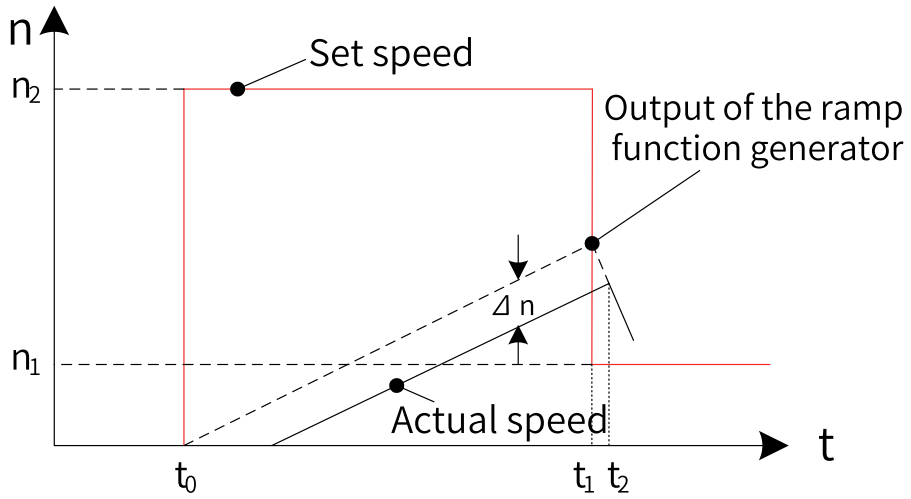


Figure 5-70 Output speed of ramp function generator (ramp tracking enabled)

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-46	Ramp tracking enable	0	0: Disabled 1: Enabled 2: Torque limit reached Others: B connector	Sets whether slope tracking is enabled. With this function enabled, when the torque reaches the limit and the deviation between the frequency reference and the feedback frequency is greater than b7-47 (ramp tracking error), the frequency reference is limited to the actual value plus the error. 0: Disabled - Ramp tracking disabled 1: Enable - Ramp tracking enable 2: Torque limit reached – Whether ramp tracking is enabled depends on whether the current motor torque limit is reached Other: Connector B - Whether ramp tracking is enabled depends on the state of connector B.
b7-47	Ramp tracking error	10.0%	0.0% to 100.0%	Set the ramp tracking error value.

5.2.7 Motor Parameter Group

Scenarios

This function is applicable to scenarios where multiple groups of motors are used with one AC drive. The user can select different motor parameter groups and save different motor parameters to improve the flexibility of use. In other words, the user can directly select the set motor parameter groups and do not need to reset or auto-tuning.

Function description

The MD630-INT supports four groups of motor parameters. Each motor parameter parameter stores a group of motor-specific parameters, such as basic parameters and control parameters.

The motor parameter group is set by b0-00 (Motor parameter group selection 1) and b0-01 (Motor parameter group selection 2). The motor parameter group is valid according to the binary bit combination. For details, see the following table. In addition, view the motor parameter group currently in effect by parameter U2-00.

Table 5–9 Selecting motor parameter group through parameters

Parameter Setting			Active Motor Parameter Group
b0-00	b0-01	U2-00	-
0	0	0	Motor parameter group 1
0	1	1	Motor parameter group 2
1	0	2	Motor parameter group 3
1	1	3	Motor parameter group 4

In addition, the user can select the motor parameter group through the DI terminal when the DI terminal function is 41 (motor selection terminal 1) and 76 (motor selection terminal 2). Similarly, the motor parameter group can be activated through binary bit combination. For example, assign DI1 terminal with 41 (Motor selection terminal 1) and DI2 with 76 (Motor selection terminal 2). For details, see the following table.

Table 5–10 Selecting motor parameter group through DI terminals

Parameter Setting			Active Motor Parameter Group
DI1 status	DI2 status	U2-00	-
0	0	0	Motor parameter group 1
0	1	1	Motor parameter group 2
1	0	2	Motor parameter group 3
1	1	3	Motor parameter group 4

Note: The priority of the motor parameter selection via the DI terminal is higher than that of the parameter selection method. When function 41 (Motor Selection Terminal 1) and 76 (Motor Selection Terminal 2) are assigned to the DI terminal, the parameters b0-00 and b0-01 become inactive. Additionally, the corresponding parameters will be set to read-only status. For example, when the DI1 function is set to 41 (Motor selection terminal 1), b0-00 becomes read-only and the active motor parameter group can only be set through the DI terminal rather than b0-00 and b0-01.

Related parameters

Param.	Name	Default Value	Value Range	Descriptions
b0-00	Motor parameter group selection 1	0	0: Inactive 1: Active 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Used to motor parameter group selection 1. **Value description** 0: Inactive - The setpoint 0 indicates the function is inactive. 1: Active - The setpoint 0 indicates the function is active. 3 to 9: DI1 to DI7 - Indicates whether this function is active depends on the DI state. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. Others: B connector - Whether this function is active depends on other B connector. You can select other B connector through the pop-up window. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. **Note:** The selection of the motor parameter group is determined by the combination of b0-00 and b0-01 in the form of binary bits. Binary bit combination: When b0-00 is 0 and b0-01 is 0, the combination is 0x0, indicating that motor parameter group 1 is selected. When b0-00 is 1 and b0-01 is 0, the combination is 0x1, indicating that motor parameter group 2 is selected. When b0-00 is 0 and b0-01 is 1, the combination is 0x2, indicating that motor parameter group 3 is selected. When b0-00 is 1 and b0-01 is 1, the combination is 0x3, indicating that motor parameter group 4 is selected. The motor parameter group that activated at last can be viewed through U2-00. After the DI terminal is assigned with function 41 [Motor selection terminal 1], the value of b0-00 is automatically switched to the corresponding DI terminal connector parameter (L0484 to L0490).
b0-01	Motor parameter group selection 2	0	0: Inactive 1: Active 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Used to motor parameter group selection 2. **Value description** Same as b0-00 **Note:** Same as b0-00
U2-00	Current motor parameter group	0	-	Displays the active motor parameter group. **Value description** 0 to 3: Motor parameter group 1 to motor parameter group 4

5.2.8 Modify Motor Direction

5.2.8.1 Motor Running Direction Limit

Scenarios

This function is applicable to the scenarios where forward or reverse motor rotation is prohibited and only one direction of motor rotation is allowed.

Function description

The motor running direction can be limited by setting parameters d1-01 (positive speed) and d1-02 (negative speed).

- When d1-01 is set to 0 (Inhibited), the motor runs at zero frequency when a forward run command is input to the AC drive.
- When d1-02 is set to 0 (Inhibited), the motor runs at zero frequency when a reverse run command is input to the AC drive.

Related parameters

Table 5–11 Reverse running inhibited

Param.	Name	Default	Value Range	Descriptions
d1-01	Positive speed enable	1	0: Disallowed 1: Allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	This parameter specifies whether the AC drive allows forward operation. F2-20 is the mapping of d1-01 [Positive speed enable] in group F. The two parameters have the same function. Value description 0: Forward operation is inhibited. 1: Forward operation is allowed. 3 to 9: DI1 to DI7 - Depending on the final state of DI 0 indicates that forward run is prohibited, and 1 indicates that forward run is allowed. Other: B connector - Whether the forward operation is allowed depends on other B connectors. 0 indicates that forward run is prohibited, and 1 indicates that forward run is allowed. Note: After the DI is assigned with function 78 [Forward run allowed], the value of d1-01 is automatically switched to the value of the corresponding DI connector parameter (L0484–L0490 displayed).
d1-02	Negative speed enable	1	0: Disallowed 1: Allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	This parameter specifies whether reverse operation is allowed for the AC drive. F2-21 is the mapping of d1-02 (Negative speed enable) in group F. The two parameters have the same function. Value description 0: Reverse operation is inhibited. 1: Reverse operation is allowed. 3 to 9: DI1 to DI7 - Depending on the final state of DI 0 indicates that reverse run is inhibited, and 1 indicates that reverse run is allowed. Others: B connector - Whether the reverse run is allowed depends on the state of the B connector. 0 indicates that reverse run is inhibited, and 1 indicates that reverse run is allowed. Note: After the DI is assigned with function 79 [Forward run allowed], the value of d1-02 is automatically switched to the value of the corresponding DI connector parameter (L0484–L0490 displayed).

Notes: The MD630-INT supports four groups of motor parameters: d9-01/d9-02 for motor parameter group 2, y1-01/y1-02 for motor parameter group 3, and y9-01/y9-02 for motor parameter group 4.

5.2.8.2 Change Motor Direction Without Changing Motor Wiring

Scenarios

This function is applicable to the scenario when changing the motor running direction without changing motor wiring.

Description

Used to change the motor rotation direction through parameter modification, which equals to adjusting any two of UVW cables.

Notes: The MD630-INT supports four groups of motor parameters: d0-14 for motor parameter group 1, d8-14 for motor parameter group 2, y0-14 for motor parameter group 3, and y8-14 for motor parameter group 4.

Related parameters

Table 5–12 Changing motor rotation direction through parameters

Param.	Name	Default	Value Range	Description
F2-14 (d0-14)	Motor running direction selection	0	0: Default direction 1: Opposite to normal direction	It is used to set the motor running direction.

5.2.8.3 Dead Zone Time of Forward/Reverse Run Switchover

Scenarios

When the motor is switched between forward and reverse running, the direction cannot be switched immediately. After a period of buffer time, the switch can be performed. This buffer time is the dead zone time of forward/reverse switchover. During this time, the output frequency is 0 Hz.

Working Principle

This function is used to specify the transition period when the output is 0 Hz during forward/reverse run switchover of the AC drive. The transition period is called dead zone time of forward/reverse run switchover, which can be set through P0-26.

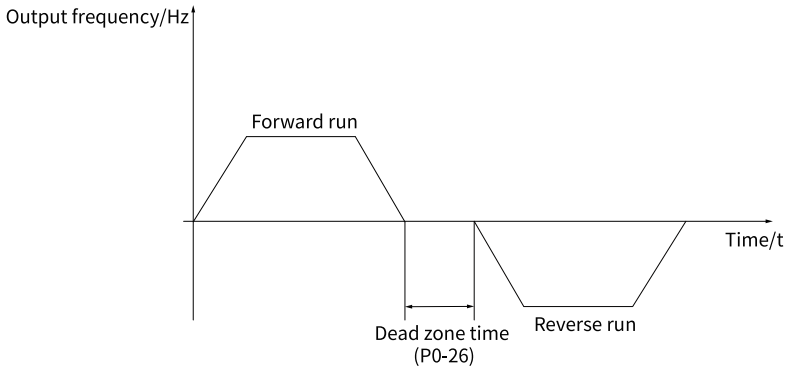


Figure 5-71 Dead zone time of forward/reverse run switchover

Related parameters

Table 5–13 Related parameters of dead-zone time

Param.	Parameter Name	Default	Value Range	Descriptions
P0-26	Dead-zone time of forward/reverse run	0.0s	0.0s to 3000.0s	This parameter defines the transition time at 0 Hz output during switchover between forward running and reverse running.

5.2.9 Speed Control/Torque Control Switchover

Scenarios

The product supports two motor control modes: speed control and torque control modes. This function is applicable to switch between the two control modes.

Description

In speed control mode, the speed reference undergoes a series of processing, including limiting, ramp function generator process, and superimposition of supplementary speed reference, to produce the actual running speed reference. Speed Control is applicable to all o control modes (V/f, SVC). In most applications, the motor speed needs to be controlled. In vector control, the speed can be controlled accurately.

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control includes torque reference and overspeed contol. The torque reference includes torque reference setting, gain calculation, filtering, and acceleration/ deceleration. Overspeed control includes setting speed limit, filtering, acceleration/deceleration, and speed offset mode.

Torque control must be combined with overspeed control. When the motor output torque is not greater than the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent the motor from overspeed, the motor speed must be limited under torque control. When the motor speed exceeds the limit, the motor speed control is used. When the motor speed returns below the limit, the torque control is used.

The two control modes can be switched through d0-01, d8-01, y0-01, and y8-01 (Motor parameter group 1 to 4).

Related parameters

Table 5–14 Speed / Torque mode switchover related parameters

Item	Parameter Name	Default	Value Range	Descriptions
F0-02 (Motor parameter group 1) d0-01 (Motor parameter group 1) d8-01 (Motor parameter group 2) y0-01 (Motor parameter group 3) y8-01 (Motor parameter group 4)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 9: DI1 to DI7 - Depends on the terminal state of the DI. 0: speed control; 1: torque control. Others: B connector The control method depends on the status of B connector. 0 indicates speed control and 1 indicates torque control. Additional information: Torque control is invalid in V/f mode.

Notes: F0-02 is the mapping parameter of d0-01. F0-02 changes and d0-01 changes accordingly.

5.2.10 Control Terminal

5.2.10.1 Control Terminals

Control terminals

The product supports eight control terminals, including digital input (DI), digital output (DO/RO), virtual digital input (VDI), virtual digital input (VDO), high-speed digital input (HDI), high-speed digital output (HDO), analog input (AI), and analog output (AO).

The MD630S-INT is equipped with DI1 to DI7 (DI7 can be used as a normal DI, pulse input terminal, or high-speed digital input terminal HDI), RO (relay output terminal), and FM (can be used as a normal DO or HDO), DO, AI1 to AI2, AO.

The MD630N-INT is equipped with DI1 to DI2, RO (relay output terminal), DO, AI1 to AI2.

The control interfaces of MD630 are as follows.

Table 5–15 List of control interfaces

Terminal Name	Product	
	MD630S-INT	MD630N-INT
DI1	Supported	Supported
DI2	Supported	Supported
DI3	Supported	-
DI4	Supported	-
DI5	Supported	-

Terminal Name	Product	
	MD630S-INT	MD630N-INT
DI6	Supported	-
DI7	Supported	-
RO	Supported	Supported
FM	Supported	-
DO	Supported	Supported
AI1	Supported	Supported
AI2	Supported	Supported
AO	Supported	-

Note

- □: This product supports.
- -: This product does not support.

5.2.10.2 Digital Input (DI) Terminal

List of functions

Each DI terminal can be assigned a DI terminal function. A DI terminal function cannot be used repeatedly.

The MD630S-INT is equipped with terminals DI1 to DI7. The MD630N-INT is equipped with terminals DI1 and DI2. See the following table for functions of terminals DI1 to DI7. Only DI7 supports high-speed digital input (HDI), which is the normal DI input by default. For details, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 323*.

Table 5–16 DI terminal function assignment

Function	DI Terminal						
	DI1	DI2	DI3	DI4	DI5	DI6	DI7
DI terminal function selection	□	□	□	□	□	□	□
Input filter time 1	□	□	□	□	□	□	□
Input filter time 2	□	□	□	□	□	□	□
Input filter time selection	□	□	□	□	□	□	□
Switch-on delay	□	□	□	□	□	□	□
OFF delay	□	□	□	□	□	□	□
Forced function enable	□	□	□	□	□	□	□
forced data	□	□	□	□	□	□	□
Terminal active mode (active level)	□	□	□	□	□	□	□
High-speed digital input	-	-	-	-	-	-	□

Description

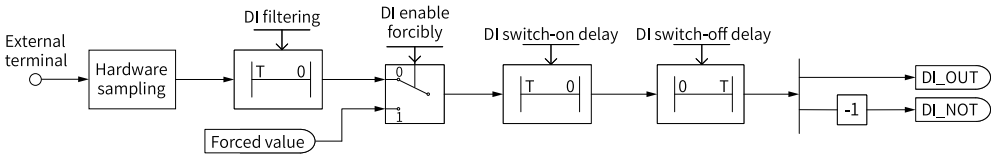


Figure 5-72 DI data flow diagram

DI terminal distribution: For MD630S-INT, see the CN4 in *" Terminal Layout of Standard Models" on page 81*. For MD630N-INT, see the CN4 in *" Terminal Layout of Bus Type Models" on page 86*.

For details about the DI terminal wiring, see *" DI terminal wiring" on page 93*.

DI terminal functions

Name	Description	Remarks	Related Parameters
1.DI terminal selection	Each DI terminal can be configured with a function number through parameters E0-00 to E0-06. Each function number represents the function to be achieved when the corresponding DI terminal is closed or disconnected.	• The same function cannot be set repeatedly by two DIs. For example, if DI1 is configured as terminal start/stop module A_IN1, no other DI terminals can be configured as the same function. • Multiple DI terminals are used to select multiple function numbers to achieve complex functions. For example, users can set E0-00 (DI1 function selection) to 1 (terminal start/stop module A_IN1), and E0-01 (DI2 function selection) to 2 (terminal start/stop module A_IN2).	*"Table 5-17 DI terminal function parameters" on page 299*
2. DI terminal as parameter source	DI terminal as parameter source refers to selecting the DI terminals as the source of parameters and control the function through the DI terminal state.	When a DI terminal is assigned a function, the value of the corresponding parameter is automatically switched to a parameter in group L04, and the value cannot be modified. For example, when E0-01 (DI2 function selection) is set to 4 (JOG1 source of terminal start/stop module A), the value of the corresponding parameter b9-07 is switched to L0485 (DI2 forcibly modified by E0-01) and the number of connector L0485 is displayed on the operating panel. The value of b9-07 cannot be modified. The DI2 terminal controls whether the jog 1 signal of the start/stop module is active. After E0-01 (DI2 function selection) is set to another function, b9-07 is restored to the default value and can be any input source.	-
3. Terminal status connector	1. Displays the status of the current DI terminal. 0 indicates that the DI terminal is open and 1 indicates that the DI terminal is closed. 2. Parameters labeled "Other: B Connector" in the drop-down menu can be configured as the DI terminal status connector.	The DI terminal status connector can be used as input for this type of parameters. In other words, you can configure "Other: B Connector" in the parameter option, or select the DI terminal status as the input through the "Other: B Connector" option. For details, see *" Parameter interconnection" on page 769*.	*"Table 5-19 DI terminal status connector" on page 304*
4. Other functions	-	-	*"Table 5-20 DI parameter list" on page 304*

Related parameters

Table 5–17 DI terminal function parameters

Terminal	Param.	Model	**Parameter Number**	Default	Description
DI1	E0-00 (F4-03)	MD630S-INT MD630N-INT	0 to 80	1	For details, see "Table 5-18 Options of DI terminal function parameters (E0-00 to E0-06)" on page 299.
DI2	E0-01 (F4-04)	MD630S-INT MD630N-INT		4	
DI3	E0-02 (F4-05)	MD630S-INT		9	
DI4	E0-03 (F4-06)	MD630S-INT		12	
DI5	E0-04 (F4-07)	MD630S-INT		13	
DI6	E0-05 (F4-08)	MD630S-INT		0	
DI7	E0-06 (F4-09)	MD630S-INT		0	

Table 5–18 Options of DI terminal function parameters (E0-00 to E0-06)

Value	Function	Description	Related Parameters
0	Invalid	Set 0 for reserved terminals to avoid malfunction.	-
1	Terminal start/stop module A_IN1	Input 1 of terminal module A, which is determined by the terminal module mode. (Valid when the command source is terminal control)	F0-03 (b1-00), b9-00, b9-01, and b9-02
2	Terminal start/stop module A_IN2	Input 2 of terminal module A, which is determined by the terminal module mode. (Valid when the command source is terminal control)	F0-03 (b1-00), b9-00, b9-01, and b9-03
3	Terminal start/stop module A_IN3	Input 3 of terminal module A, which is determined by the terminal module mode. (Valid when the command source is terminal control)	F0-03 (b1-00), b9-00, b9-01, and b9-04
4	JOG1 source of terminal start/stop module A	Used to set the AC drive to jog forwardly. In the jog mode, the drive runs at a low speed temporarily for maintenance and commissioning of the equipment on site.	F0-03 (b1-00) and b9-07
5	JOG2 source of terminal start/stop module A	Used to set the AC drive to jog reversely. In the jog mode, the drive runs at a low speed temporarily for maintenance and commissioning of the equipment on site.	F0-03 (b1-00) and b9-08
6	Function as UP key for frequency adjustment	Used to increase the frequency when the frequency is set through the terminal. When this terminal is active, it works as if the  key is kept pressed down. When this terminal is inactive, it works as if the key is released.	F0-03 (b1-00), b3-00, P0-87, P0-88, and P0-89

Value	Function	Description	Related Parameters
7	Function as DOWN key for frequency adjustment	Used to decrease the frequency when the frequency is set through the terminal. When this terminal is active, it works as if the  key is kept pressed down. When this terminal is inactive, it works as if the key is released.	F0-03 (b1-00), b3-00, P0-87, P0-88, and P0-89
8	Coast to stop	The AC drive stops output to shut down. At this time, the power supply of the motor is cut off and the driving system is in the free braking state. The AC drive immediately stops output after the terminal is active, and the load coasts to stop based on the mechanical inertia.	b2-00/b4-00
9	Fault reset (RESET)	The terminal is used to reset faults of the AC drive and reset upon detection of a rising edge on the DI signal. When active, the terminal has the same function as the STOP/RES key on the operating panel. Remote fault reset is also supported.	b2-04/b4-04
10	Operation Pause (Terminal Control)	When the terminal is active, the drive pauses and stops according to the mode set by d0-07. When the terminal is inactive, the drive operates normally. (Valid when the command source is terminal control).	d0-07
11	Normally open (NO) input of external fault	When the terminal is active, it is equivalent to an external fault signal. When the terminal is active, the drive operates normally. After receiving the external signal, the AC drive reports E015.1, and acts according to the value of H1-02 (Fault protection action selection).	H1-02 and H2-00
12	Multi-reference terminal 1	Multi-reference is selected as the main frequency source. 16 speeds or 16 references can be set through combinations of 16 states of these four terminals. This mode is suitable for applications that use several frequencies, not requiring continuous adjustment of the drive's running frequency.	F0-29(b5-00), b6-00, and b8-03
13	Multi-reference terminal 2		F0-29(b5-00), b6-00, and b8-04
14	Multi-reference terminal 3		F0-29(b5-00), b6-00, and b8-05
15	Multi-reference terminal 4		F0-29(b5-00), b6-00, and b8-06
16	Ramp acceleration/ deceleration selection terminal 1	Four groups of acceleration/deceleration time can be selected through combinations of four states of these two terminals. Jog acceleration time indicates the time to accelerate from 0 Hz to the acceleration/deceleration base frequency (F0-46). Jog deceleration time indicates the time to decelerate from the acceleration/deceleration base frequency (F0-46) to 0 Hz.	b7-04 to b7-30
17	Ramp acceleration/ deceleration selection terminal 2		b7-04 to b7-30
19	Clear data set by UP/ DOWN key or by terminal functioning as UP/DOWN key	When the main frequency is set through the operating panel and this function is selected, the frequency set by  or  key on the operating panel or by terminal functioning as the UP/DOWN key (6 or 7) can be cleared, and the frequency reference will be reset to the value of b5-01 or b6-01.	F0-03 (b1-00), b3-00, P0-87, P0-88, and P0-89
21	Acceleration/ Deceleration prohibited	Do not adjust the frequency during AC drive running (except stop command). The AC drive runs at the current operating frequency without being affected by external input frequency when the terminal is active.	b7-04 to b7-30

Value	Function	Description	Related Parameters
22	PID pause	PID calculation pauses and maintains the current output. When the terminal is active, the drive maintains the current PID output and no longer performs PID adjustment. When the terminal is inactive, the PID continues to be calculated based on the current output.	P2-00 to P2-38
23	Simple PLC status reset	When the terminal is active, the simple PLC is restored to the initial state.	P1-04
24	Wobble pause	In the wobble process, when the terminal is active, the wobble frequency function is paused and the drive outputs at the center frequency.	P0-94 to P0-98
29	Torque control prohibited	When the terminal is active, the drive switches to speed control mode if it is currently in torque control mode. When the terminal is inactive, the drive switches back to the torque control mode.	-
32	Immediate DC braking	When the terminal is active, the AC drive directly switches over to the DC braking state. DC braking indicates that the drive outputs direct current to the stator winding of the asynchronous motor to form a static magnetic field, enabling the motor to brake with energy consumption. In this state, the rotor cuts the static magnetic field to generate braking torque, which stops the motor quickly.	d0-25 to d0-34
33	NC input of external faults	When the terminal is inactive, it is equivalent to an external fault input signal. When the terminal is active, the AC drive is in normal state. After receiving the external signal, the AC drive reports E015.2, and acts according to the value of H1-02 (Fault protection action selection).	H1-02 and H2-01
34	Frequency modification enable	When the terminal is active, the RFG input frequency can be modified. When the terminal is inactive, the RFG input frequency cannot be modified.	-
35	PID action direction inverted	The terminal is used to reverse the PID action direction defined by P2-01 (PID action direction).	P2-01
36	External stop terminal 1	The terminal is used to stop the AC drive and functions the same as the STOP/RES key on the operating panel.	-
38	PID integral pause	After this terminal is activated, the PID integral adjustment function pauses. However, the proportional and derivative adjustment functions are still valid.	P2-34
41, 76	Motor terminal selection	The function is used to select a motor. For example, when DI1 is assigned with function 41 and DI2 is assigned with function 76, motor 1 applies when DI1 and DI2 are inactive; motor 2 applies when DI1 is active and DI2 is inactive; motor 3 applies when DI1 is inactive and DI2 is active; motor 4 applies when DI1 and DI2 are both active.	b0-00 and b0-01

Value	Function	Description	Related Parameters
43	PID parameter switchover	If PID parameters are switched through the DI (P2-11 = 1), the PID parameters P2-14 (proportional gain Kp1), P2-15 (integral time Ti1), and P2-16 (derivative time Td1) are used when the terminal is inactive. The PID parameters P2-17 (proportional gain Kp2), P2-18 (integral time Ti2), and P2-19 (derivative time Td2) are used when the terminal is active.	P2-11 to P2-19
44	Source of user-defined fault 1	When the terminal is active, the AC drive reports E027.1, and acts according to H1-04 (Fault protection action selection).	H2-02
45	Source of user-defined fault 2	When the terminal is active, the AC drive reports E027.2, and acts according to H1-04 (Fault protection action selection).	H2-03
46	Speed control/Torque control selection	The terminal is used to switch the AC drive between speed control and torque control. If F0-02 (speed/torque control mode) is set to 0, the torque control mode is used when the terminal is active, and the speed control mode is used when the terminal is inactive. When F0-02 (speed/torque control mode) is set to 1 and the terminal is active, the control mode is speed control mode. When the terminal is inactive, the control mode is torque control mode.	F0-02
47	Emergency stop	When the terminal is active, the drive stops based on the stop mode defined by d0-06 (OFF3 quick stop mode).	d0-06
49	Decelerate to DC braking	The drive decelerates to the start frequency of DC braking for stop (d0-27) and then enters the DC braking state.	d0-27
50	Clear current running time	The terminal is used to clear the current running time of the AC drive. If the current running time is shorter than the set value (greater than 0) of P0-18 and P0-19 and the terminal is active, the current running timing is cleared. If the current running time is longer than the set value (greater than 0) of P0-18 and P0-19, the current running timing is not cleared even if the terminal is active.	P0-18, P0-19, P0-20
61	Terminal start/stop module B_IN1	Input 1 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).	B3-00, b9-00, b9-09, and b9-10
62	Terminal start/stop module B_IN2	Input 2 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).	B3-00, b9-00, b9-09, and b9-11
63	Terminal start/stop module B_IN3	Input 3 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).	B3-00, b9-00, b9-09, and b9-12
64	JOG1 source of terminal start/stop module B	The AC drive runs at low speed for a short time in the jogging mode 1. The operation frequency and direction are determined by the jog 1 frequency, and the default is positive frequency. This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control)	b3-00 and b9-15
65	JOG2 source of terminal start/stop module B	The AC drive runs at low speed for a short time in the jogging mode 2. The operation frequency and direction are determined by the jog 2 frequency, and the default is negative frequency. This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control)	b3-00 and b9-16

Value	Function	Description	Related Parameters
66	Forced local control	In any other control mode, if the terminal is active, forced local control is valid.	-
67	Forced terminal control	In any other control mode, if the terminal is active, forced terminal control is valid.	-
68	Forced communication control	In any other control mode, if the terminal is active, forced communication control is valid.	-
69	Forced user-defined control	In any other control mode, if the terminal is active, forced user-defined control is valid.	
70	Control channel selection	Select two control command channels through the terminal. When the terminal is inactive, control channel 1 is selected. When the terminal is active, control channel 2 is selected.	b0-02
71	Set channel selection	Selects the set channels through the terminal. When the terminal is inactive, set channel 1 is selected. When the terminal is active, set channel 2 is selected.	b0-03
72	Terminal module A/B selection	Selects two groups of terminal start/stop modules through terminals. When the terminal is inactive, terminal start/stop module A is selected. When the terminal is active, terminal start/stop module B is selected.	b9-00
77	Running enable (all modes)	When the terminal is active, the drive is allowed to run. When the terminal is inactive, the drive is not allowed to run or must stop according to the mode set by d0-07.	d0-07
78	Forward operation permission	When the terminal is active, the frequency reference is allowed to be a positive value. When the terminal is inactive and the frequency reference is set to a positive value, the drive runs at 0 Hz.	-
79	Reverse operation permission	When the terminal is active, the frequency reference is allowed to be a negative value. When the terminal is inactive and the frequency reference is set to a negative value, the drive runs at 0 Hz.	-
80	RFG input reset	When the terminal is active, the drive runs at the frequency reference. When the terminal is inactive, the target frequency reference is set to zero and the drive runs at 0 Hz.	-

Note

The column "Related Function Code" indicates the function code that may need to be configured to implement the function.

Table 5–19 DI terminal status connector

Param.	Name	Default	Value Range	Description
L0002	DI1	0	0 to 1	Bit connector: Displays the final level status of DI1 to DI7. **Value description** 0: Open 1: Closed **Note:** It can be used as an option for the "Other: B Connector" parameter.
L0003	DI2	0	0 to 1	
L0004 (MD630S-INT)	DI3	0	0 to 1	
L0005 (MD630S-INT)	DI4	0	0 to 1	
L0006 (MD630S-INT)	DI5	0	0 to 1	
L0007 (MD630S-INT)	DI6	0	0 to 1	
L0008 (MD630S-INT)	DI7	0	0 to 1	

Table 5–20 DI parameter list

Param.	Name	Default	Value Range	Description
E0-16	DI input filter time 1	0.010s	0.000 to 1.000	This parameter defines the filter time 1 for the AC drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000 to 1.000	This parameter defines the filter time 2 for the AC drive to respond to changes in DI terminal status.
E0-18	DI input filter time selection	0	Bit 0 to Bit 1: DI1 filter time to DI2 filter time 0: Filter time 1 1: Filter time 2 Bit 2 to Bit 6: DI3 filter time (Only valid for MD630S) to DI7 filter time (Only valid for MD630S) 0: Filter time 1 1: Filter time 2 Bit 7 to Bit 15: Reserved	Defines the filter time of which DI is active. **Value description** Bit 0 to Bit 6: DI1 filter time to DI7 filter time 0: Filter time 1 - The filter time of DI1 to DI7 is defined by E0-16. 1: Filter time 2 - The filter time of DI1 to DI7 is defined by E0-17.

Param.	Name	Default	Value Range	Description
E0-20	DI1 switch-on delay time	0.0s	0.0 to 3600.0	Defines the delay coefficient when each terminal is switched on/off. **Note:** 1. The parameter can be used together with the filter time. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-21	DI1 switch-off delay time	0.0s	0.0 to 3600.0	
E0-22	DI2 switch-on delay time	0.0s	0.0 to 3600.0	
E0-23	DI2 switch-off delay time	0.0s	0.0 to 3600.0	
E0-24	DI3 switch-on delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-25	DI3 switch-off delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-26	DI4 switch-on delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-27	DI4 switch-off delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-28	DI5 switch-on delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-29	DI5 switch-off delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-30	DI6 switch-on delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-31	DI6 switch-off delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-32	DI7 switch-on delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-33	DI7 switch-off delay time (MD630S)	0.0s	0.0 to 3600.0	
E0-56	DI forced function enable	0	Bit 0 to Bit 1: DI1 source to DI2 source 0: Hardware 1: Forced value Bit 2 to Bit 6: DI3 source to DI7 source 0: Hardware 1: Forced value Bit 7 to Bit 15: Reserved	Defines the source of DI1 to DI7 (in bit sequence). **Value description** Bit 0 to Bit 6: DI1 source to DI7 source 0: Hardware - The source of DI1 to DI7 is hardware terminal input. 1: Forced value - The source of DI1 to DI7 is specified by E0-57. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default	Value Range	Description
E0-57	DI forced data	0	Bit 0 to Bit 1: DI1 setting to DI2 setting 0: Low level 1: High level Bit 2 to Bit 5: DI3 setting (Only valid for MD630S) to DI6 setting (Only valid for MD630S) 0: Low level 1: High level Bit 6: DI7/HDI setting (Only valid for MD630S) 0: Low level 1: High level Bit 7 to Bit 9: Reserved Bit 10 to Bit 15: VDI1 setting to VDI6 setting 0: Low level 1: High level	Defines the level status of the forced value of DI1 to DI7 (in bit sequence). **Value description** Defines the level status of the forced value of DI1 to DI7 and VDI1 to VDI6 (in bit sequence). **Note:** 1. For DI terminals, this parameter is valid when the corresponding bit of E0-56 is set to the forced value. 2. For VDI terminals, this parameter is valid when E0-50 to E0-55 are set to 1 (forced value). 3. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-58	DI active mode selection	0	Bit 0 to Bit 1: DI1 active mode to DI2 active mode 0: Active at high level 1: Active at low level Bit 2 to Bit 6: DI3 active mode (Only valid for MD630S) to DI7 active mode (Only valid for MD630S) 0: Active at high level 1: Active at low level Bit 7 to Bit 9: Reserved Bit 10 to Bit 15: VDI1 active mode to VDI6 active mode 0: Active at high level 1: Active at low level	Defines the active mode of DI1 to DI7 (in bit sequence). **Value description** Bit 0 to Bit 6: DI1 active mode to DI7 active mode 0: Active at high level - Active when the DI terminal is connected to the COM port 1: Active at low level - Active when the DI terminal is disconnected from the COM port

Application instances

When the DI1 and DI2 active mode selection (E0-58) is set to active at high level (0x0000), do as follows to perform the function: "DI1 starts in the forward direction and DI2 starts in the reverse direction".

1. Set b9-01 to 3 (IN1 forward start, IN2 reverse start).
2. Set the DI1 function to "Terminal control IN1" (E0-00 = 01).
3. Set the DI2 function to "Terminal control IN2" (E0-01 = 02).
4. Set terminals as the main command source of control channel 1 (b1-00 = 1).

5. Set the DI terminal active mode (E0-58 = 0). In this mode, the DI terminal is active when closed and inactive when open. If the reverse logic is required, set the corresponding bit of E0-58 to 1.

When DI1 input is active and DI2 is inactive, the AC drive is in forward running state. When DI2 input is active and DI1 is inactive, the AC drive is in reverse running state.

5.2.10.3 Digital Output (DO) Terminal

Function list

The following table describes the standard functions of RO, FM and DO terminals. Among them, only FM supports High-Speed Digital Output (HDO), which is set by default as HDO at the factory. For details about HDO functions, see *"5.2.10.7 High-speed Digital Output (HDO)" on page 329*.

Table 5–21 List of terminal function assignment

Function	Terminal		
	RO	FM	DO
Output function	Supported	Supported	Supported
ON delay	Supported	Supported	Supported
OFF delay	Supported	Supported	Supported
Output source setting	Supported	Supported	Supported
Forced data	Supported	Supported	Supported
Output terminal polarity selection	Supported	Supported	Supported
Communication output	Supported	Supported	Supported
High-speed digital output	-	Supported	-

Function description

MD630S-INT is equipped with one relay output terminal (RO), one multi-functional output terminal (FM), and one digital output terminal as standard. FM can be used as normal DO (FMR) or HDO (FMP).

MD630N-INT is equipped with one relay output terminal (RO) and one digital output terminal (DO) as standard. Each DO/RO terminal can be assigned with a specific function.

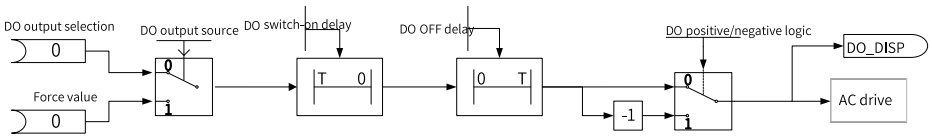


Figure 5-73 DO data flow diagram

DO terminal layout

RO terminal layout: For MD630S-INT, see CN3 in *" Terminal Layout of Standard Models" on page 81*. For MD630N-INT, see CN3 in *" Terminal Layout of Bus Type Models" on page 86*.

DO terminal layout: For MD630S-INT, see CN5 in " Terminal Layout of Standard Models" on page 81. For MD630N-INT, see CN4 in " Terminal Layout of Bus Type Models" on page 86.

For RO terminal wiring, see "3.6.3 Electrical wiring of relay output" on page 96. For DO terminal wiring, see " DO terminal wiring" on page 94.

DO terminal function

Function name	Function description	Description and related parameters
1. DO terminal function selection	The DO/RO terminals can be set through parameter groups (E1-00 to E1-38). The FM terminal is set by default as HDO (FMP). When E5-00 is set to 1, the terminal can be used as a regular DO (FMR). In this case, the function is determined by E1-08 (i.e. DO-related function).	"10.2.7.2 E1 DORO" on page 1356: E1-00 to E1-38 Terminal function selection: "Table 5-22 RO1/DO1/FMR terminal setting" on page 308
2. Other function settings	-	"Table 5-24 DO/RO-related parameters" on page 312
3. Terminal status connector	1 .Displays the status of the DO terminal. The value 0 indicates that the DO terminal has no output and the value 1 indicates that the DO terminal has output. 2 .You can configure the parameter with option "Others: B connector" in the drop-down menu as the DO terminal status connector.	Since the DO terminal has only two states, 0 (no output) or 1 (output), you can configure it using the parameter with the "Others: B connector" option in the drop-down menu, as described in "5.7.1.1.1 Connector" on page 769. "Table 5-25 DO terminal status connector" on page 314

Table 5–22 RO1/DO1/FMR terminal setting

Param.	Name	Default	Setting range	Description
E1-00	RO1 output function selection	2	0 to 44	See "Table 5-23 DO terminal setting function description" on page 308.
E1-04	DO1 output function selection	0		
E1-08	FMR output function selection (for MD630S)	0		

The functions that can be configured for DO/RO terminal are shown in the following table.

Table 5–23 DO terminal setting function description

Value	Function	Description	Related parameters
0	No output	The output terminal has no function.	-
1	AC drive running	When the drive is in running status with an output frequency (which can be zero), the terminal outputs the active signal.	-
2	Fault output	When the AC drive stops due to a fault (coast to stop, maximum capacity to stop, quick stop, or decelerate to stop), the terminal outputs an active signal.	-

Value	Function	Description	Related parameters
3	Frequency level detection FDT1 output	When the running frequency exceeds the frequency detection value, the terminal outputs an active signal. When the running frequency falls below the result of the frequency detection value minus the FDT hysteresis (P0-34 x P0-35), the terminal stops outputting the active signal.	P0-34, P0-35
4	Frequency reached	When the running frequency is within a certain range (target frequency ± P0-38 x A2-04), the DO outputs an active signal.	P0-38
5	Running at zero speed (no output at stop)	When the AC drive is running and its output frequency is 0, the terminal outputs an active signal. When the AC drive is in the stop status, the signal is inactive.	-
6	Motor overload pre-alarm	Prior to motor overload protection, the drive determines whether the motor load exceeds the overload warning threshold according to the overload warning coefficient (d1-47). If the threshold is exceeded, the terminal outputs an active signal. For calculation of the alarm threshold, see the description of motor overload protection.	d1-47
7	Drive overload pre-alarm	When the cumulative overload of the drive reaches the pre-overload threshold (A3-53), the terminal outputs an active signal.	A3-53
11	Cyclic operation of simple PLC done	When the simple PLC completes one cycle, the terminal outputs a pulse signal with the width of 250 ms.	P1-00
12	Cumulative operating time reached	If the cumulative operating time of the AC drive exceeds the time set by the combination of P0-18 and P0-19, the terminal outputs an active signal.	P0-18, P0-19
13	Wobble frequency limited	In a wobble process, when the frequency reference exceeds the upper or lower limit of the frequency and the output frequency reaches the upper or lower limit of the frequency, the terminal outputs an active signal.	P0-94 to P0-96 F1-10, F1-11 F2-22 to F2-27
14	Torque limit reach	When the output torque reaches the torque limit in the speed control mode, the terminal outputs an active signal.	F2-30 to F2-33
15	Ready to run	When the drive is in the normal state after power-on, the terminal outputs an active signal.	-
16	AI1 > AI2	When the per-unit value of AI1 is higher than the per-unit value of AI2 (L2244 AI1 input value higher than L2246 AI2 input value), the terminal outputs an active signal.	E2-07 to E2-83
17	Frequency upper limit reached	During forward run, when U0-00 [Running frequency] and U0-01 [Set frequency] are both greater than or equal to the product of L3068 [Maximum positive frequency] and per-unit frequency, the terminal outputs an active signal. During reverse run, when U0-00 [Operating frequency] and U0-01 [Set frequency] are both greater than or equal to the product of L3072 [Minimum negative frequency] and per-unit frequency, the terminal outputs an active signal.	U0-00 to U0-01 F1-10 F2-22 to F2-25 L3068, L3072

Value	Function	Description	Related parameters
18	Frequency lower limit reached (no output at stop)	When P0-11 (Running mode when frequency reference < frequency lower limit) is set to 1 (stop), the terminal outputs an inactive signal regardless of whether the operating frequency reaches the lower limit. When P0-11 (Running mode when frequency reference < frequency lower limit) is set to 0 (run at the frequency lower limit) or 2 (run at zero speed) and the running frequency reaches the lower limit, the terminal outputs an active signal. During forward run, when U0-00 [Running frequency] and U0-01 [Set frequency] are both less than or equal to the product of L3070 [Minimum positive frequency] and per-unit frequency, the terminal outputs an active signal. During reverse run, when U0-00 [Running frequency] and U0-01 [Set frequency] are both less than or equal to the product of L3074 [Minimum negative frequency] and per-unit frequency, the terminal outputs an active signal.	U0-00 to U0-01 F1-10 F2-26, F2-27 L3070, L3074
19	Undervoltage state output	When the drive is in the undervoltage state, the terminal outputs an active signal.	-
20	Communication setting	The active or inactive state of the terminal is controlled by the setpoint of communication address 0x2001 or 0x7312. (The n0-12 compatibility mode must be enabled to write to 0x2001 address.)	n0-12 U3-18
23	Run at zero speed 2 (output at stop)	When the AC drive is running or stopped with its output frequency as 0, the terminal outputs an active signal.	-
24	Cumulative power-on time reached	When the cumulative power-on time of the AC drive (Ad-02/Ad-03) exceeds the time defined by P0-16/P0-17, the terminal outputs an active signal.	Ad-02, Ad-03 P0-16, P0-17
25	Frequency level detection FDT2 output	The DO terminal outputs an active signal when the running frequency exceeds the frequency detection value, and stops outputting the active signal when the running frequency is lower than the result of the detection value minus the frequency detection hysteresis (P0-36 x P0-37).	P0-36, P0-37
26	Frequency 1 reached	The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by P0-39 (Detection frequency 1). Frequency detection range = (P0-39 - P0-40) x A2-04 (Per-unit frequency base value) to (P0-39 + P0-40) x A2-04 (Per-unit frequency base value).	P0-39, P0-40
27	Frequency 2 reached	The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by P0-41 (Detection frequency 2). Frequency detection range = (P0-41 - P0-42) x A2-04 (Per-unit frequency base value) to (P0-41 + P0-42) x A2-04 (Per-unit frequency base value).	P0-41, P0-42
28	Current 1 reached	The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by P0-43 (Detection current 1). Current detection range = (P0-43 - P0-44) x C4-04 (rated motor current) to (P0-43 + P0-44) x C4-04.	P0-43, P0-44
29	Current 2 reached	The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by P0-45 (Detection current 2). Current detection range = (P0-45 - P0-46)×C4-04 (rated motor current) to (P0-45 + P0-46) x C4-04.	P0-45, P0-46

Value	Function	Description	Related parameters
30	Timing operation reached	When the timing function set by P0-13 is enabled and the operating time reaches the set timing duration, the terminal outputs an active signal. The timing value is set by P0-14 and P0-15.	P0-13 to P0-15
31	AI1 input limit exceeded	If the value of AI1 input is larger than the value of E2-14 (AI1 input protection upper limit) or lower than the value of E2-15 (AI1 input protection lower limit), the terminal outputs an active signal.	E2-14, E2-15
32	Three-phase loss	When the drive is in the three-phase loss state, the terminal outputs an active signal.	-
33	Reverse run	When the drive is running in the reverse direction, the terminal outputs an active signal.	-
34	Zero current state	When the output current of the drive is within the zero current range for a duration longer than that defined by P0-48 (zero current detection delay), the DO terminal outputs an active signal. Zero current detection range = 0 to (P0-47 x C4-04)	P0-47, P0-48
35	Module temperature reached	When U0-82 (Inverter module heatsink temperature) reaches the value of P0-33 (module temperature threshold), the terminal outputs an active signal.	P0-33, U0-82
36	Output current limit violated	When the output current of the AC drive is higher than P0-49 (output current overlimit threshold) for a period longer than P0-50 (Delay time for output current overlimit detection), the DO terminal outputs an active signal.	P0-49, P0-50
37	Frequency lower limit reached (output at stop)	During forward run, when U0-00 [Running frequency] and U0-01 [Set frequency] are both less than or equal to the product of L3070 [Minimum positive frequency] and per-unit frequency, the terminal outputs an active signal. During reverse run, when U0-00 [Running frequency] and U0-01 [Set frequency] are both less than or equal to the product of L3074 [Minimum negative frequency] and per-unit frequency, the terminal outputs an active signal. When the set frequency is lower than the absolute value of the minimum effective frequency, the terminal outputs an active signal even in the stop state.	U0-00 to U0-01 F1-10 F2-26, F2-27 L3070, L3074
38	Abnormality (fault/minor fault/warning)	When a fault occurs and the fault protection action is set to "continue to run", the DO terminal outputs an active signal. For details about the fault protection action, see H1-00 to H1-13.	-
40	Current running time reached	When the current running time of the drive exceeds the time defined by P0-20 (Current running time reach), the terminal outputs an active signal.	P0-20, U0-26
41	Fault output (excluding undervoltage)	When a fault (other than the undervoltage fault) occurs on the AC drive, the DO terminal outputs an active signal.	-
42	STO output	When the STO function is triggered, the RO terminal outputs an active signal.	-
43	Minor fault or warning	When a minor fault that restricts the running of the AC drive occurs, the operating panel of the AC drive displays "Lxxx.xx" and the DO terminal outputs an active signal.	-
44	AI2 input limit exceeded	If the value of AI2 input is larger than the value of E2-23 (AI2 input protection upper limit) or lower than the value of E2-24 (AI2 input protection lower limit), the terminal outputs an active signal.	E2-23, E2-24

Table 5–24 DO/RO-related parameters

Param.	Name	Default	Setting range	Description
E1-00	RO1 output function selection	2	0 to 44	See *"Table 5-23 DO terminal setting function description" on page 308*.
E1-04	DO1 output function selection	0		
E1-08	FMR (HDO) output function selection (for MD630S)	0		
E1-16	RO switch-on delay time	0.0s	0.0s to 3600.0s	This parameter sets the RO output delay time. RO outputs an active signal only after the set delay time elapses. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E1-17	RO switch-on delay time	0.0s	0.0s to 3600.0s	
E1-24	DO output switch-on delay time	0.0s	0.0s to 3600.0s	This parameter sets the DO output delay time. The DO outputs an active signal only after the set delay time elapses. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E1-25	DO output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-32	FMR output switch-on delay time (for MD630S)	0.0s	0.0s to 3600.0s	This parameter sets the FMR output delay time. FMR outputs an active signal only after the set delay time elapses. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E1-33	FMR output switch-off delay time	0.0s	0.0s to 3600.0s	

Param.	Name	Default	Setting range	Description
E1-36	DO/RO/VDO output source	0	Bit 0: RO output source 0: Output function setting 1: Forced value Bit 4: DO output source 0: Output function setting 1: Forced value Bit 8: FMR output source (for MD630S) 0: Output function setting 1: Forced value Bit 10 to Bit 15: VDO1 to VDO6 output source 0: Output function setting 1: Forced value	Defines the output source of RO, DO, FMR, and VDO1 to VDO6 (in bit sequence). **Value description:** 0: Output function setting - The DO/RO/VDO output depends on E1-00 to E1-08, and E1-10 to E1-15. 1: Forced value - The DO/RO/VDO output depends on E1-37. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E1-37	DO/RO/VDO forced data	0	Bit 0: RO reference 0: Low level 1: High level Bit 4: DO reference 0: Low level 1: High level Bit 8: FMR output source (for MD630S) 0: Low level 1: High level	Defines the level state of forced values of RO, DO, FMR, and VDO1 to VDO6 (in bit sequence). **Value description:** 0: Low level - Force low level of RO, DO, FMR, and VDO. 1: High level - Force high level of RO, DO, FMR, and VDO. Note: It is valid when the corresponding bit of E1-36 is 1. In this case, the output is hardware-independent. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.

Param.	Name	Default	Setting range	Description
E1-38	DO/RO/VDO terminal polarity selection	0	Bit 0: RO 0: Positive logic 1: Negative logic Bit 4: DO 0: Positive logic 1: Negative logic Bit 8: FMR output source (valid only for MD630S) 0: Positive logic 1: Negative logic	Defines the polarity of the RO, DO, FMR, and VDO1 to VDO6 terminals (in bit sequence). **Value description:** 0: Positive logic - Used to keep the output level of RO, DO, FMR, and VDO in positive logic. That is, when the output function of the selected terminal is active, RO, DO, FMR, and VDO generate output. When the output function of the selected terminal is invalid, RO, DO, FMR, and VDO do not generate output. 1: Negative logic - Used to invert the output level of RO, DO, FMR, and VDO. When the output function of the selected terminal is invalid, RO, DO, FMR, VDO generate output. When the output function of the selected terminal is valid, RO, DO, FMR, and VDO do not generate output.

Table 5–25 DO terminal status connector

Param.	Name	Default	Setting range	Description
L0034	RO	0	0 to 1	Bit connector: displaying the final level state of RO terminal. Value description: 0: No output 1: output **Note:** It can be used as an option for the "Others: B connector" parameter.
L0038	DO	0	0 to 1	Bit connector: displaying the final level state of DO terminal. **Value description:** 0: No output 1: output **Note:** It can be used as an option for the "Others: B connector" parameter.
L0042 (MD630S)	FMR	0	0 to 1	Bit connector: displaying the final level state of FMR terminal. **Value description:** 0: No output 1: output **Note:** It can be used as an option for the "Others: B connector" parameter.

Application example

When the DO output source (E1-36) is set to 0x0000, to perform the following function: "DO outputs an active signal when the AC drive is running", do as follows.

1. 1. Assign DO with function "Running" (E1-04 = 1).
2. Sets the polarity of the RO, DO, and VDO terminals (E1-38 = 0000).
   Value description:

   0: Positive logic

   Used to keep the output level of RO, FMR, DO, and VDO in positive logic. That is, when the output function of the selected terminal is active,RO, FMR, DO, and VDO generate output. When the output function of the selected terminal is invalid, RO, FMR, DO, and VDO do not generate output.

   1: Negative logic

   Used to invert the output level of RO, FMR, DO, and VDO. When the output function of the selected terminal is invalid, RO, FMR, DO, and VDO generate output. When the output function of the selected terminal is valid, RO, FMR, DO, and VDO do not generate output.

   If the negative logic is selected, DO will output when the drive is not running, and DO will not output when the drive is running.
3. Set the output source of DO to "Output function setting" (E1-36 = 0000), that is, whether the DO generates output depends on the function selected by E1-04.

After setting the preceding steps, the DO outputs the valid level when the drive is running. When the drive stops, the DO outputs the invalid level.

The FMR is a multi-functional output terminal unique to the MD630S. It can be used as either a regular DO or an HDO. By default, it is used as an HDO. If you need to use it as a regular DO, set F4-88 (E5-00) (FM multi-functional terminal output selection) to 1 (Digital output).

5.2.10.4 Virtual Digital Input (VDI) Terminal

Function list

The following table describes the standard functions of VDI1 to VDI6 terminals.

Function	VDI terminal					
	VDI1	VDI2	VDI3	VDI4	VDI5	VDI6
VDI terminal function selection	Supported	Supported	Supported	Supported	Supported	Supported
Whether the VDI source can be set	Supported	Supported	Supported	Supported	Supported	Supported
forced data	Supported	Supported	Supported	Supported	Supported	Supported
Terminal active mode (active level)	Supported	Supported	Supported	Supported	Supported	Supported

Function description

The VDI terminal function refers to a virtual digital input terminal, similar in logic to the DI input function on the control board. It can be used as a multi-functional digital input.

The MD630-INT series AC drive is equipped with six multi-functional DI terminals (VDI1 to VDI6) by default. Each VDI terminal can be assigned with a specific function like DI.

The VDI source can be set through parameter groups E0-50 to E0-55, and function selection can be set through parameter groups E0-10 to E0-15. When the VDI source set in parameter groups E0-50 to E0-55 is active, the functions selected in parameter groups E0-10 to E0-15 are active. The parameter set in groups E0-50 to E0-55 can assign VDI sources to function as physical DI terminal inputs, thereby emulating the purpose of DI terminals when the number of DIs are insufficient.

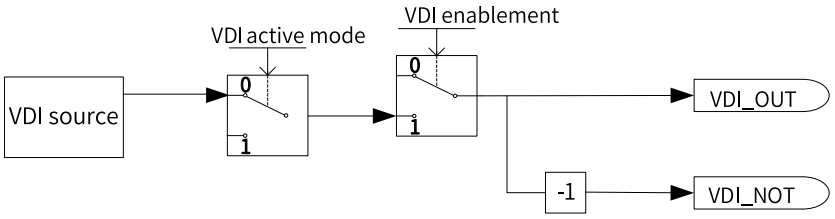


Figure 5-74 VDI data flow diagram

VDI terminal layout

VDI is the virtual DI terminal. The VDI source can be actual physical terminal signals such as AI, DI, and DO/RO, which are set through E0-50 to E0-55.

After selecting the actual physical terminal signal, see the corresponding physical terminal in the hardware wiring diagram. For example, if the VDI source is AI1, you need to perform wiring based on *"5.2.10.8 Analog Input Terminal (AI)" on page 334*. Note that AI does not function as DI in AI2 temperature mode, and therefore AI2 is invalid in this case.

VDI terminal function

Function name	Function description	Related parameters
1. VD terminal function selection	The VDI terminals can be set through E0-10 to E0-15. The optional functions are the same as those of the DI.	*"Table 5-26 VD terminal function selection" on page 317*
2. VDI source selection	The VDI terminal source can be set through E0-50 to E0-55.	*"Table 5-27 VDI source selection" on page 318*
3. Other function settings	-	*"Table 5-28 Other function settings" on page 319*
4. Terminal status connector	1 .Displays the status of the VDI terminal. The value 0 indicates that the VDI terminal has no input and the value 1 indicates that the VDI terminal has input. 2 .You can configure the parameter with option "Others: B connector" in the drop-down menu as the VDI terminal status connector.	Since the VDI terminal has only two states, 0 (open) or 1 (closed), you can configure it using the parameter with the "Others: B connector" option in the drop-down menu, as described in *"5.7.1.1.1 Connector" on page 769*. *"Table 5-29 VDI terminal status connector" on page 320*

Table 5–26 VD terminal function selection

Param.	Name	Default	Setting range	Description
E0-10	VDI1 terminal function selection	0	0 to 80	See *"Table 5-18 Options of DI terminal function parameters (E0-00 to E0-06)" on page 299*. **Note:** This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E0-11	VDI2 terminal function selection	0		
E0-12	VDI3 terminal function selection	0		
E0-13	VDI4 terminal function selection	0		
E0-14	VDI5 terminal function selection	0		
E0-15	VDI6 terminal function selection	0		

Table 5–27 VDI source selection

Param.	Name	Default	Setting range	Description
E0-50	VDI1 source	1	1: Forced value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 (valid only for MD630S) 14: DI4 (valid only for MD630S) 15: DI5 (valid only for MD630S) 16: DI6 (valid only for MD630S) 17: DI7/HDI (valid only for MD630S) 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 (Continued on next page)	Defines the VDI1 source. 1: Forced value - The forced value is set according to E0-57. 4: AI1 - The DI setting source is the comparison result among AI1 input, E2-35, and E2-36. 5: AI2 - The DI setting source is the comparison result among AI2 input, E2-35, and E2-36. 11: DI1 - Set the source according to DI1 status. 12: DI2 - Set the source according to the DI2 state. 13: DI3 - Set the source according to the DI3 state. 14: DI4 - Set the source according to DI4 status. 15: DI5 - Set the source according to DI5 status. 16: DI6 - Set the source according to DI6 status. 17: DI7/HDI - Set the source according to DI7 status. 22: VDI2 - Set the source according to the VDI2 state. 23: VDI3 - Set the source according to the VDI3 state. 24: VDI4 - Set the source according to the VDI4 state. 25: VDI5 - Set the source according to the VDI5 state. 26: VDI6 - Set the source according to the VDI6 state. (Continued on next page)
E0-50	VDI1 source	1	(Continued) 27: I/O card 1-DI1 28: I/O card 1-DI2 29: I/O card 1-DI3 30: I/O card 2-DI1 31: I/O card 2-DI2 32: I/O card 2-DI3 51: RO1 55: DO1 59: FMR (valid only for MD630S) 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6	(Continued) 27: I/O card 1-DI1 - Set the source based on the status of I/O card 1-DI1. 28: I/O card 1-DI2 - Set the source based on the output state of the O card 1-DI2. 29: I/O card 1-DI3 - Set the source based on the output state of the I/O card 1-DI3. 30: I/O card 2-DI1 - Set the source based on the output state of the I/O card 2-DI1. 31: I/O card 2-DI2 - Set the source based on the output state of the I/O card 2-DI2. 32: I/O card 2-DI3 - Set the source based on the output state of the I/O card 2-DI3. 51: RO1 - Set the source according to the RO1 output state. 55: DO1 - Set the source according to the DO1 output state. 59: FMR - Set the source according to the FMR output state. 61: VDO1 - Set the source based on the VDO1 output state. 62: VDO2 - Set the source based on the VDO2 output state. 63: VDO3 - Set the source based on the VDO3 output state. 64: VDO4 - Set the source based on the VDO4 output state. 65: VDO5 - Set the source based on the VDO5 output state. 66: VDO6 - Set the source based on the VDO6 output state.
E0-51	VDI2 source	1	No "22: VDI2", add "21: VDI1", and other values are the same as E0-50.	Sets the VDI2 source. **Value description:** Same as E0-50.
E0-52	VDI3 source	1	No "23: VDI3", add "21: VDI1", and other values are the same as E0-50.	Sets the VDI3 source. **Value description:** Same as E0-50.

Param.	Name	Default	Setting range	Description
E0-53	VDI4 source	1	No "24: VDI4", add "21: VDI1", and other values are the same as E0-50.	Sets the VDI4 source. **Value description:** Same as E0-50.
E0-54	VDI5 source	1	No "25: VDI5", add "21: VDI1", and other values are the same as E0-50.	Sets the VDI5 source. **Value description:** Same as E0-50.
E0-55	VDI6 source	1	No "26: VDI6", add "21: VDI1", and other values are the same as E0-50.	Sets the VDI6 source. **Value description:** Same as E0-50.

Table 5–28 Other function settings

Param.	Name	Default	Setting range	Description
E0-57	DI forced data	0	Bit 10 to Bit 15: VDI1 to VDI6 setting 0: Low level 1: High level	Defines the level status of the forced value of VDI1 to VDI6 (in bit sequence). **Value description:** Defines the level status of the forced value of VDI1 to VDI6 (in bit sequence). Note: 1. For VDI, the parameter is valid when E0-50 to E0-55 are set to 1 (forced value). 2. This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
E0-58	DI active mode selection	0	Bit 10 to Bit 15: VDI1 to VDI6 active mode 0: Active at high level 1: Active at low level	Defines the active mode of VDI1 to VDI6 (in bit sequence). **Value description:** Bit 10: VDI1 active mode 0: Active high - When the VDI1 source set by E0-50 is high level, the function selected by E0-10 is active. 1: Active low - When the VDI1 source set by E0-50 is low level, the function selected by E0-10 is active. Bit 11 to Bit 15: VDI2 to VDI6 active mode 0: Active at high level 1: Active at low level

Table 5–29 VDI terminal status connector

Param.	Name	Default	Setting range	Description
L0012	VDI1	0	0 to 1	Bit connector: displaying the final output level status of VDI1. **Value description:** 0: Open 1: Closed Note: It can be used as an option for the "Others: B connector" parameter.
L0013	VDI2	0	0 to 1	Bit connector: displaying the final output level status of VDI2. **Value description and Note:** Same as L0012.
L0014	VDI3	0	0 to 1	Bit connector: displaying the final output level status of VDI3. **Value description and Note:** Same as L0012.
L0015	VDI4	0	0 to 1	Bit connector: displaying the final output level status of VDI4. **Value description and Note:** Same as L0012.
L0016	VDI5	0	0 to 1	Bit connector: displaying the final output level status of VDI5. **Value description and Note:** Same as L0012.
L0017	VDI6	0	0 to 1	Bit connector: displaying the final output level status of VDI6. **Value description and Note:** Same as L0012.

Application example

When the VDI1 and VDI2 active mode selection (E0-58) is set to 00000, to perform the function: "VDI1 starts in the forward direction and VDI2 starts in the forward direction", do as follows to set the VDO output as the VDI input.

1. Set the VDI1 function to "Terminal control IN1" (E0-10 = 1).
2. Set the VDI2 function to "Terminal control IN2" (E0-11 = 2).
3. Set the VDI1 source to "VDO1" (E0-50=61).
4. Set the VDI2 source to "VDO2" (E0-51=62).
5. Set the command source to "Terminal" (b1-00=1).
6. Set the start/stop module mode (b9-01 = 3).
7. Set VDO1 and VDO2 output source as "Forced value" (E1-36=0x0C00).

After preceding steps are done, when the forced VDO1 output is active level, E1-37 = 0x0400 (VDI1 input is active level), and VDO2 does not generate output (VDI2 input is inactive level), the drive is in forward run state. When the forced VDO2 output is active level, E1-37 = 0x0800 (VDI2 input is active), and VDO1 does not generate output (VDI1 input is inactive level), the drive is in reverse run state.

5.2.10.5 Virtual Digital Output Terminal (VDO) Functions

List of functions

The following table describes the standard functions of VDO1 to VDO6 terminals.

Table 5–30 List of VDO terminal function assignment

Function	VDO Terminal					
	VDO1	VDO2	VDO3	VDO4	VDO5	VDO6
VDO output function selection	Supported	Supported	Supported	Supported	Supported	Supported
Output source	Supported	Supported	Supported	Supported	Supported	Supported
Forced data	Supported	Supported	Supported	Supported	Supported	Supported
Output polarity selection	Supported	Supported	Supported	Supported	Supported	Supported

Description

The drive is equipped with six multi-function relay output terminals (VDO1 to VDO6). Each VDO terminal can be assigned with a specific function like DO. The VDI and VDO can be used together to implement flexible control methods and simple logic control.

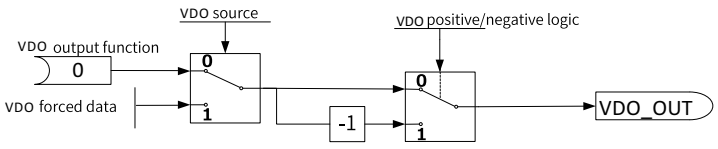


Figure 5-75 VDO data flow diagram

VDO terminal layout

VDO is a virtual DO and has no physical terminal.

VDO Function

Function	Description	Related Parameters
1.VDO function selection	The VDO terminals can be set through parameter groups (E1-10 to E1-15). For related parameters, see E1-00 to E1-38.	*"10.2.7.2 E1 DORO" on page 1356*: E1-00 to E1-38 Terminal function selection: *"Table 5-31 VDO terminal functions" on page 322*
2. Other functions	-	*"Table 5-32 VDO-related parameters" on page 322*
3. Terminal status connector	1 .Displays the status of the current VDO terminal. 0 indicates that the VDO terminal has no output and 1 indicates that the VDO terminal has output. 2 .Parameters labeled "Other: B Connector" in the drop-down menu can be configured as the VDO terminal status connector.	The VDO can be configured in the drop-down menu of the parameter "Other: Connector B", as it can only be configured as 0 (no output) or 1 (with output). For details, see *"5.7.1.1.1 Connector" on page 769*. *"Table 5-33 VDO terminal status connector" on page 323*

Table 5–31 VDO terminal functions

Param.	Name	Default	Value Range	Description
E1-10	VDO1 function selection	0	0 to 44	For details, see *"Table 5-23 DO terminal setting function description" on page 308*.
E1-11	VDO2 function selection	0	Same as E1-10	Same as E1-10
E1-12	VDO3 function selection	0	Same as E1-10	Same as E1-10
E1-13	VDO4 function selection	0	Same as E1-10	Same as E1-10
E1-14	VDO5 function selection	0	Same as E1-10	Same as E1-10
E1-15	VDO6 function selection	0	Same as E1-10	Same as E1-10

Table 5–32 VDO-related parameters

Param.	Name	Default	Value Range	Description
E1-37	Forced DO/RO data	0	Bit 10 to Bit 15: VDO1 to VDO6 settings 0: Low level 1: High level	Defines the level state of the forced values of RO/DO/VDO in bit sequence. **Value description** 0: Low level - The RO/FMR/DO/VDO output is forced to be low-level. 0: High level - The RO/FMR/DO/VDO output is forced to be high-level. Note: This parameter is valid when the corresponding bit of E1-36 is 1. The output has no relation with hardware. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E1-38	DO/RO polarity selection	0	Bit 10 to Bit 15: VDO1 to VDO6 0: Positive logic 1: Negative logic	Bit 0 to Bit 15 of this parameter specify the polarities of the VDO terminals. **Value description** 0: Positive logic - Set the DO and VDO output level to maintain positive logic, that is, when the selected functions of E1-00 to E1-04 and E1-10 to E1-15 are enabled or the forced value of E1-37 outputs signal at high level, the VDO outputs signal. 1: Negative logic - Set the DO and VDO output level to maintain negative logic, that is, when the selected functions of E1-00 to E1-04 and E1-10 to E1-15 are disabled or the forced value of E1-37 outputs signal at low level, the VDO outputs signal.

Table 5–33 VDO terminal status connector

Param.	Name	Default	Value Range	Description
L0044	VDO1	0	0 to 1	Bit connector: Displays the final output level state of VDO1. **Value description** 0: No output 1: output **Note:** It can be used as an option for the "Other: B Connector" parameter.
L0045	VDO2	0	0 to 1	Bit connector: Displays the final output level state of VDO2. **Value description:** Same as L0044
L0046	VDO3	0	0 to 1	Bit connector: Displays the final output level state of VDO3. **Value description:** Same as L0044
L0047	VDO4	0	0 to 1	Bit connector: Displays the final output level state of VDO4. **Value description:** Same as L0044
L0048	VDO5	0	0 to 1	Bit connector: Displays the final output level state of VDO5. **Value description:** Same as L0044
L0049	VDO6	0	0 to 1	Bit connector: Displays the final output level state of VDO6. **Value description:** Same as L0044

Application instances

When the VDO output source (E1-36) is set to 0000 (output function), to perform the function "VDO outputs an active signal when the drive is faulty", do as follows.

1. Set the VDO function to "fault output" (E1-10 = 02).
2. Set the output source of VDO1 to "output function" (E1-36 = 0000).

After setting the preceding steps, when the drive is faulty, the VDO outputs an active level. When the fault is cleared, the VDO outputs an inactive level.

5.2.10.6 High-Speed Digital Input (HDI)

List of functions

The HDI function refers to the high-speed digital input terminal DI7.

Function	HDI (DI7)
Terminal type selection (normal DI/high-speed HDI)	Supported
Hardware source selection	Supported

Function	HDI (DI7)
Forced value	Supported
2-point curve	Supported
4-point curve	Supported
Curve Selection	Supported
Curve absolute value/inversion calculation	Supported
Upper/Lower limit selection of the curve	Supported
Filter time	Supported
Denoising threshold	Supported
Impulse noise	Supported

Description

The MD630S-INT is equipped with a high-speed digital input terminal. The MD630N-INT is not equipped with a DI7 terminal. Therefore, it does not support the high-speed digital input terminal function (HDI).

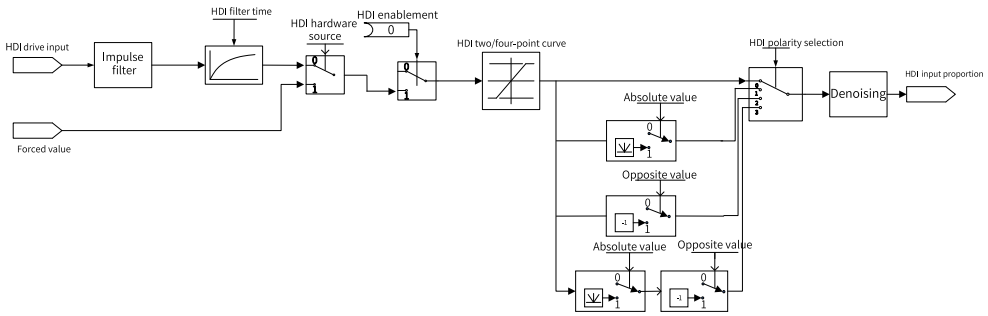


Figure 5-76 HDI data flow diagram

HDI terminal layout

DI terminal layout: For HDI terminal layout of MD630S-INT, see the information on DI7 of CN4 in *" Terminal Layout of Standard Models" on page 81*. The MD630N-INT is not equipped with a high-speed digital input terminal.

For details about the DI terminal wiring, see *" DI terminal wiring" on page 93*.

HDI function

Function	Description	Related Parameters
1.DI7 terminal type selection	DI7 is used as a regular DI by default. If it is used as a high-speed digital input terminal (HDI), you need to modify E4-00 [HDI terminal type selection] to 0 [Used as HDI]. When E4-01 [HDI input enable state] is set to 1 [Enable], the function of DI7 is defined by E4-00 to E4-36.	*"Table 5-34 DI7 terminal type selection" on page 325*
2. Other function setting	/	*"Table 5-35 Parameter list of HDI functions" on page 325*

Table 5–34 DI7 terminal type selection

Param.	Name	Default	Value Range	Description
E4-00	DI7/HDI terminal type selection	1	0 to 1	Defines the DI function assigned to DI7. **Value description** 0: Use as HDI - DI7 terminal is used as HDI. 1: Used as DI - DI7 is used as normal DI.
E4-01	HDI input enable state	0	0 to 1	Displays the HDI state. **Value description** 0: Disable - HDI is disabled. 1: Enabled - HDI is enabled. **Note:** Whether HDI is enabled is determined by E4-00.

Table 5–35 Parameter list of HDI functions

Param.	Name	Default	Value Range	Description
E4-02	HDI hardware source selection	0	0 to 1	Used to select the HDI input source. 0: Hardware sampling - The HDI input source is the hardware sampling, namely DI7 input. 1: Forced value - The HDI input source is the forced value set by E4-03. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E4-03	HDI forced value	0.00 kHz	0.00 kHz to 20.00 kHz	Defines the forced HDI value. **Note:** 1. This parameter is valid when HDI input is enabled and the value of E4-02 is set to 1 (forced value). 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E4-07	HDI curve setting	0	0 to 1	Defines the HDI curve, which can be two-point curve or four-point curve. **Value description** 0: Two-point curve 1: Four-point curve

Param.	Name	Default	Value Range	Description
E4-08	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency. **Note:** When the high-speed pulse at the DI7 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI7 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. F4-12 corresponds to the x axis of the minimum pulse input, that is, the minimum input frequency of the pulse.
E4-09	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the percentage corresponding to the minimum pulse input. **Note:** Same as E4-08. E4-09 corresponds to the y axis of minimum pulse input, that is, the set value corresponding to the minimum pulse input.
E4-10	Maximum input of two-point HDI curve	20.00 kHz	E4-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency. **Note:**Same as E4-08. E4-10 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.
E4-11	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. **Note:** Same as E4-08. E4-11 corresponds to the y axis of maximum pulse input, that is, the set value corresponding to the maximum pulse input.
E4-12	Minimum input of four-point HDI curve	0.00 kHz	0.00 kHz to E4-14	Sets the minimum input point of x axis on HDI four-point curve, that is, the minimum pulse input frequency. **Note:** When the high-speed pulse at the DI7 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI7 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a four-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. F4-12 corresponds to the x axis of the minimum pulse input, that is, the minimum input frequency of the pulse.

Param.	Name	Default	Value Range	Description
E4-13	Percentage corresponding to minimum input of four-point HDI curve	-100.0%	-800.0% to 800.0%	Sets the y axis corresponding to HDI curve minimum input point, that is, the per-unit value in percentage corresponding to the minimum pulse input. **Note:** Same as E4-12. E4-13 corresponds to the y axis of minimum pulse input, that is, the set value corresponding to the minimum pulse input.
E4-14	Inflection point 1 input of four-point HDI curve	5.00 kHz	E4-12 to E4-16	Sets the inflection point 1 of x axis on HDI four-point curve, that is, the pulse input frequency at inflection point 1. **Note:** Same as E4-12. E4-14 corresponds to the x-axis of the inflection point 1, that is, the pulse input frequency at inflection point 1.
E4-15	Percentage corresponding to inflection point 1 input of four-point HDI curve	-30.0%	-800.0% to 800.0%	This parameter defines the y axis corresponding to inflection point 1 on the HDI 4-point pulse curve, that is, the per-unit percentage value corresponding to the value of inflection point 1. **Note:**Same as E4-12. E4-15 corresponds to the y axis of the inflection point 1, that is, the reference corresponding to the pulse input frequency at inflection point 1.
E4-16	Inflection point 2 input of four-point HDI curve	10.00 kHz	E4-14 to E4-18	Sets the inflection point 2 of x axis on HDI four-point curve, that is, the pulse input frequency at inflection point 2. **Note:** Same as E4-12. E4-16 corresponds to the x-axis of the inflection point 2, that is, the pulse input frequency at inflection point 2.
E4-17	Percentage corresponding to inflection point 2 input of four-point HDI curve	30.0%	-800.0% to 800.0%	This parameter defines the y axis corresponding to inflection point 2 on the HDI 4-point pulse curve, that is, the per-unit percentage value corresponding to the value of inflection point 2. **Note:**Same as E4-12. E4-17 corresponds to the y axis of the inflection point 2, that is, the reference corresponding to the pulse input frequency at inflection point 2.
E4-18	Maximum input of four-point HDI curve	20.00 kHz	E4-16 to 20.00 kHz	Sets the maximum input point of x axis on HDI four-point curve, that is, the maximum pulse input frequency. **Note:** Same as E4-12. E4-18 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.
E4-19	Percentage corresponding to maximum input of four-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 4-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. **Note:** Same as E4-12 E4-19 corresponds to the y axis of maximum pulse input, that is, the set value corresponding to the maximum pulse input.

Param.	Name	Default	Value Range	Description
E4-32	HDI filter time	0.10s	0.00s to 10.00s	The parameter is used to set the HDI software filter time. **Note:** 1. Perform software filtering on HDI pulse input (after the impulse noise is processed) 2. When on-site signals are prone to interference, you may increase the HDI filter time to enhance the stability of the per-unit percentage value input to the AC drive.
E4-33	HDI curve absolute value inverted	0	0 to 3	Defines the processing mode of HDI sampling values. **Value description** Ones position: HDI 0: Normal - The per unit percentage of HDI normal input that processed based on the curve is used. 1: Absolute value - The absolute value of the per unit percentage of the HDI input after being processed based on the curve is used. 2: Inversion - The per unit percentage of the HDI input after being processed based on the curve is inverted. 3: Absolute value inverted - The per unit percentage of the HDI input after being processed based on the curve is inverted.
E4-34	HDI denoising threshold	0.0%	0.0% to 10.0%	Sets the HDI denoising time. **Additional information:** 1. For the per unit percentage of the HDI input after the HDI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default	Value Range	Description
E4-35	HDI curve upper and lower limit selection	0	0 to 1	Defines the output when the HDI pulse input is lower than the minimum input of the curve. Value description 0: Limited - When HDI input is lower than minimum input of curve, the per unit percentage value on the curve is the corresponding value of minimum input. 1: Not limited - When the AI input voltage is lower than the minimum input of the curve, the interpolation calculation continues based on the curve slope.
E4-36	HDI impulse noise	0	0ms to 1000ms	Set the filter duration time of HDI impulse noise. The impulse noise threshold is 250 Hz. **Note:** 1. For HDI hardware sampling, if the absolute value of the difference between the input of current cycle and input of the last cycle is greater than the threshold (250 Hz), then the signal of the last cycle is inputted. After the time defined by E4-36 elapses, the HDI signal of current cycle is inputted. 2. If the absolute value of the difference between this input and the last input is less than the threshold of 250 Hz, the last HDI signal is directly accepted as input.

Application instance

To perform the following function: "HDI as main frequency source", do as follows.

1. Set DI7 to "Used as HDI" (E4-00 = 0).
2. Set the function of HDI curve to make 0% to 100% correspond to 0 Hz to 20 kHz (E4-08 = 0 kHz, E4-09 = 0%, E4-10 = 20 kHz, and E4-11 = 100%).
3. Set the frequency source to HDI input (b5-00 = 5).

After setting the preceding steps, when HDI input is 0 Hz, the main frequency is set to 0 Hz. When HDI input is 10 kHz, the main frequency is set to 50% of C4-06 (rated motor frequency).

5.2.10.7 High-speed Digital Output (HDO)

List of functions

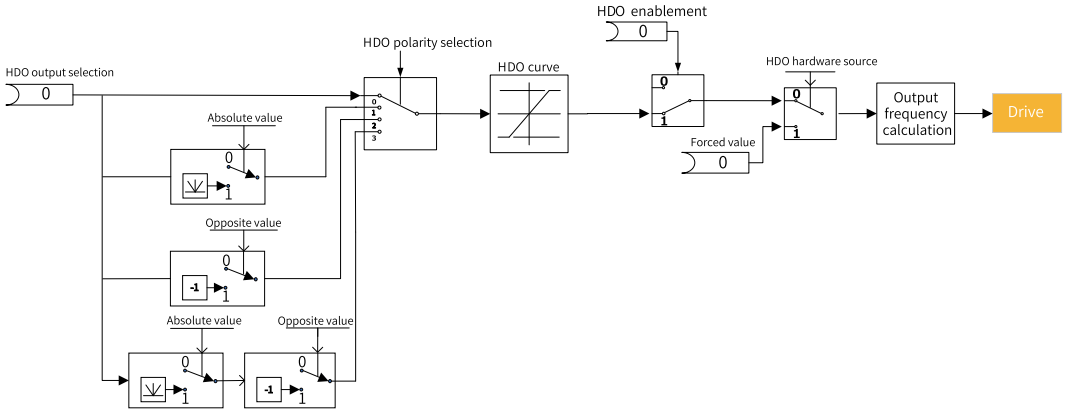
The HDO function refers to the high-speed digital output terminal FM.

Function	HDO (FM)
Terminal output selection (normal DO/high-speed HDO)	Supported
Output function	Supported
2-point curve	Supported
Output polarity selection	Supported
Hardware source selection	Supported

Function	HDO (FM)
Forced value	Supported
Maximum output frequency	Supported

Description

The MD630S-INT is equipped with a high-speed digital input terminal (FM). The MD630N-INT is not equipped with an FM terminal. Therefore, it does not support the high-speed digital output terminal function (HDO).



HDO terminal layout

HDO terminal layout: For HDI terminal layout of MD630S-INT, see the information on CN5 in *“Terminal Layout of Standard Models” on page 81*.

For the hardware wiring of the MD630S-INT high-speed output terminals, see *“Wiring of the high-speed digital output terminal FM” on page 95*.

HDO functions

Function	Description	Related Parameters
1. FM terminal type selection	By default, FM is used as a normal HDO. It can be set through parameter E5-00 (FM multi-function terminal output selection). When E5-00 is set to 0 (HDO pulse output (FMP)), the function is determined by E5-00 to E5-15, that is, HDO-related functions.	*“Table 5-36 FM terminal type selection” on page 331*
2. HDO output function selection	-	*“Table 5-37 HDO function selection parameter” on page 331*
3. Other functions	-	*“Table 5-39 Other functions” on page 332*

Table 5–36 FM terminal type selection

Param.	Name	Default	Value Range	Description
E5-00	FM multi-function terminal output selection	0	0 to 1	Used to set the FM multi-function terminal output to FMP (HDO high-speed pulse output terminal) or FMR (digital output terminal for open collector). **Value description** 0: HDO pulse output (FMP) - The FM terminal is the HDO pulse output terminal. 1: Digital output (FMR) - The FM terminal is the regular DO (FMR) output terminal.

Table 5–37 HDO function selection parameter

Param.	Name	Default	Value Range	Description
E5-01	HDO output function selection	0	0 to 16	For details, see *"Table 5-38 HDO functions" on page 331*

Table 5–38 HDO functions

Value Range	Function	Description
0	Running frequency	The HDO outputs the pulse that corresponds to the ratio of the AC drive running frequency to rated motor frequency (with 100% corresponding to the rated motor frequency).
1	Frequency reference	The HDO outputs the pulse that corresponds to the ratio of the AC drive frequency reference to rated motor frequency (with 100% corresponding to the rated motor frequency).
2	Output current	The HDO outputs the pulse that corresponds to the ratio of the AC drive output current to rated motor current (with 100% corresponding to two times of the rated motor current).
3	Motor output torque (absolute value)	The HDO outputs the pulse that corresponds to the ratio of the AC drive output ratio to rated motor torque (with 100% corresponding to two times of the rated motor torque).
4	Output power	The HDO outputs the pulse that corresponds to the ratio of the AC drive output power ratio to motor rated power (with 100% corresponding to two times of the rated motor power).
5	Output voltage	The HDO outputs the pulse that corresponds to the ratio of the AC drive output voltage to rated motor voltage (with 100% corresponding to 1.2 times of the rated motor voltage).
6	Pulse input	The HDO output pulse follows the HDI input frequency (with 50.0% corresponding to 20.0 kHz).
7	AI1	The HDO output pulse follows the AI1 input voltage (with 100.0% corresponding to 10 V).
8	AI2	The HDO output pulse follows the AI2 input voltage (with 100.0% corresponding to 10 V).
12	Communication	The HDO outputs the pulse that corresponds to the ratio of data that is written to 2004H/7315H address to 32767 (with 100.0% corresponding to HDO communication setting).
13	Motor speed	The HDO outputs the pulse that corresponds to the ratio of the motor speed to the motor speed at rated motor frequency (with 100.0% corresponding to the speed at the rated frequency).
14	Output current	The HDO outputs the pulse that corresponds to the ratio of the AC drive output current to 1000 A (with 100.0% corresponding to 1000.0 A).
15	Bus voltage	The HDO outputs the pulse that corresponds to the ratio of the AC drive bus voltage to 1000 V (with 100.0% corresponding to 1000.0 V).
16	Motor output torque (actual value, proportion to the rated motor torque)	HDO outputs the pulse that corresponds to the ratio of AC drive output torque to the rated motor torque (with 100.0% corresponding to the rated motor torque, 50% corresponding to 0, and 0% corresponding to the negative rated motor torque).

Table 5–39 Other functions

Param.	Name	Default	Value Range	Description
E5-03	Minimum input of HDO curve	0.0%	-100.0% to E5-05	Defines the minimum x-axis input point of the HDO curve, that is, the per-unit percentage of the selected HDO function. **Note:** The HDO curve input is the percentage of the function variable selected by E5-01. The curve output is the percentage of the maximum frequency of the HDO output (E5-15).
E5-04	Percentage corresponding to minimum input of HDO curve	0.00%	0.00% to 100.00%	Defines the y-axis corresponding to the minimum input point of the HDO curve, that is, the percentage of the maximum frequency of HDO output (E5-15). **Note:** See E5-03.
E5-05	Maximum input of HDO curve	100.0%	E5-03 to 100.0%	Defines the maximum x-axis input point of the HDO curve, that is, the per-unit percentage of the selected HDO function. **Note:** See E5-03.
E5-06	Percentage corresponding to the maximum input of HDO curve	100.00%	0.00% to 100.00%	Defines the y-axis corresponding to the maximum input point of the HDO curve, that is, the percentage of the maximum frequency of the HDO output (E5-15). **Note:** See E5-03.
E5-11	HDO output polarity selection	0	Ones position: HDO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens position: Reserved Hundreds position: Reserved Thousands place: Reserved Ten thousands place: Reserved	Defines the HDO output polarity. **Value description** 0: Normal - The per-unit percentage of the selected function remains unchanged. 1: Absolute value - The absolute value of the per-unit percentage of the selected function is used. 2: Inverted value - The inverted per-unit percentage of the selected function is used. 3: Inverted absolute value - The inverted absolute value of the per-unit percentage of the selected function is used.

Param.	Name	Default	Value Range	Description
E5-12	HDO hardware source	0	Ones position: HDO selection 0: Output function setting 1: Forced value Tens position: Reserved Hundreds position: Reserved Thousands place: Reserved Ten thousands place: Reserved	This parameter specifies the hardware source of HDO. **Value description** 0: Output function setting - E5-01 as the source. 1: Forced value - E5-13 as the source.
E5-13	HDO forced value	0.00%	0.00% to 100.00%	Defines the HDO forced output value, which is a percentage to the maximum frequency of HDO output (E5-15). **Note:** This parameter is active when E5-12 is set to 1.
E5-15	Maximum frequency of HDO output	50.00 kHz	0.01 kHz to 100.00 kHz	Defines the maximum frequency of HDO output. **Note:** The final HDO output frequency is set by HDO curve or forced value x E5-15.

Application instances

To perform the following function: "HDO outputs operating frequency", do as follows.

1. Set E5-00 (FM multi-function terminal output selection) to 0 (HDO pulse output (FMP)).
2. Set E5-01 to 0 (operating frequency) to set the HDO function.
3. Set the curve relation of HDO to "0% to 100%" (per unit percentage of the function variable selected by E5-01) corresponding to "0% to 100%" (per unit percentage of the HDO output pulses corresponding to E5-15).
4. Set E5-03 (minimum input of HDO curve) to 0.0% (per unit percentage of the function variable selected by E5-01) and set E5-04 (corresponding setting of minimum HDO input) to 0.0% (percentage of the maximum frequency of HDO output).
5. Set E5-05 (maximum input of HDO curve) to 100.0% (per unit percentage of the function variable selected by E5-01) and set E5-06 (corresponding setting of the maximum HDO input) to 100.0% (percentage of the maximum frequency of HDO output).
6. Set the maximum frequency of HDO output to 50 kHz (E5-15 = 50.00 kHz).

After setting the preceding steps, when the AC drive is running, the AC drive calculates the per unit percentage of the HDO output frequency based on the per unit percentage of the current running frequency and the curve set by E5-03 to E5-06. Multiply the per unit percentage of the HDO output frequency by E5-15 (maximum HDO output frequency) to obtain the actual pulse frequency of the HDO output, and drive the output of the FM terminal.

Suppose the rated frequency is 50 Hz, the running frequency is 25 Hz, and the HDO curve receives an input value of 50%. Based on parameters E5-03 to E5-06, the HDO curve output value is 50%. The current maximum HDO output frequency is 50 kHz. Therefore, the final HDO output frequency is 50 kHz x 50% = 25 kHz.

5.2.10.8 Analog Input Terminal (AI)

List of functions

The following table describes the standard functions of AI1 and AI2 terminals. Only AI2 supports the temperature mode. If AI2 is set to the temperature mode, functions such as correction, gain + offset, denoising, and filtering are disabled.

Table 5–40 List of AI terminal function assignment

Function	Terminal	
	AI1	AI2
Voltage/current input switchover	Supported	Supported
Correction	Supported	Supported
Gain + offset	Supported	Supported
Denoising	Supported	Supported
Filter time setting	Supported	Supported
Dead zone width	Supported	Supported
Jump point + jump amplitude setting	Supported	Supported
Input protection upper limit/lower limit/protection time	Supported	Supported
High/low level judgment threshold when AI used as DI	Supported	Supported
Curve absolute value/inversion calculation	Supported	Supported
Curve Selection	Supported	Supported
Curve lower limit selection	Supported	Supported
2-point curve (1 to 3)	Supported	Supported
4-point curve (1 and 2)	Supported	Supported
Hardware source selection	Supported	Supported
Forced value setting	Supported	Supported
AI temperature mode	-	Supported

Description

The MD630S-INT and MD630N-INT are both equipped with two analog input terminals (input range: -10 V to 10 V). The AI terminal can select input curve processing or gain and deviation processing to implement corresponding functions.

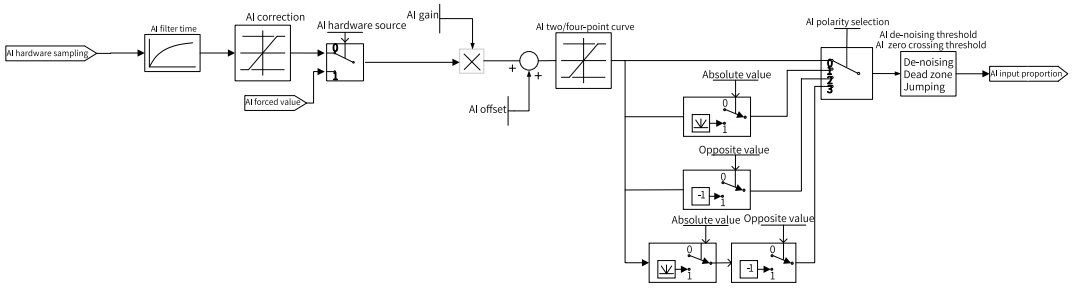


Figure 5-77 AI data flow diagram

AI terminal layout

AI terminal layout: For MD630S-INT, see the CN4 in *" Terminal Layout of Standard Models" on page 81*. For MD630N-INT, see the CN5 in *" Terminal Layout of Bus Type Models" on page 86*.

AI terminal hardware wiring (MD630S-INT used as an example): For AI1, see *" AI1 terminal wiring" on page 90*. For AI2, see *" AI2 terminal wiring" on page 90*.

Note

- The AI1 voltage/current mode of the MD630S-INT is switched by DIP switch S4 on the control board, the AI2 voltage/current mode is switched by DIP switch S2 on the control board, and the AI2 temperature mode is switched by DIP switch S3 on the control board.
- The AI1 voltage/current mode of the MD630N-INT is switched by DIP switch S3 on the control board, the AI2 voltage/current mode is switched by DIP switch S1 on the control board, and the AI2 temperature mode is switched by DIP switch S2 on the control board.

Table 5–41 AI DIP switch

Terminal Assigment			DIP Switch Description
Pin	ON	OFF	
S4 (MD630S-INT) S3 (MD630N-INT)	Current	Voltage	ON: AI1 is set to current input mode and the input range is 0 mA to 20 mA.
			OFF (default): AI1 is set to voltage input mode and the input range is -10 V to 10 V.
S2 (MD630S-INT) S1 (MD630N-INT)	Current	Voltage	ON: AI2 is set to current input mode and the input range is 0 mA to 20 mA.
			OFF (default): AI2 is set to voltage input mode and the input range is -10 V to 10 V.
S3 (MD630S-INT) S2 (MD630N-INT)	Temperature mode	Analog input	ON: AI2 is set to temperature mode.
			OFF (default): AI2 is set to the voltage/current input mode.

Note: For the current-type AI input, 1 mA current corresponds to 0.5 V voltage. That is, 20 mA corresponds to 10 V.

AI functions

Function	Description	Scenario	Related Parameters
1.AI correction	These parameters are used to correct the AI to eliminate the impact of AI zero offset and gain. This group of parameters have been corrected by default. If restored to default, these setpoints are restored to the values calibrated by default. Generally, no calibration is needed on site.	The measured voltage indicates the actual output voltage measured by instruments such as the multimeter. The displayed voltage indicates the voltage sampled and displayed by the drive. For details, see U0-21 and U0-22. During correction, send two voltage values to each AI terminal, and save the measured values and displayed values in group U0 to AC-00...AC-03. Then the drive automatically performs AI zero offset and gain correction. In cases where the reference voltage does not match the sampled voltage, make correction on site to match the sampled value with the reference value.	**Alarm**: Correction is invalid for AI temperature mode. Take AI1 as an example. The field correction method is as follows: 1. Set the AI1 voltage signal (about 2 V). 2. Measure the AI1 voltage and save it to EE-00. 3. View the value of U0-21 and save it to EE-01. 4. Set the AI1 voltage signal (about 8 V). 5. Measure the AI1 voltage and save it to EE-02. 6. View the value of U0-21 and save it to EE-03. 7. When AI2 is corrected, the actual sampled voltage can be viewed in U0-22. 8. For AI1 and AI2, it is recommended to use 2 V and 8 V as the two correction points. **Related parameters:** *"Table 5-42 AI correction parameters" on page 337*
2. AI used as DI	The AI1 and AI2 terminals can be used as DI. • When the AI input voltage is greater than 7 V, the AI terminal status is high level. • When the AI input voltage is below 3 V, the AI terminal status is low level. • When the AI input voltage is between 3 V and 7 V, the AI terminal status is hysteresis.	1 .When used as DI, AI acts as the source of VDI1 to VDI6, which can be set by E0-50 to E0-55. 2 .The result of the AI that used as DI can be checked through the connector. When AI is used as DI, the result is either 0 (low level for the AI used as DI) or 1 (high level for the AI used as DI), which can be configured in the parameter drop-down box of "Others: B connector". For details, see *" Parameter interconnection" on page 769*.	**Working principle:** *"Figure 5-78 Schematic diagram for the AI used as DI" on page 338* **Related parameters:** *"Table 5-43 Parameters when AI used as DI" on page 338* E0-50 to E0-55: *"5.2.10.4 Virtual Digital Input (VDI) Terminal" on page 315* *"Table 5-44 Result of the AI used as DI" on page 338*
3. Other functions	-	-	*"Table 5-45 AI-related parameters" on page 339*

Table 5–42 AI correction parameters

Param.	Name	Default	Value Range	Description
EE-00	AI1 measured voltage 1	Factory-corrected	-10.000 V to 10.000 V	This parameter indicates the AI1 measured voltage 1, that is, the voltage measured by the meter. **Note:** When PT100 analog voltage correction is carried out on AI3, a correction curve is formed through two points. Each point corresponds to a measured voltage and a displayed voltage.
EE-01	AI1 displayed voltage 1	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AI1 displayed voltage 1, which is the voltage before correction (U0-21). **Note:** See EE-00.
EE-02	AI1 measured voltage 2	Factory-corrected	-10.000 V to 10.000 V	This parameter indicates the AI1 measured voltage 2, that is, the voltage measured by the meter. **Note:** See EE-00.
EE-03	AI1 displayed voltage 2	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AI1 displayed voltage 2, which is the voltage before correction (U0-21). **Note:** See EE-00.
EE-04	AI2 measured voltage 1	Factory-corrected	-10.000 V to 10.000 V	This parameter indicates the AI2 measured voltage 1, that is, the voltage measured by the meter. **Note:** When analog voltage correction is conducted on AI2, a correction curve is obtained based on two points, each of which corresponds to a measured voltage and a displayed voltage.
EE-05	AI2 displayed voltage 1	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AI2 displayed voltage 1, which is the voltage before correction (U0-22). **Note:** See EE-04.
EE-06	AI2 measured voltage 2	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AI2 measured voltage 2, that is, the voltage measured by the meter. **Note:** See EE-04.
EE-07	AI2 displayed voltage 2	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AI2 displayed voltage 2, which is the voltage before correction (U0-22). **Note:** See EE-04.

Table 5-43 Parameters when AI used as DI

Param.	Name	Default	Value Range	Description
E2-35	High level judgment threshold when AI used as DI	7.0 V	5.5 V to 9.0 V	Defines the threshold for judging high level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-36	Low level judgment threshold when AI used as DI	3.0 V	1.0 V to 4.5 V	Defines the threshold for judging low level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

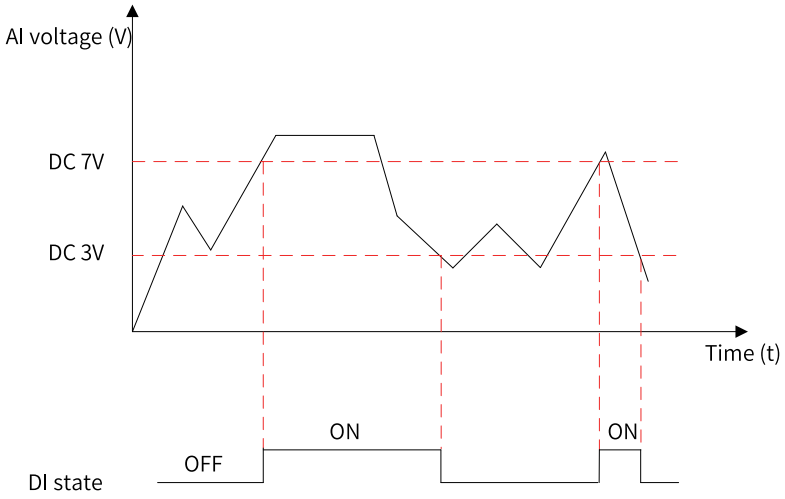


Figure 5-78 Schematic diagram for the AI used as DI

Table 5-44 Result of the AI used as DI

Param.	Name	Default	Value Range	Description
L0054	AI1 used as DI level	0: Low level	0 to 1	Bit connector: Displays the level status when AI1 is used as the DI. 0: Low level 1: High level It can be used as an option for the "Other: B Connector" parameter.
L0055	AI2 used as DI level	0: Low level	0 to 1	Bit connector: Displays the level status when AI2 is used as the DI. 0: Low level 1: High level It can be used as an option for the "Other: B Connector" parameter.

Table 5–45 AI-related parameters

Param.	Name	Default	Value Range	Description
E2-07	AI1 gain	1.00	-10.00 to 10.00	This parameter defines the gain multiple of AI1 analog sampling voltage. **Additional information:** 1. Used with E2-08, the AI1 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-08	AI1 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI1 analog sampling voltage. **Note:** 1. Used with E2-07, the AI1 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-09	AI1 denoising threshold	0.0%	0.0% to 100.0%	This parameter defines the AI1 denoising threshold. **Additional information:** 1. For the per unit percentage of the AI1 input after the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-10	AI1 fitter time	0.10s	0.00s to 10.00s	This parameter indicates the software filter time of AI1. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.

Param.	Name	Default	Value Range	Description
E2-11	AI1 zero-crossing threshold	0.0%	100.0%	Defines the zero-crossing threshold of AI1. The output within the defined range is 0.0%, which is used to eliminate fluctuation around zero. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-12	AI1 jump point	0.0%	-800.0% to 800.0%	This parameter defines the jump point for AI1. If the difference between the value (per-unit value in percentage obtained after AI1 is processed by the AI curve) and the jump point is within the jump amplitude (E2-13), the value of the jump point will be output. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-13	AI1 jump amplitude	0.1%	0.0% to 100.0%	This parameter defines the AI1 jump amplitude. If the input is within the range from E2-12 - E2-13, the value of the AI1 jump point will be output. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-14	Upper limit of AI1 input protection	8.00 V	E2-15 to 10.00 V	This parameter defines the AI1 input protection upper limit. It is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-14 or lower than E2-15, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 (AI open circuit fault).
E2-15	Lower limit of AI1 input protection	2.00 V	0.00 V to E2-14	This parameter defines the AI1 input protection lower limit. It is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-15 or lower than E2-14, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 (AI open circuit fault).

Param.	Name	Default	Value Range	Description
E2-16	AI2 gain	1.00	-10.00 to 10.00	This parameter defines the gain multiple of AI2 analog sampling voltage. **Additional information:** 1. Used with E2-17, the AI2 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI2 input voltage (U0-10 AI2 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-17	AI2 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI2 analog sampling voltage. **Note:** 1. Used with E2-16, the AI2 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI2 input voltage (U0-10 AI2 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-18	AI2 denoising threshold	0.0%	0.0% to 100.0%	This parameter defines the AI2 denoising threshold. **Additional information:** 1. For the per unit percentage of the AI2 input after the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-19	AI2 filter time	0.10s	0.00s to 10.00s	Defines the software filter time of AI2. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.

Param.	Name	Default	Value Range	Description
E2-20	AI2 zero-crossing threshold	0.0%	0.0% to 100.0%	Defines the AI2 zero-crossing threshold. If the percentage calculated according to the AI curve per-unit value does not exceed the threshold, the percentage is set to 0.0% forcibly. This parameter aims to eliminate fluctuations around zero point. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-21	AI2 jump point	0.0%	-800.0% to 800.0%	This parameter defines the jump point for AI2. If the difference between the value (per-unit value in percentage obtained after AI2 is processed by the AI curve) and the jump point is within the jump amplitude (E2-22), the value of the jump point will be output. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-22	AI2 jump amplitude	0.1%	0.0% to 100.0%	This parameter defines the jump amplitude for AI2. If the difference between the value (per-unit value in percentage obtained after AI2 is processed by the AI curve) and the jump point (E2-21) is within the jump amplitude (E2-22), the value of the jump point will be output. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-23	Upper limit of AI2 input protection	8.00 V	E2-24 to 10.00 V	This parameter defines the AI2 input protection upper limit. It is used to indicate whether AI2 input voltage is within the set range. **Note:** When the AI2 value is higher than E2-24 or lower than E2-23, the DO terminal outputs an active signal to indicate that AI2 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.4 (AI open circuit).
E2-24	Lower limit of AI2 input protection	2.00 V	0.00 V to E2-23	This parameter defines the AI2 input protection lower limit. It is used to indicate whether AI2 input voltage is within the set range. **Note:** When the AI2 value is higher than E2-24 or lower than E2-23, the DO terminal outputs an active signal to indicate that AI2 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.4 (AI open circuit).

Param.	Name	Default	Value Range	Description
E2-34	AI input protection time	0.01s	0.00s to 1.00s	Defines the duration during which the AI input exceeds the limit. When the AI input overlimit time is greater than or equal to the value of this parameter, the AI input overlimit flag (L0050 to L0051) is outputted or the AI open circuit fault is reported.
E2-35	High level judgment threshold when AI used as DI	7.0 V	5.5 V to 9.0 V	Defines the threshold for judging high level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-36	Low level judgment threshold when AI used as DI	3.0 V	1.0 V to 4.5 V	Defines the threshold for judging low level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-37	AI curve absolute value inverted	0	Ones position: AI1 selection 0: Normal 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens position: AI2 selection 0: Normal 1: Absolute value 2: Inverted value 3: Inverted absolute value Hundreds position: Reserved Thousands place: Reserved Ten thousands place: Reserved	Defines the input polarity of AI1 and AI2 (assigned by ones and tens). **Value description** 0: Normal - The per unit value of the normal AI curve is used. 1: Absolute value - The absolute value of the per unit value of the AI curve is used. 2: Inverted value - The per unit value of the AI curve is inverted. 3: Inverted absolute value - The absolute per unit value of the AI curve is inverted. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default	Value Range	Description
E2-38	AI curve selection	0x21	Ones position: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens position: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds position: Reserved Thousands place: Reserved	Defines the input/output curve of AI1 and AI2. **Value description** Ones position: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens position: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67)
E2-39	AI lower limit selection	0x000	Ones position: Selection when AI1 value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Tens position: Selection when AI2 value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Hundreds position: Reserved Thousands place: Reserved	Defines the output when AI1 and AI2 input voltages are lower than the minimum input of the curve (assigned by ones and tens in sequence). **Value description** 0000H - When the AI input is lower than the minimum input of the curve, the curve per unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is 0.0%.

Param.	Name	Default	Value Range	Description
E2-40	AI curve 1 minimum input	0.00 V	-10.00 V to E2-42	Defines the minimum input point of x axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). **Note:** 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y axis represents the per-unit percentage of the rated motor frequency. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** See E2-40.
E2-42	AI curve 1 maximum input	10.00 V	E2-40 to 10.00 V	Defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40.
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** See E2-40.
E2-44	AI curve 2 minimum input	0.00 V	-10.00 V to E2-46	Defines the minimum input point of x axis on AI curve 2, that is, the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40.
E2-45	Percentage corresponding to minimum input of AI curve 2	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** See E2-40.
E2-46	AI curve 2 maximum input	10.00 V	E2-44 to 10.00 V	Defines the maximum input point of x axis on AI curve 2, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40.
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** See E2-40.

Param.	Name	Default	Value Range	Description
E2-48	AI curve 3 minimum input	0.00 V	-10.00 V to E2-50	Defines the minimum input point of x axis on AI curve 3, that is, the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40.
E2-49	Percentage corresponding to minimum input of AI curve 3	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 3 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** See E2-40.
E2-50	AI curve 3 maximum input	10.00 V	E2-48 to 10.00 V	Defines the maximum input point of x axis on AI curve 3, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40.
E2-51	Percentage corresponding to the maximum input of AI curve 3	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 3 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** See E2-40.
E2-52	AI curve 4 minimum input	0.00 V	-10.00 V to E2-54	Defines the minimum input point of x axis on AI curve 4, that is, the minimum analog input voltage (or minimum analog input current). **Note:** 1. The x axis of the AI curve represents the analog input voltage (or current), and the y axis represents the per unit percentage corresponding to the analog input voltage. If the AI input is selected as the frequency source, y axis represents the percentage of the maximum frequency (C4-10). 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-53	Percentage corresponding to minimum input of AI curve 4	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 4 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** See E2-40.
E2-54	AI curve 4 inflection 1 input	3.00 V	E2-52 to E2-56	Defines the inflection 1 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Note:** See E2-40.
E2-55	Corresponding percentage of AI curve 4 inflection 1 input	30.0%	-800.0% to 800.0%	Defines the y-axis corresponding to inflection point 1 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 1. **Note:** See E2-40.

Param.	Name	Default	Value Range	Description
E2-56	AI curve 4 inflection 2 input	6.00 V	E2-54 to E2-58	Defines the inflection 2 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Note:** See E2-40.
E2-57	Corresponding percentage of AI curve 4 inflection 2 input	60.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Note:** See E2-40.
E2-58	AI curve 4 maximum input	10.00 V	E2-56 to 10.00 V	Defines the maximum input point of x axis on AI curve 4, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40.
E2-59	Percentage corresponding to the maximum input of AI curve 4	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 4 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** See E2-40.
E2-60	AI curve 5 minimum input	-10.00 V	-10.00 V to E2-62	Defines the minimum input point of x axis on AI curve 5, that is, the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40.
E2-61	Percentage corresponding to minimum input of AI curve 5	-100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 5 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** See E2-40.
E2-62	AI curve 5 inflection 1 input	-3.00 V	E2-60 to E2-64	Defines the inflection 1 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Note:** See E2-40.
E2-63	Corresponding percentage of AI curve 5 inflection 1 input	-30.0%	-800.0% to 800.0%	Defines the y-axis corresponding to inflection point 1 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 1. **Note:** See E2-40.
E2-64	AI curve 5 inflection 2 input	3.00 V	E2-62 to E2-66	Defines the inflection 2 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Note:** See E2-40.
E2-65	Corresponding percentage of AI curve 5 inflection 2 input	30.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Note:** See E2-40.

Param.	Name	Default	Value Range	Description
E2-66	AI curve 5 maximum input	10.00 V	E2-64 to 10.00 V	Defines the maximum input point of x axis on AI curve 5, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40.
E2-67	Percentage corresponding to the maximum input of AI curve 5	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 5 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** See E2-40.
E2-81	AI hardware source selection	0	0 to 11	Defines the hardware source of AI (AI1 and AI2 are arranged by ones and tens in sequence). **Value description** 0: hardware sampling - The AI value is sourced from hardware sampling. 1: Forced value - The AI1/AI2 voltage is set forcibly through E2-82/E2-83. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-82	AI1 forced value	0	-10.0 V to 10.0 V	Defines the forced value of AI1. **Note:** 1. This parameter is valid when the ones of E2-81 is set to 1. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E2-83	AI2 forced value	0	-10.0 V to 10.0 V	Defines the forced value of AI2. **Note:** 1. This parameter is valid when the tens of E2-81 is set to 1. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Application instances

- Application instance 1: AI1 used as an analog input
  To perform the following function: "AI as running frequency source", do as follows.

  1. Set the curve selection for AI voltage and frequency: Select one of the five curves (E2-38 = 0x0021) from E2-40 to E2-67 (by default, AI1: curve 1, AI2: curve 2).
  2. Set the mapping relationship of AI1 curve to "0 V to 10 V corresponds to 0% to 100%" (E2-40 = 0 V, E2-41 = 0%, E2-42 = 10 V, E2-43 = 100%).
  3. Set whether to continue curve interpolation or keep the minimum curve input point of the curve (by default, E2-39 = 0x000) when the curve lower limit is exceeded.

4. Set whether to perform secondary processing on AI1 curve calculation (E2-37 = 0, absolute value or inversion is not required by default).
5. Determine whether to adjust the denoising threshold, filter time, zero crossing threshold, jump point + jump amplitude (through E2-09 to E2-13) based on the actual conditions.
6. Set the frequency source to AI1 (b5-00 = 02).

After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the AC drive runs at 50% of C4-06 (rated motor frequency). When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.

- Application instance 2: AI2 temperature sensor mode
  AI2 of the MD630-INT provides the temperature sensor input function. When AI2 is used as the temperature sensor input, only E2-73 to E2-76 determine the function of AI2. AI2 temperature sensor mode is a completely independent channel. Analog input functions of AI2 do not work in the temperature sensor mode.

  To perform the following function: "AI2 used as PT100 temperature sensor input", do as follows.

  1. Set AI2 to PT100 temperature sensor mode (E2-73 = 1). In this case, analog input functions (defined by E2-16 to E2-67) of AI2 are disabled.
  2. Set E2-74 (AI2 motor temperature reach), E2-75 (motor overtemperature pre-alarm threshold), and E2-76 (motor overtemperature protection threshold).
  3. The temperature information collected in AI2 temperature mode is displayed in U0-90. L0057, L0058, and L0059 display the motor temperature reach signal, motor overtemperature fault, and motor overtemperature pre-alarm information.

  The AI2 temperature mode configuration is completed after preceding steps and hardware wiring.

Param.	Name	Default	Value Range	Description
E2-73	AI2 temperature mode - motor temperature sensor type	0	0 to 4	Defines the AI2 temperature sensor type. **Value description** 0: As analog input - AI2 is used as normal analog input 1: PT100 - AI2 is used as the input of the PT100 sensor. 2: PT1000 - AI2 is used as the input of the PT1000 sensor. 3: KTY84-130 - AI2 is used as the input of the KTY84-130 sensor. 4: PTC130 - AI2 is used as the input of the PTC130 sensor. **Note:** AI2 indicates the corresponding temperature value of PT100, PT1000, KTY84-130, and PTC130 sensors, which is displayed in U0-90.
E2-74	AI2 temperature mode - motor temperature reach	75℃	0 to 100	Defines the alarm threshold for motor temperature. **Note:** If the AI2 temperature exceeds the alarm threshold, L0057 of the B connector (AI2 temperature mode - motor temperature reached) is set to 1.

Param.	Name	Default	Value Range	Description
E2-75	AI2 temperature mode - motor overtemperature alarm threshold	110°C	0 to E2-76	Defines the motor overtemperature alarm threshold.
E2-76	AI2 temperature mode - motor overheat protection threshold	130°C	E2-75 to 200	Defines the motor overtemperature protection threshold.

5.2.10.9 Analog Output (AO) Terminals

List of Functions

The AO function refers to the analog output terminal.

Function	AO
Output function	Supported
Polarity selection	Supported
Curve type	Supported
2-point curve	Supported
Zero offset coefficient	Supported
Gain + offset	Supported
hardware source selection	Supported
Forced value	Supported
Correction (also called calibration)	Supported

Function description

The MD630 is equipped with an analog output terminal (AO1) and MD630N-INT does not have AO terminal. The AO terminal can select any function of the analog output terminal, and the corresponding curve or gain and deviation parameters.

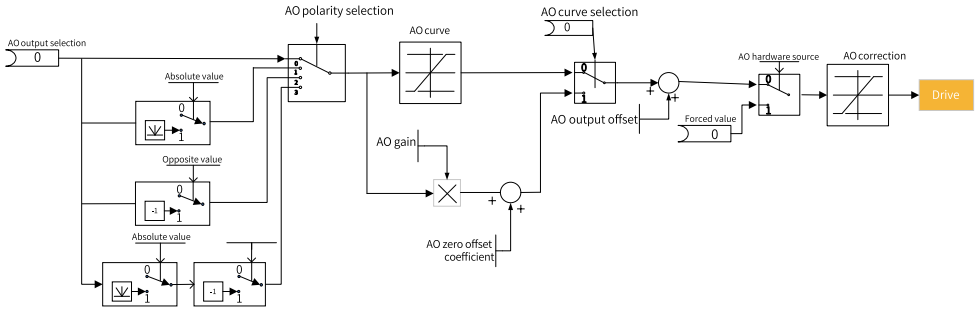


Figure 5-79 AO data flow diagram

AO terminal layout

AO terminal layout: For MD630S-INT, see CN5 in *" Terminal Layout of Standard Models" on page 81*. For MD630N-INT, no analog output terminals are available.

For the hardware wiring of the MD630S-INT high-speed input terminals, see *" AO terminal wiring" on page 91*.

Table 5–46 AO terminal DIP switch

Terminal Assignment			DIP Switch Description
Pin	ON	OFF	
S5	Current	Voltage	ON: AO current output mode and the output range is 0 mA to 20 mA
			OFF (default): AO is the voltage output mode and the output range is 0 to 10 V.

Note: For the current-type AO, 1 mA current corresponds to 0.5 V voltage. That is, 20 mA corresponds to 10 V.

AO Function

Function	Description	Scenarios	Description and related parameters
1. AO function selection	The AO terminals are set through the parameter group (E3-00 to E3-27). The AO terminal functions are set by the parameter E3-00.	/	"Table 5-47 AO1 function selection (for E3-00)" on page 352
2. Correction	These parameters are used to correct the AO to eliminate the impact of AO zero offset and gain. This group of parameters have been corrected by default. If restored to default, these setpoints are restored to the values calibrated by default. Generally, no calibration is needed on site.	Target voltage indicates the theoretical output voltage of the AC drive. During correction, make AO terminal outputs voltage, and save the measured values and ideal values to the above parameters. Then the AC drive automatically performs AI zero offset and gain correction. In cases where the ideal output voltage does not match the actual output voltage, make correction on site to match the sampled value with the reference value.	You need to calibrate the voltage on site in the following way: 1. Set the target voltage signal (about 2 V) of the AO terminal. 2. Set EE-12 to 2V. 3. Measure the voltage of AO terminal and set the value of parameter EE-13 to the measured value. 4. Set the target voltage signal (about 8 V) of the AO terminal. 5. Set EE-14 to 8V. 6. Measure the voltage of AO terminal and set the value of parameter EE-15 to the measured value. 7. For AO, it is suggested to use 2 V and 8 V as the two correction points. **Corresponding parameters** "Table 5-49 AO calibration parameter" on page 353
3. Other functions	-	-	"Table 5-50 Related parameters" on page 354 The analog output 0 V to 10 V corresponds to 0% to 100%. When the AO function is set to 1 (frequency setting), and the AC drive frequency is set to 50% of the rated frequency, the output voltage of the AO is 5 V (50% x 10 V).

Table 5–47 AO1 function selection (for E3-00)

Param.	Description	Default	Value Range	Description
E3-00	AO1 function selection	0	0 to 16	"Table 5-48 AO functions" on page 352

Table 5–48 AO functions

Value Range	Function	Description
0	Operating frequency	The AO outputs the voltage that corresponds to the ratio of the AC drive running frequency to rated motor frequency. (100.0% corresponds to the rated motor frequency.)
1	Frequency reference	The AO outputs the voltage that corresponds to the ratio of the AC drive frequency reference to rated motor frequency. (100.0% corresponds to the rated motor frequency.)

Value Range	Function	Description
2	Output current	The AO outputs the voltage that corresponds to the ratio of the AC drive output current to rated motor current. (100.0% corresponds to two times of the rated motor current.)
3	Motor output torque	The AO outputs the voltage that corresponds to the ratio of the AC drive output ratio to rated motor torque. (100.0% corresponds to two times of the rated motor torque.)
4	Output power	The AO outputs the voltage that corresponds to the ratio of the AC drive output power ratio to motor rated power. (100.0% corresponds to two times of the rated motor power.)
5	Output voltage	The AO outputs the voltage that corresponds to the ratio of the AC drive output voltage to rated motor voltage. (100.0% corresponds to 1.2 times of the rated motor voltage.)
6	HDI input	The AO output voltage follows the HDI input frequency. (50.0% corresponds to 20.00 kHz.)
7	AI1	The AO output voltage follows the AI1 input voltage. (100.0% corresponds to 10 V.)
8	AI2	The AO output voltage follows the AI2 input voltage. (100.0% corresponds to 10 V.)
12	Communication	The AO outputs the voltage that corresponds to the ratio of data that is written to 2002h/7313h address to 32767. (100.0% corresponds to AO communication setting)
13	Motor speed	The AO outputs the voltage that corresponds to the ratio of the motor speed to the motor speed at rated motor frequency (100.0% corresponds to the speed at the rated frequency).
14	Output current	The AO outputs the voltage that corresponds to the ratio of the AC drive output current to 1000 A. (100.0% corresponds to 1000.0 A)
15	Bus voltage	The AO outputs the voltage that corresponds to the ratio of the AC drive bus voltage to 1000 V. (100.0% corresponds to 1000.0 V)
16	Motor output torque (actual value, proportion to the rated motor torque)	AO outputs the voltage that corresponds to the ratio of AC drive output torque to the rated motor torque (100% corresponds to the rated motor torque, 50% corresponds to 0%, and 0% corresponds to the rated motor torque).

Table 5–49 AO calibration parameter

Param.	Name	Default	Value Range	Description
EE-12	AO target voltage 1	Factory-calibrated	-10.000 V to 10.000 V	Defines the AO target voltage 1, that is, the expected output voltage. **Note:** When analog voltage correction is performed on AO, a correction curve is formed through two points, corresponding to a target voltage and a measured voltage.
EE-13	AO measured voltage 1	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AO measured voltage 1, that is, the output voltage measured by the meter. **Note:** See EE-12.
EE-14	AO target voltage 2	Factory-calibrated	-10.000 V to 10.000 V	Defines the AO target voltage 2, that is, the expected output voltage. **Note:** See EE-12.
EE-15	AO measured voltage 2	Factory-calibrated	-10.000 V to 10.000 V	This parameter indicates the AO measured voltage 2, that is, the output voltage measured by the meter. **Note:** See EE-12.

Table 5–50 Related parameters

Param.	Description	Default	Value Range	Description
E3-03	AO polarity selection	0	0 to 33	Set the AO1 curve output polarity through the ones place of this parameter. 0: Normal - The output value on the AO curve is not changed. 1: Absolute value- The absolute value of the output value on the AO curve is used. 2: Opposite to normal value - The value opposite to the output value on the AO curve is used. 3: Opposite to absolute value - The value opposite to the absolute value of the output value on the AO curve is used.
E3-04	AO curve	0	0 to 11	The ones place of this parameter is used to set the AO1 curve type. 0: Two-point curve - Set the two-point curve parameters of AO1 through E3-05 to E3-08. 1: Gain+Offset - Set the gain and deviation parameters of AO1 through E3-17 to E3-18.
E3-05	Minimum input of AO1 curve	0.0%	-800.0% to E3-07	Defines the minimum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-06	Setting corresponding to AO1 curve minimum input	0.00V	0.00 V to 10.00 V	Defines the y-axis corresponding to the minimum input point of the AO curve, that is, the AO analog voltage.
E3-07	Maximum input of AO1 curve	100.0%	E3-05 to 800.0%	Defines the maximum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-08	Setting corresponding to AO1 curve maximum input	10.00V	0.00 V to 10.00 V	Defines the y-axis corresponding to the maximum input point of the AO curve, that is, the AO analog voltage.

Param.	Description	Default	Value Range	Description
E3-17	AO1 zero offset coefficient	0.0%	-100.0% to +100.0%	In the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). The zero offset coefficient 100% of AO1 corresponds to 10 V (or 20 mA). The standard output refers to the value corresponding to the analog output of 0 V to 10 V (or 0 mA to 20 mA) with no zero offset or gain correction. Zero offset = Zero offset coefficient x 10 V (or 20 mA) The AC drive supports one AO (AO1), which can be used to indicate the internal operating parameters in the analog mode. The parameter property indicated is defined by E3-00. Formula for calculating zero offset coefficient: $b = \frac{(X1 \times Y2 - X2 \times Y1)}{(X1 - X2) \times Y_{MAX}} \times 100\%$ Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2). Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. The value of E3-17 (AO zero offset coefficient) is 80%.
E3-18	AO1 gain	1.00	10.00 to 10.00	In the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). The zero offset coefficient 100% of AO1 corresponds to 10 V (or 20 mA). The standard output refers to the value corresponding to the analog output of 0 V to 10 V (or 0 mA to 20 mA) with no zero offset or gain correction. Zero offset = Zero offset coefficient x 10 V (or 20 mA) The AC drive supports one AO (AO1), which can be used to indicate the internal operating parameters in the analog mode. The parameter property indicated is defined by E3-00. Formula for calculating the gain: $K = \frac{(Y1 - Y2) \times X_{MAX}}{(X1 - X2) \times Y_{MAX}}$ For X_{MAX}, see *"Table 5-51 Relationship between analog output content and corresponding maximum values (Xmax)" on page 356*. Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2). Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. Therefore, the AO gain (E3-18) should be set to -0.5.
E3-23	AO1 output offset	0.00V	-10.00 V to +10.00 V	Set the output offset voltage of the AO. The voltage calculated by the AO curve plus this offset gets the final output.

Param.	Description	Default	Value Range	Description
E3-26	AO hardware source selection	0	0 to 11	Defines the AO curve input source through the ones place of this parameter. 0: Output function - The reference source is selected according to parameter E3-00. 1: Forced setpoint - The forced output value is selected according to parameter E3-27.
E3-27	AO1 forced value	0.00V	0.00 V to 10.00 V	Sets the forced AO value. **Note:** When the value of E3-26 is 1, the E2-27 setting is valid.

Table 5–51 Relationship between analog output content and corresponding maximum values (Xmax)

Analog Output Content	Corresponding Max. Value (Xmax)
Operating frequency	Rated output frequency
Frequency reference	Rated output frequency
Output current	2 x Rated motor current
Output torque (absolute value)	2 x Rated motor torque
Output power	2 x Rated power
Output voltage	1.2 x Rated drive voltage
Pulse input	20.00 kHz
AI1	10 V
Length	Maximum set length
Counting value	Maximum counting value
Communication	100.0%
Motor speed	Speed at the rated output frequency
Output current	1000.0 A
Output voltage	1000.0 V
Output torque (actual value)	Rated motor torque

Instances

To perform the following function: "AO outputs operating frequency", do as follows.

1. Allocate AO with function "Operating frequency" (E3-00 = 0).
2. To set AO curve to "0 V to 10 V corresponds to 0% to 100%":
3. Set E3-05 to 0.0%, and E3-06 to 0.00 V.
4. Set E3-07 to 100.0%, and E3-08 to 10.00 V.

After setting the preceding steps, the AO outputs the voltage that corresponds to the ratio percentage of the AC drive running frequency to the rated frequency when the device is running.

For example, if the rated frequency is 50 Hz and the running frequency is 25 Hz, the AO receives a value of 50%, and the AO output corresponds to 5 V.

5.2.10.10 DI Function Settings

5.2.10.10.1 Operation Pause (Terminal Control)

Scenarios

This function is used to pause the AC drive without changing the operation command.

Operation principles

Set parameter F0-03 (main command source of control channel 1) to 1 (terminal control) to enable the operation pause function in terminal control mode.

As shown in the following figure, the AC drive responds to the operation command of the DI terminal and starts only when the operation pause function is OFF. If the operation pause function is enabled when the AC drive is running, the drive is stopped in a way configured by the parameter d0-07 (stop mode during operation). If the operation command of the DI terminal is still valid after the stop, the AC drive starts automatically as long as the operation pause function is set to OFF.

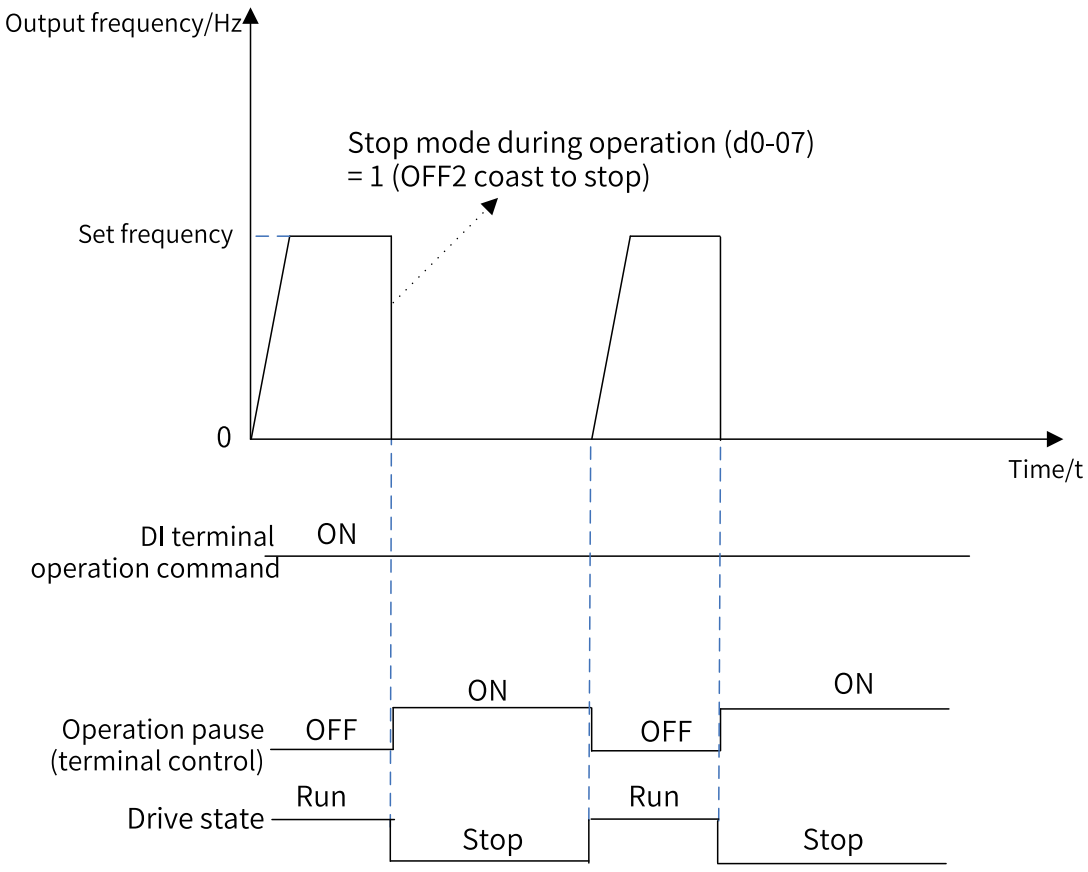


Figure 5-80 Schematic diagram of operation pause (terminal control)

Application examples

The following examples use terminals as the source of operation commands:

1. Set F0-03 (main command source of control channel 1) to 1 (terminal control).
2. Set F4-03 (DI1 function selection) to 1 (terminal start/stop module A_IN1).
3. Set F4-04 (DI2 function selection) to 10 (operation pause controlled by terminal)
4. Set E0-58 (DI active mode selection) to 0x0000 (active high).

With the above configuration, the AC drive operation commands can be controlled through DI1, and running pause can be controlled through DI2. The AC drive can only start when DI2 is disconnected and DI1 is connected.

5.2.10.10.2 Operation Enablement

Scenarios

This function is used to protect the AC drive from inadvertent startup through the operation enablement terminal.

Operation principles

The operation enablement function (terminal control) is the pre-condition for the AC drive to start. This function imposes no restriction on F0-03 (main command source of control channel 1), that is, the function can be used with any operation command source (operating panel, terminal, communication, or custom).

As shown in the following figure, the AC drive responds to the operation command of the DI terminal and starts only when the operation enablement function is ON and the corresponding DI terminal is valid. If this function is enabled when the AC drive is running, the drive is stopped in a way configured by the parameter d0-07 (stop mode during operation). If the operation command of the DI terminal is still valid after the stop, the AC drive starts automatically as long as the operation enablement function is ON and the corresponding DI terminal is valid.

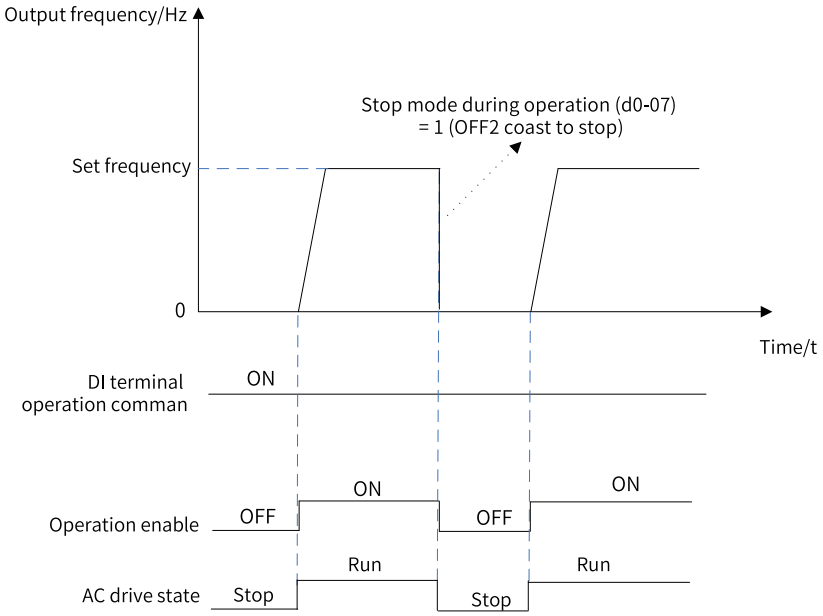


Figure 5-81 Schematic diagram of operation enablement (terminal control)

Application examples

The following examples use terminals as the source of operation commands:

1. Set F0-03 (main command source of control channel 1) to 1 (terminal control).
2. Set F4-03 (DI1 function selection) to 1 (terminal start/stop module A_IN1).
3. Set F4-04 (DI2 function selection) to 77 (operation pause controlled by terminal).
4. Set E0-58 (DI active mode selection) to 0x0000 (active high).

With the above configuration, the AC drive operation commands can be controlled through DI1, and operation enablement can be controlled through DI2. The AC drive can only start when both DI1 and DI2 are closed.

5.2.10.10.3 Speed Control/Torque Control Switchover

Scenarios

This function is used to switch the motor control mode of the AC drive between speed control and torque control.

Operation principles

There are two DI functions for speed control/torque control switchover, namely "29: torque control inhibition" and "46: speed control/torque control selection".

These two DI functions and the parameter F0-02 (motor control mode) jointly determine the control mode of the AC drive, as shown in the following figure.

If the DI terminal 29 is active, the system control mode is forcibly set to speed control and input to the system.

- When the speed control/torque control switchover terminal is active, the speed control mode stays unchanged while the torque control mode is forcibly switched to speed control mode.
- When this terminal is inactive, it has no effect on the motor control mode.

If the DI terminal 29 is inactive, the DI terminal 46 determines whether to switch the motor control mode set by F0-02. The control mode is input to the system.

- When the speed control/torque control switchover terminal is active, the motor control mode is different to that set by F0-02. That is, if F0-02 is set to speed control, the system is automatically switched to torque control. If F0-02 is set to torque control, the system is automatically switched to speed control.
- When this terminal function is inactive, F0-02 determines the current motor control mode of the system.

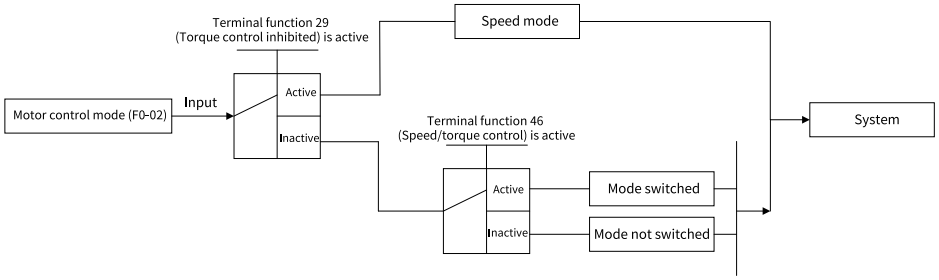


Figure 5-82 Schematic diagram of speed control/Torque control switchover

Application examples

1. Set F0-02 (Motor control mode) to 1 (torque control).
2. Set F4-03 (DI1 function selection) to 29 (torque control inhibition).
3. Set F4-04 (DI2 terminal selection) to 46 (speed control/Torque control selection).
4. Set E0-58 (DI active mode selection) to 0x0000 (active high).

With the above configuration, the motor control mode is speed control if the DI1 terminal is closed or if the DI1 terminal is open and the DI2 terminal is closed. The motor control mode is torque control if both the DI1 and DI2 terminals are open.

5.2.10.10.4 Immediate DC Braking

Scenarios

This function is used to immediately brake the motor in an emergency to ensure that the rotor stops securely.

Function description

When the DI terminal is set to immediate DC braking and is active, the AC drive outputs the current set by d0-30 (DC braking current at stop) and immediately brakes the motor. At this point, the motor is in a dynamic braking state. When the DI terminal is inactive, the DC braking state is lifted and the motor can operate normally.

Operation principles

When the motor operates normally, activating the immediate DC braking DI terminal makes the AC drive output the current set by d0-30 and immediately brake the motor to a stop. If the DI terminal remains active, the AC drive continuously outputs the current set by d0-30 to the motor and keeps the motor in a braking state. If the DI terminal becomes inactive while the operation command persists, the motor exits the braking state and starts normally.

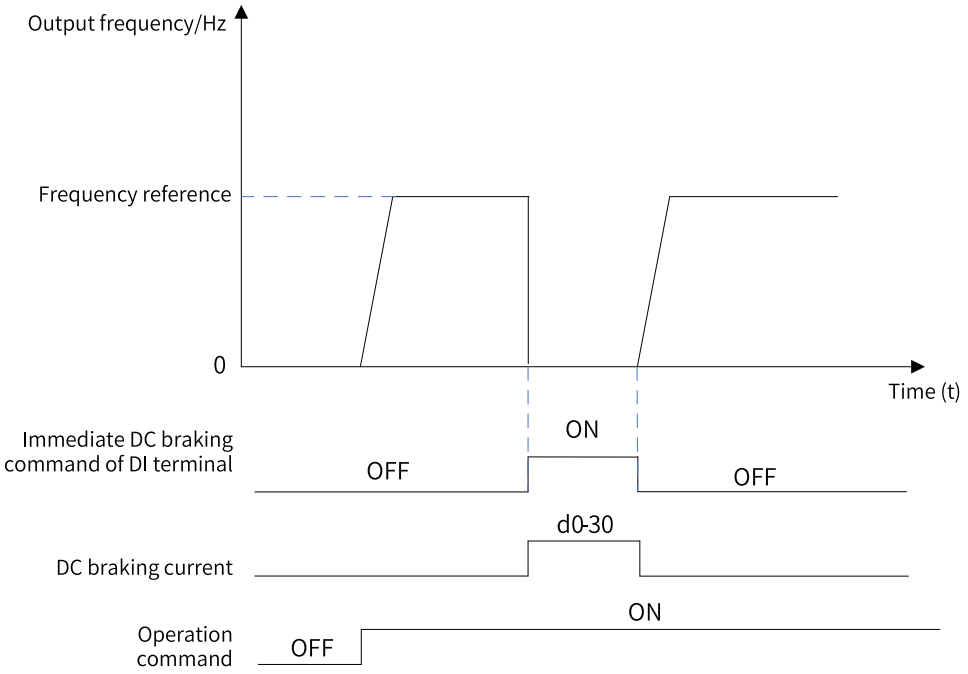


Figure 5-83 Schematic diagram of immediate DC braking

Application examples

1. Set F4-03 (DI1 function selection) to 32 (immediate DC braking).
2. Set d0-30 (DC braking current at stop) to 50%.
3. Set E0-58 (DI active mode selection) to 0x0000 (active high).

With the above configuration, if the DI1 terminal is closed, the AC drive outputs the current set by d0-30 and immediately brakes the motor to ensure that the rotor stops securely.

5.2.10.10.5 Decelerating to DC Braking

Scenarios

This function is used to decelerate the motor to a certain frequency before applying DC braking to ensure that the rotor stops securely.

Function description

When the DI terminal is set to decelerating to DC braking and is active, the AC drive first decelerates to the frequency set by d0-27 (start frequency of DC braking at stop), outputs the current set by d0-30 (DC braking current at stop), and immediately brakes the motor. At this point, the motor is in a

dynamic braking state. When the DI terminal is inactive, the DC braking state is lifted and the motor can operate normally.

Operation principles

When the motor operates normally, activating the decelerating to DC braking DI terminal makes the AC drive first decelerate to the frequency set by d0-27, output the current set by d0-30, and immediately brake the motor to a stop. If the DI terminal remains active, the AC drive continuously outputs the current set by d0-30 to the motor and keeps the motor in a braking state. If the DI terminal becomes inactive while the operation command persists, the motor exits the braking state and starts normally.

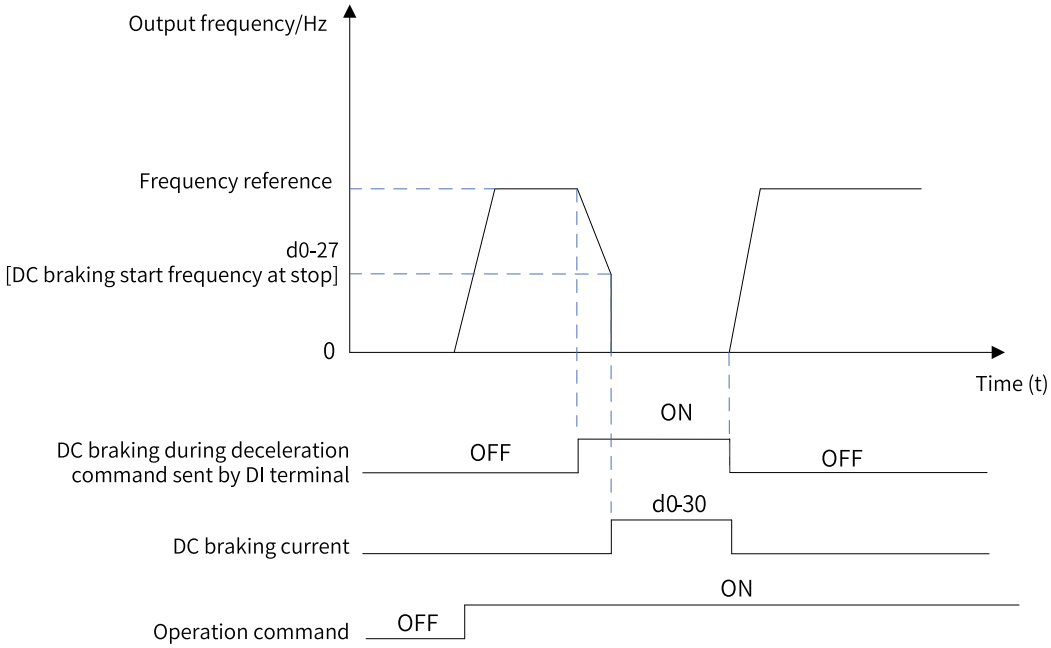


Figure 5-84 Schematic diagram of decelerating to DC braking

Application examples

1. Set F4-03 (DI1 function selection) to 49 (decelebrating to DC braking).
2. Set d0-30 (DC braking current at stop) to 50%.
3. Set d0-27 (start frequency of DC braking at stop) to 10 Hz.
4. Set E0-58 (DI active mode selection) to 0x0000 (active high).

With the above configuration, if the DI1 terminal is closed, the AC drive first decelerates to 10 Hz, outputs the current set by d0-30, and immediately brakes the motor to ensure that the rotor stops securely.

5.2.10.11 DO Function Settings

5.2.10.11.1 Motor overload pre-alarm

Scenarios

This function is used to monitor the motor overload state during operation and output the state through the DO terminal.

Function description

Before motor overload protection, the drive determines whether the motor load exceeds the overload pre-alarm threshold set by d1-47. If the threshold is exceeded, the DO terminal outputs an active signal.

Working Principle

The motor overload pre-alarm function is active when d1-47 is set to less than 100%. When the output current of the AC drive exceeds the motor's rated current, the motor overload cumulative value (L3210) starts to accumulate. When L3210 reaches the threshold set by d1-47, the motor pre-overload alarm (A111.1) is reported and the DO terminal outputs an active signal. The motor overload fault (E11-1) is reported when L3210 accumulates to 100%.

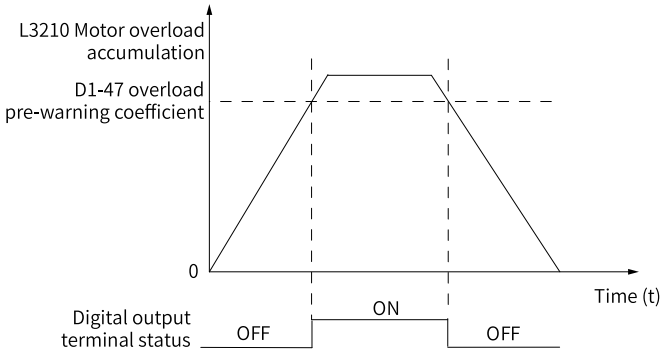


Figure 5-85 Motor overload pre-alarm

The relationship between overload current and fault reporting time is shown in the following figure.

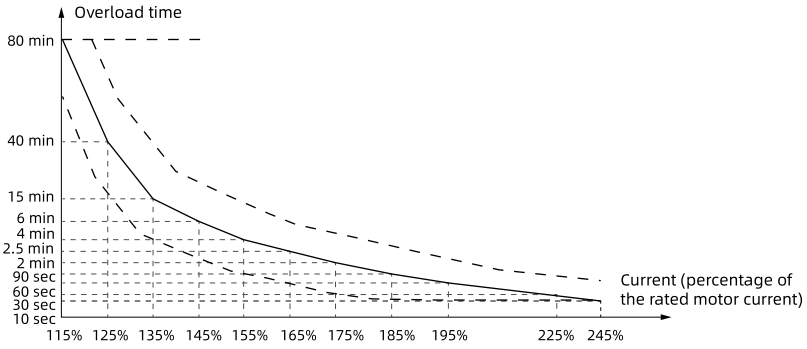


Figure 5-86 Motor overload curve

Instances

1. Set d1-45 to 1 to enable motor overload protection and set the motor overload pre-alarm coefficient (d1-47) to less than 100%.
2. Set E1-00 (RO output function selection) to 6 (motor overload pre-alarm).

With the above configuration, the RO terminal outputs an active signal when the system detects that the motor is in the pre-overload state.

5.2.10.11.2 Drive Overload Pre-alarm

Scenarios

This function is used to monitor the AC drive overload state during operation and output the state through the DO terminal.

Function description

Before drive overload protection, the system determines whether the drive load exceeds the pre-overload threshold set by A3-53. If the threshold is exceeded, the DO terminal outputs an active signal.

Operation principles

The drive overload pre-alarm function is active when A3-53 is set to less than 100%. When the output current of the AC drive exceeds the its rated current, the drive overload cumulative value starts to accumulate. When the cumulative value reaches the threshold set by A3-53, the drive pre-overload alarm (A110.1) is reported and the DO terminal outputs an active signal. The drive overload fault (E10-1) is reported when the drive overload cumulative value reaches 100%.

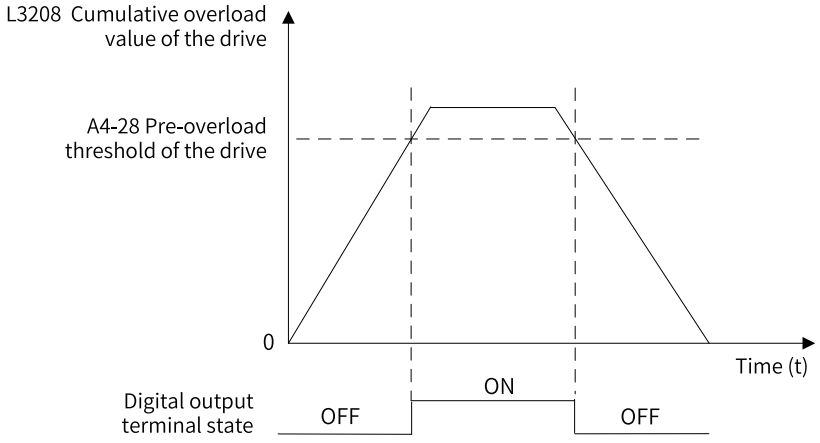


Figure 5-87 Schematic diagram of drive overload pre-alarm

Application examples

1. Set the drive pre-overload threshold (A3-53) to less than 100%.
2. Set E1-00 (RO output function selection) to 7 (drive overload pre-alarm).

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the pre-overload state.

5.2.10.11.3 Torque Limited

Scenarios

This function is used to limit the output torque in the speed control mode and output the state through the DO terminal.

Function description

The torque limit function is active in vector control (FVC or SVC) mode. To switch to this mode, set F0-01 (motor control method) to 0 (SVC). When F0-02 (motor control mode) is set to 0 (speed control) and the DO terminal is set to 14 (torque limited), the system is in the torque limit state and the corresponding DO terminal outputs an active signal.

Operation principles

This section takes motor forward operation as an example to demonstrate the DO function 14 (torque limited).

As shown in the following figure, the DO function 14 outputs DO function 14 only when the conditions below are met:

1. The torque limit flag is active.
2. The flag indicating a deviation of the motor operation speed is active.

For the first condition to be met, the motor object output torque (L3260) must exceed the limit threshold of the maximum positive torque (L3112) for a certain duration to enable system detection and assessment. If L3260 is lower than the limit threshold of L3112, the torque limit flag is invalid.

For the second condition to be met, there must be a deviation between the current motor operation speed and the target operation frequency of the system. If both conditions are met, the system determines that drive is in the torque limited state.

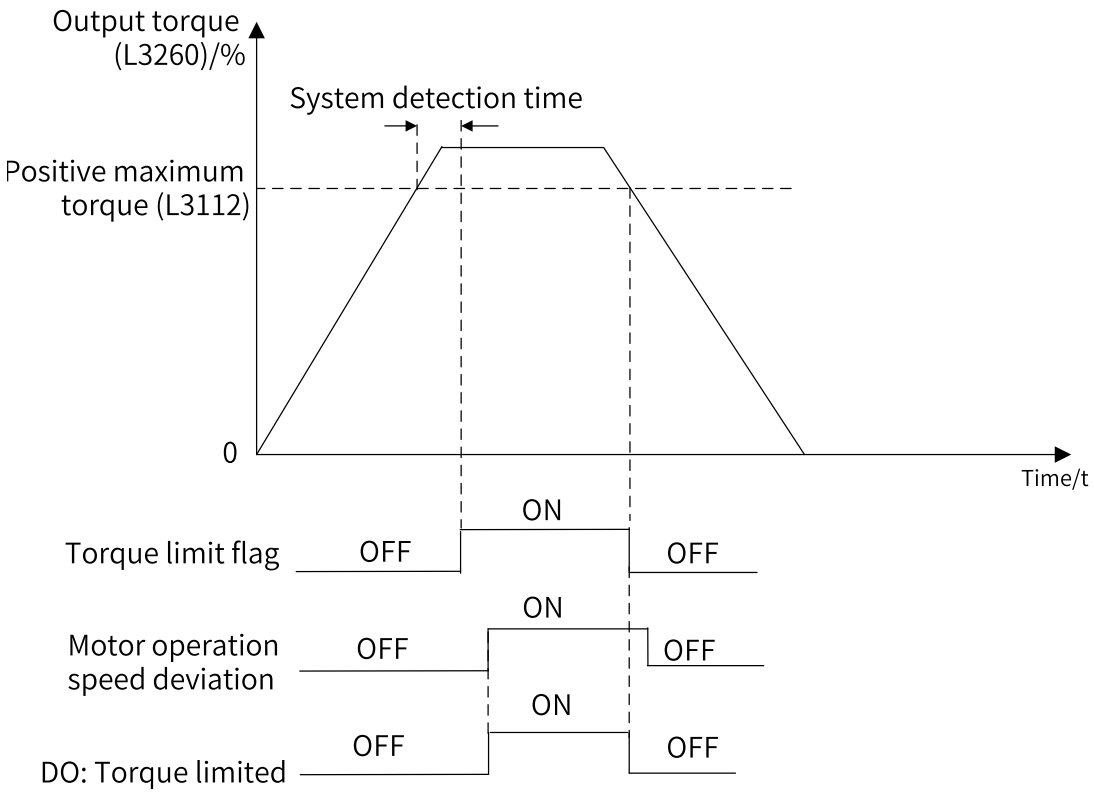


Figure 5-88 Operation principles

Application examples

1. Set d1-09 (digital setting of torque upper limit 1), d1-11 (torque upper limit 2), d1-10 (digital setting of torque lower limit 1), and d1-12 (torque lower limit 2).
2. Set E1-00 (RO output function selection) to 14 (torque limited).

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the torque limited state.

5.2.10.11.4 Undervoltage State Output

Scenarios

Undervoltage is prone to occur under conditions such as voltage dip and low grid voltage. This function is used to monitor the motor bus voltage under such conditions and output the state through the DO terminal.

Function description

The AC drive determines whether the system is in an undervoltage state by monitoring the bus voltage. If undervoltage occurs, the DO terminal outputs an active signal.

Operation principles

When the bus voltage is lower than the unervoltage threshold (A3-56) due to voltage dip or low grid voltage, the unervoltage fault (E9-1) is reported and the DO terminal outputs an active signal.

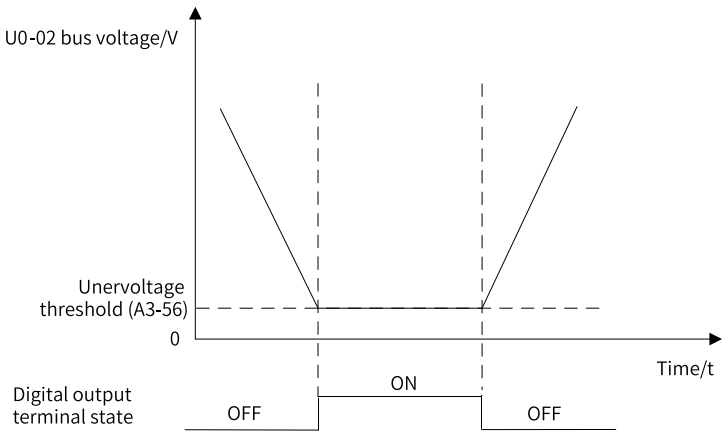


Figure 5-89 Schematic diagram of undervoltage state output

Application examples

Set E1-00 (RO output function selection) to 19 (undervoltage state output).

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the undervoltage state.

5.2.10.11.5 Communication Setting

Scenarios

This function is used to control the DO terminal output through remote communication.

Function description

When the DO terminal function is set to 20 (communication setting), the system sends a specific value to address 0x2001 or 0x7312, and the corresponding DO terminal outputs an active signal.

Working principle

For the digital output terminals RO, DO, FMR (for MD630S-INT), and the analog digital output terminals VDO1 to VDO6 of the MD630-INT AC drive, if the function 20 (communication setting) is selected, the address 0x2001 or 0x7312 is uniformly used.

This 16-bit address assigns each terminal to a specific bit position. The terminal outputs an active signal when 1 is written to the corresponding bit of 0x2001 or 0x7312. The terminal does not output an active signal when 0 is written.

The written data can be queried in U3-18.

Table 5–52 Bit positions of digital output terminals (communication setting)

Terminal Name	Bit Position at Address 0x2001 or 0x7312
RO	bit0
DO	bit4
FMR	bit8
VDO1	bit10
VDO2	bit11

Terminal Name	Bit Position at Address 0x2001 or 0x7312
VDO3	bit12
VDO4	bit13
VDO5	bit14
VDO6	bit15

Instances

Take the configuration of the DO terminal for communication setting as an example:

1. Set E1-04 (DO output function selection) to 20 (communication setting) and the address is 0x7312.
2. According to *"Table 5-52 Bit positions of digital output terminals (communication setting)" on page 367*, the DO terminal corresponds to bit4 at address 0x7312.
3. Confirm that the data to be sent is 0x0010 (bit4 is 1 and the remaining bits are 0).
4. Send 0x0010 to address 0x7312 to trigger the DO terminal to output an active signal.

5.2.10.11.6 Three-phase Loss

Scenarios

This function is used to monitor the phase loss state of the AC drive during operation and output the state through the DO terminal.

Function description

When the three-phase output current is too low, the AC drive is in the phase loss state and the DO terminal outputs an active signal.

Operation principles

When three-phase loss protection is enabled (d1-78 = 1), if the three-phase output current remains below the three-phase loss detection threshold (d1-82) for a specific duration (d1-81), the three-phase loss fault (E30-1) is reported and the DO terminal outputs an active signal.

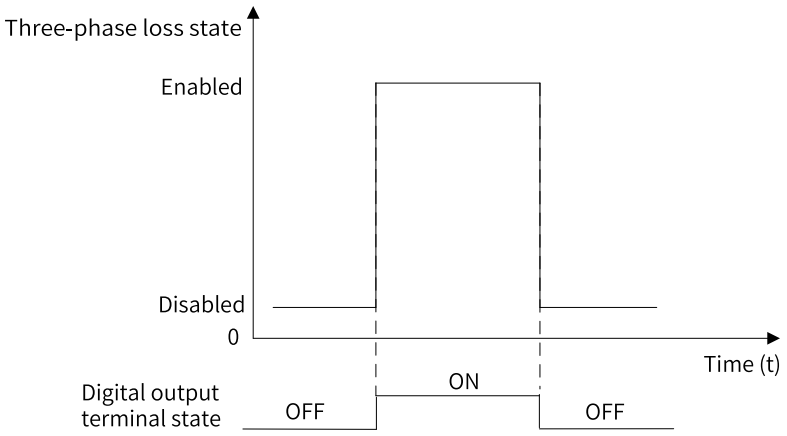


Figure 5-90 Schematic diagram of three-phase loss

Application examples

1. Set E1-00 (RO output function selection) to 32 (three-phase loss).
2. Set d1-78 to 1 to enable three-phase loss protection.

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the three-phase state.

5.2.10.11.7 AI Input Over-limit

Scenarios

This function is used to detect whether AI1 and AI2 analog inputs exceed the limit.

Function description

Analog inputs AI1 and AI2 feature over-limit detection function. For details, see *"5.2.10.8 Analog Input Terminal (AI)" on page 334*. When AI1/AI2 exceeds the limit, the DO terminal outputs an active signal if it is set to 31 (AI1 input over-limit)/44 (AI2 input over-limit).

Note that over-limit detection function is not supported for AI2 in temperature sensor mode.

Operation principles

The following figure takes AI1 as an example. If the AI1 input voltage remains higher than E2-14 (AI1 input protection upper limit) or lower than E2-15 (AI1 input protection lower limit) for a duration exceeding E2-34 (AI input protection time), the DO terminal outputs an active signal when it is set to 31 (AI1 input over-limit). If the AI1 input voltage is lower than E2-14 or higher than E2-15, the DO terminal does not output a signal.

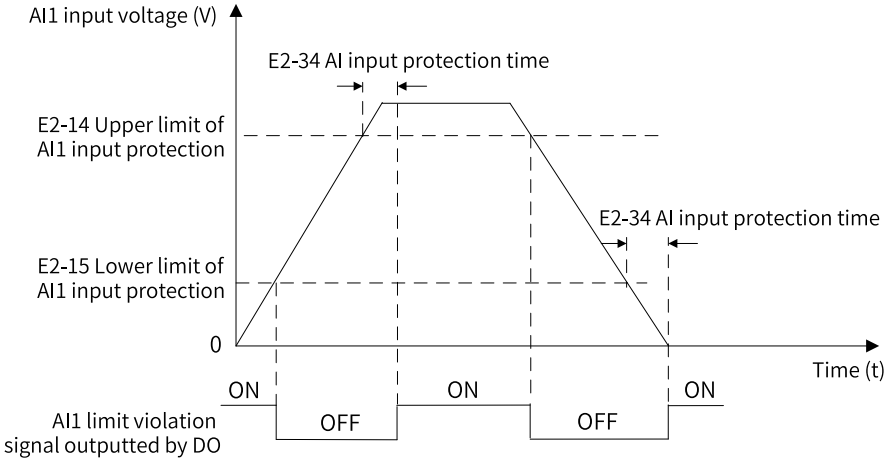


Figure 5-91 Schematic diagram of AI input over-limit

Application examples

Take AI1 as an example:

1. Set E2-14 (AI1 input protection upper limit) to 9 V, E2-15 (AI1 input protection lower limit) to 1 V, and E2-34 (AI input protection time) to 1 s.

2. Set E1-00 (RO output function selection) to 31 (AI1 input over-limit).

With the above configuration, the RO terminal outputs an active signal when the AI1 input voltage remains higher than 9 V or lower than 1 V for over 1 s. If the AI1 input voltage is 1 V to 9 V, the RO terminal does not output an active signal.

5.2.10.11.8 Module Over-temperature

Scenarios

This function is used to monitor whether the module temperature reaches the threshold through the control interface.

Function description

When the system detects that the module temperature reaches the threshold, the DO terminal outputs an active signal if it is set to 35 (module over-temperature).

Operation principles

As shown in the following figure, when the DO terminal function is set to 35 (module over-temperature) and U0-82 (module temperature) exceeds P0-33 (module temperature threshold), the DO terminal outputs an active signal. Otherwise, the DO terminal does not output an active signal.

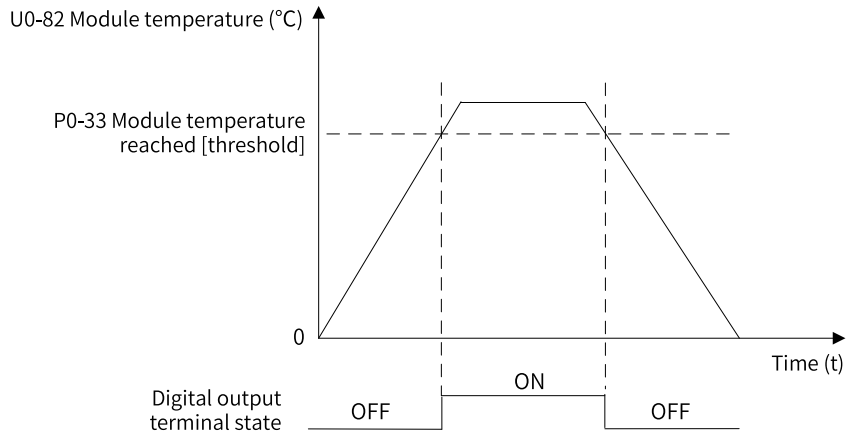


Figure 5-92 Schematic diagram of module over-temperature

Application examples

1. Set P0-33 (module temperature threshold) to 60°C.
2. Set E1-00 (RO output function selection) to 35 (module over-temperature).
3. With above configuration, the RO terminal outputs an active signal when U0-82 (module temperature) exceeds 60°C.

5.2.10.12 I/O Expansion Card

The MD6X0-Multi-function I/O expansion card (MD-IO-M1) supports seven control interfaces, including two DIs, one DO, one AI, one AO, one RO, and one RTD temperature input. AI supports voltage/current input, AO supports voltage/current output, and RO supports the sub-long mechanical life requirements of the lifting industry (1 million). The I/O expansion card is applicable to the MD630-INT T1-T5 model. It can be used to add up to two I/O expansion cards. For details on the operation of the two cards, see the *I/O Expansion Card User Guide*.

5.2.10.12.1 Digital Input (DI) Terminal of I/O Expansion Card

The IO expansion card is equipped with terminals DI1 and DI2. For details of the DI terminal functions, see the following table. For details, see the DI functions of MD630-INT in *"5.2.10.2 Digital Input (DI) Terminal" on page 297*.

The DI terminals of the I/O expansion card support forced functions. EA-00 (DI forced function enable) is used to set the type of DI forced function source (hardware input or forced value). EA-01 (DI forced data) is used to force the high-level/low-level input of the DI terminal. EA-02 to EA-10 are used to set DI-related delay parameters.

The DI parameters in the EA group for terminal control are shown below.

Param.	Name	Default	Value Range	Description
EA-00	DI forced function enable	0x0000	0x0000 to 0xFFFF	Defines the source of DI1 and DI2 (in bit sequence) values. **Description** 0: Hardware - from hardware input. 1: Forced value - from EA-01 (forced data).
EA-01	DI forced data	0x0000	0x0000 to 0xFFFF	Used to set the level state of DI1 and DI2 forcibly according to the bit sequence. **Value description** 0: Low level - The DI is forced to be low-level. 0: High level - The DI is forced to be high-level. **Note:** When the terminal bit of EA-00 is set to 1, the level is active and the DI input is unrelated to hardware.
EA-02	DI1 switch-on delay time	0.0	0.0s to 3600.0s	Defines the delay change time when DI1 is switched on. **Note:** The parameter can be used together with the filter time.
EA-03	DI1 switch-off delay time	0.0	0.0s to 3600.0s	Defines the delay change time when DI1 is switched off. **Note:** The parameter can be used together with the filter time.

Param.	Name	Default	Value Range	Description
EA-04	DI2 switch-on delay time	0.0	0.0s to 3600.0s	Defines the delay change time when DI2 is switched on. **Note:** The parameter can be used together with the filter time.
EA-05	DI2 switch-off delay time	0.0	0.0s to 3600.0s	Defines the delay change time when DI2 is switched off. **Note:** The parameter can be used together with the filter time.
EA-08	DI input filter time selection	0x0000	0x0000 to 0xFFFF	This parameter sets which DI filter time takes effect. **Value description** Bit 0: DI1 filter time - Selects DI1 filter time. 0: Filter time 1 - The DI1 filter time is set through EA-09. 1: Filter time 2 - The DI1 filter time is set through EA-10. Bit 1 DI2 filter time - Selects DI2 filter time. 0: Filter time 1 - The DI2 filter time is set through EA-09. 1: Filter time 2 - The DI2 filter time is set through EA-10.
EA-09	DI input filter time 1	0.010	0.000s to 1.000s	Defines the filter time 1 for the drive to respond to changes in DI terminal status.
EA-10	DI input filter time 2	0.010	0.000s to 1.000s	Defines the filter time 2 for the drive to respond to changes in DI terminal status.

5.2.10.12.2 Digital Output (DO)/Relay Output (RO) Terminal of I/O Expansion Card

The IO expansion card supports one digital output terminal (DO) and one relay output terminal (RO). Both support settings of switch-on delay and switch-off delay, as shown below.

EA-16 (DO1 output function selection) can be set to any output terminal function. EA-17 (RO1 output function selection) sets the output function of RO1, and EA-18 sets the output source of DO and RO (according to the bit sequence). For the DO function, see the description of the DO function of MD630-INT (*"5.2.10.3 Digital Output (DO) Terminal" on page 307*).

The DO and RO parameters in the EA group are shown below.

Param.	Name	Default	Value Range	Description
EA-16	DO1 output function selection	0: No output	0 to 44	Defines the DO output function.
EA-17	RO1 output function selection	0: No output	0 to 44	Defines the RO output function.
EA-18	DO/RO output source	0x0000	0x0000 to 0xFFFF	Defines the output source of DO and RO (according to the bit sequence). **Value description** 0: Output function setting - The output of DO and RO depends on parameters EA-16 and EA-17. 1: Forced value - The output of DO and RO depends on EA-19.

Param.	Name	Default	Value Range	Description
EA-19	Forced DO/RO value	0x0000	0x0000 to 0xFFFF	Defines the level state of forced values of DO and RO (in bit sequence). **Value description** 0: Low level - The output of DO and RO is forced to be low-level. 1: High level - The output of DO and RO is forced to be high-level. Note: It is valid when the corresponding bit of EA-18 is 1. In this case, the output is hardware-independent.
EA-20	DO/RO polarity selection	0x0000	0x0000 to 0xFFFF	Defines the polarity of the RO and DO terminals (in bit sequence). **Value description** 0: Positive logic - The output levels of the RO and DO are set to a positive logic. 1: Negative logic - The output levels of the RO and DO are set to a negative logic.
EA-21	DO1 switch-on delay time	0.0	0.0s to 3600.0s	Defines DO switch-on delay. The DO outputs an active signal only after the set delay time elapses.
EA-22	DO1 switch-off delay time	0.0	0.0s to 3600.0s	Defines the DO switch-off delay. DO outputs an inactive signal only after the set delay time elapses.
EA-23	RO1 switch-on delay time	0.0	0.0s to 3600.0s	Defines the RO1 switch-on delay time. The RO outputs an active signal only after the set delay time elapses.
EA-24	RO1 switch-off delay time	0.0	0.0s to 3600.0s	Defines the RO switch-off delay. RO outputs an inactive signal only after the set delay time elapses.
EA-25	Forced output state of DO/RO upon communication disconnection	0x0000	0x0000 to 0xFFFF	Defines the forced output value when communication between DO and RO (in bit sequence) terminals is disconnected. **Value description** 0: Low level - The output is forced to be low-level. 1: High level - The output is forced to be high-level.

5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card

The I/O expansion card supports one analog input terminal AI (input range is: -10 V to 10 V). The AI terminal supports both current and voltage signal types, which can be configured by parameters EA-31 to EA-58. For details, see *"5.2.10.8 Analog Input Terminal (AI)" on page 334*.

The hardware wiring of the AI terminal is shown below.

The AI voltage/current mode of the I/O expansion card is switched through the DIP switch S2 on the expansion card. Set the switch to ON for the current input mode, and to OFF for the voltage input mode.

Switch	Switch State	Function
S1 (AO mode)	ON	Current output
	OFF	Voltage output
S2 (AI mode)	ON	Current input
	OFF	Voltage input
S3 (Temperature sensor selection)	ON	PTC130 (single-core/three-core)
	OFF	PT100/PT1000/KTY84-130

AI used as DI

The AI terminal of the I/O expansion card can be used as a DI. For details, see the related section in MD630-INT user guide. Logic judgment on the AI input voltage is based on the values of EA-46 (high level threshold when AI used as DI) and EA-47 (low level threshold when AI used as DI).

- When the AI input voltage is greater than 7 V, the AI terminal status is high level.
- When the AI input voltage is below 3 V, the AI terminal status is low level.
- When the AI input voltage is between 3 V and 7 V, the AI terminal status is hysteresis.

Table 5–53 Parameters when AI used as DI

Param.	Name	Default	Value Range	Description
EA-46	High level judgment threshold when AI used as DI	7.0 V	5.5 V to 9.0 V	Defines the threshold for judging high level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-47	Low level judgment threshold when AI used as DI	3.0 V	1.0 V to 4.5 V	Defines the threshold for judging low level when the AI is used as the DI. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

AI curve gain

As a frequency source, each AI terminal supports two types of AI curves. The AI curve defines the relationship between the analog input voltage/current and the corresponding set values.

Table 5–54 Related parameters

Param.	Name	Default	Value Range	Description
EA-36	AI1 gain	1.00	-10.00 to 10.00	This parameter defines the gain multiple of AI1 analog sampling voltage. **Additional information:** 1. Used with E2-08, the AI1 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-37	AI1 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI1 analog sampling voltage. **Note:** 1. Used with E2-07, the AI1 input voltage can be amplified and offset. Suppose k is the gain, b is the offset, X is the AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage. The voltage after processing is as follows: Y = kX + b 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-38	AI1 denoising threshold	0.0%	0.0% to 100.0%	This parameter defines the AI1 denoising threshold. **Additional information:** 1. For the per unit percentage of the AI1 input after the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-39	AI1 fitter time	0.10s	0.00s to 10.00s	This parameter indicates the software filter time of AI1. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.
EA-40	AI1 zero-crossing threshold	0.0%	100.0%	Defines the zero-crossing threshold of AI1. The output within the defined range is 0.0%, which is used to eliminate fluctuation around zero. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default	Value Range	Description
EA-41	AI1 jump point	0.0%	-800.0% to 800.0%	Defines the jump point for AI1. If the difference between the value (per-unit value in percentage obtained after AI1 is processed by the AI curve) and the jump point is within the jump amplitude (E2-13), the value of the jump point will be output. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-42	AI1 jump amplitude	0.1%	0.0% to 100.0%	Defines the AI1 jump amplitude. If the input that relative to the E2-12 is within the range set by E2-13, the value of the jump point will be outputted. **Note:** This is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
EA-43	Upper limit of AI1 input protection	8.00 V	E2-15 to 10.00 V	Defines the AI1 input protection upper limit. It is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-14 or lower than E2-15, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 (AI open circuit fault).
EA-44	Lower limit of AI1 input protection	2.00 V	0.00 V to E2-14	Defines the AI1 input protection lower limit. It is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-15 or lower than E2-14, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 (AI open circuit fault).
EA-45	AI input protection time	0.01s	0.00s to 1.00s	Defines the duration during which the AI input exceeds the limit. When the AI input overlimit time is greater than or equal to the value of this parameter, the AI input overlimit flag (L0050 to L0051) is outputted or the AI open circuit fault is reported.
EA-48	AI polarity selection	0: Normal value	0 to 3	Defines AI1 input polarity. **Value description** 0: Normal - The input value of AI is used. 1: Absolute value - The absolute value of the AI input is used. 2: Inverted value - The inverted value of the AI input is used. 3: Inverted absolute value - The inverted absolute value of the AI input is used.
EA-49	AI curve selection	0x0001	0x0001 to 0x0002	Defines the output when the AI1 input voltage is lower than the minimum input of the curve. **Value description** 0000H: Minimum input - When the AI input is lower than the minimum input of the curve, the curve per unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per unit percentage is 0.0%.

Param.	Name	Default	Value Range	Description
EA-50	AI lower limit selection	0x0000	0x0000 to 0x0001	Defines the output when the AI1 input voltage is lower than the minimum input of the curve. **Value description** 0000H: Minimum input - When the AI input is lower than the minimum input of the curve, the curve per unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per unit percentage is 0.0%.
EA-51	Minimum input of AI curve 1	0.00 V	-10.00 to 10.00	Defines the minimum input point of x axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). **Note:** The x-axis of the AI curve represents the analog input voltage (or current), and the y-axis represents the per unit percentage corresponding to the analog input voltage. If the AI input is selected as the frequency source, y-axis represents the percentage to the rated frequency of the motor.
EA-52	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** Same as EA-51.
EA-53	Maximum input of AI curve 1	10.00 V	EA-51 to 10.00 V	Defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). **Note:** Same as EA-51.
EA-54	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** Same as EA-51.
EA-55	Minimum input of AI curve 2	0.00 V	-10.00 to 10.00	Defines the minimum input point of x axis on AI curve 2, that is, the minimum analog input voltage (or minimum analog input current). **Note:** Same as EA-51.
EA-56	Percentage corresponding to minimum input of AI curve 2	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** Same as EA-51.
EA-57	Maximum input of AI curve 2	10.00 V	0.00 (EA-55) to 10.00	Defines the maximum input point of x axis on AI curve 2, that is, the maximum analog input voltage (or maximum analog input current). **Note:** Same as EA-51.
EA-58	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** Same as EA-51.
EA-55	Minimum input of AI curve 2	0.00 V	-10.00 to 10.00	Defines the minimum input point of x axis on AI curve 2, that is, the minimum analog input voltage (or minimum analog input current). **Note:** Same as EA-51.

Param.	Name	Default	Value Range	Description
EA-56	Percentage corresponding to minimum input of AI curve 2	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. **Note:** Same as EA-51.
EA-57	Maximum input of AI curve 2	10.00 V	0.00 (EA-55) to 10.00	Defines the maximum input point of x axis on AI curve 2, that is, the maximum analog input voltage (or maximum analog input current). **Note:** Same as EA-51.
EA-58	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. **Note:** Same as EA-51.

Application instances

Application instance 1: To perform the following function: "AI1 as running frequency source", do as follows.

1. Set the curve selection for AI voltage and frequency: Select one of the two curves (EA-49 = 0x0001) from EA-51 to EA-58 (by default, AI1: curve 1, AI2: curve 2).
2. Set the mapping relationship of AI1 curve to "0 V to 10 V corresponds to 0% to 100%" (EA-51 = 0 V, EA-52 = 0%, EA-53 = 10 V, EA-54 = 100%).
3. Set whether to continue curve interpolation or keep the minimum curve input point of the curve (by default, EA-50 = 0x000) when the curve lower limit is exceeded.
4. Determine whether to adjust the denoising threshold, filter time, zero crossing threshold, jump point + jump amplitude (through EA-38 to EA-42) based on the actual conditions.
5. Set the frequency source to "Others" (b5-00 = Others). Select the input value of L2266 (I/O standard card 1-AI1) for the connector.

After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 input value of the I/O standard card 1 and the AI1 curve conversion of 50%. The drive runs at 50% of C4-06 (rated motor frequency). When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.

5.2.10.12.4 Analog Output (AO) Terminals of I/O Expansion Card

The IO expansion card supports one analog output terminal (AO) and the AO terminal supports output voltage and current signal types. You can select the required analog output terminal functions according to the usage scenario. For the AO function, see the description of the AO function of MD630-INT (*"5.2.10.9 Analog Output (AO) Terminals" on page 350*).

For the hardware wiring of the AO terminal, see the following.

When AO1 is used as the voltage output, the slide switch S1 is in the OFF state and supports 0 V to 10V voltage output. When AO1 is used as the current output, the slide switch S1 needs to be set to ON and supports 0 mA to 20 mA current output. For the DIP switch position of AO1 in voltage and current modes, see *"5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card" on page 373*.

The following table lists the AO function parameters.

Param.	Name	Default	Value Range	Description
EA-71	AO1 function selection	0 (Running frequency)	0-19	Defines the AO output function. After the corresponding function is selected, the AC drive calculates the per-unit percentage of the function variable and the corresponding output voltage is obtained after the AO curve.
EA-72	AO polarity selection	0	0-33	Sets the AO output polarity. **Value description** 0: Normal value - The AO curve output value remains unchanged. 1: Absolute value - The absolute value of the output value on the AO curve is used. 2: Inverted - The AO curve output value is inverted. 3: Absolute value inverted - The absolute value of AO curve output value phase is inverted.
EA-73	AO curve selection	0	0-11	Defines the AO curve type. **Value description** 0: Two-point curve - EA-74 to EA-77 are used to set the AO two-point curve parameters. 1: Gain + Offset - The gain and deviation is selected and set by parameters EA-78 and EA-79.
EA-74	Minimum input of AO curve	0.0	-800.0 to 100.0%	Defines the minimum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
EA-75	Percentage corresponding to minimum input of AO curve	0.00	0.00 V to 10.0 V	Defines the y-axis corresponding to the minimum input point of the AO curve, that is, the AO analog voltage.
EA-76	Maximum input of AO curve	100.0	0.0[EA-74] to 800.0	Defines the maximum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
EA-77	Percentage corresponding to the maximum input of AO curve	10.00V	0.00 V to 10.00 V	Defines the y-axis corresponding to the maximum input point of the AO curve, that is, the AO analog voltage.
EA-78	AO1 zero offset coefficient	0.0%	-100.0-100.0	Set the AO zero offset coefficient, which is b in the formula Y=kX+b, as a percentage of 10 V or 20 mA.
EA-79	AO1 gain	1.00	-10.00 to 10.00	Defines the AO gain, that is, k in the linear formula Y = kX+b.
EA-80	AO1 output offset	0.00V	-10.00 to 10.00	AO curve linearization parameters
EA-81	AO hardware source selection	0	0 to 11	Defines the AO curve input source through the ones. **Value description** 0: Output function - The source is defined by EA-71. 1: Forced value - The source is defined by EA-82.
EA-82	AO1 forced value	0.00	0.00 to 10.00	Defines the forced AO value. **Note:** This parameter is valid when EA-81 is set to 1.

5.2.10.12.5 RTD Motor Temperature Parameters of the I/O Expansion Card

The I/O expansion card supports independent AI sampling and independent processing of the temperature sampling of the RTD motor. Set the motor temperature sensor type and motor temperature reach threshold through EA-59 to EA-62, and view U1-45 (IO expansion card 1-RTD temperature value) to display the collected real-time temperature value.

Description: The temperature sampling resistor of the RTD is corrected by the factory. It is generally not required in the application site.

The hardware wiring of the temperature sampling of the motor of the RTD can be found in the following ways:

The expansion card is compatible with various temperature sensors (*"5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card" on page 373*). When the slide switch S3 is in the OFF state, it supports PT100, PT1000, and KTY84-130 sensors. When S3 is in the ON state, it supports PTC130 single-core and PTC130 three-core sensors. The I/O expansion card provides two wiring methods, with four-wire wiring for higher measurement accuracy. If the two-wire wiring is used, short the RTD + and RYD_I+, and the RTD- and RYD_I- terminals.

The following table describes the setting of motor temperature-related function codes.

Parameter	Name	Default Value	Value Range	Descriptions
EA-59	AI temperature mode - motor temperature sensor type	0	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 single-core 5: PTC130 three-core	Sets the type of AI temperature sensor. Option description: 0: Invalid - selected when AI temperature acquisition is not performed. 1: PT100 - AI is used as the input of the PT100 sensor. 2: PT1000 - AI is used as the input of the PT1000 sensor. 3: KTY84-130 - AI is used as the input of KTY84-130 sensor. 4: PTC130 single-core - AI used as PTC130 sensor input. 5: PTC130 three-core - AI used as PTC130 sensor input. Additional information: AI as PT100, PT1000, KTY84-130, PTC130 single-core The temperature corresponding to the input of the PTC-130 three-core sensor is displayed in U1-45.
EA-60	AI temperature mode - motor overtemperature protection threshold	130℃	EA-61 to 200	Defines the alarm threshold for motor temperature.
EA-61	AI temperature mode - motor overtemperature alarm threshold	110℃	0 to EA-60	Defines the motor overtemperature alarm threshold.
EA-62	AI temperature mode - motor temperature reach	75℃	0 to 100	Defines the motor overtemperature protection threshold.

The temperature display parameters U1-45 and U1-55 of the I/O expansion card.

Parameter	Name	Default Value	Value Range	Description
U1-45	I/O expansion card 1-RTD temperature value	0.0	PT100 (-25℃ to +200℃, ±0.5℃) PT1000 (-25℃ to +200℃, ±0.5℃) KTY84-130 (-40℃ to 260℃, ±0.5℃) PTC130 (100℃ to 180℃, ±5℃)	Displays the I/O expansion card 2-Motor temperature sampled by AI in unit of °.
U1-55	I/O expansion card 2-RTD temperature value	0.0	PT100 (-25℃ to +200℃, ±0.5℃) PT1000 (-25℃ to +200℃, ±0.5℃) KTY84-130 (-40℃ to 260℃, ±0.5℃) PTC130 (100℃ to 180℃, ±5℃)	Displays the I/O expansion card 2-Motor temperature sampled by AI in unit of °.

Application examples

The temperature sensor mode of the I/O expansion card is determined by the EA-59 AI temperature mode - Motor temperature sensor type. 0 is inactive. 1 to 4 is used as PT100, PT1000, KTY84-130, and PTC130 single-core. The temperature corresponding to the PTC130 three-core sensor input is displayed in U1-45.

To complete the function AI2 as PT100 temperature sensor input, you can set the function as follows:

1. Set AI to PT100 temperature sensor mode (EA-59 = 1).
2. Set AI temperature mode - Motor temperature reached (EA-62), AI temperature mode - Motor overheat pre-warning threshold (EA-61), AI temperature mode - Motor overheat protection threshold (EA-60).
3. The temperature information collected in AI temperature mode is displayed in U1-45.

After completing the preceding steps, plug in the I/O card to complete the AI temperature mode.

5.2.11 Prediction on Critical Component Lifetime

The MD630-INT supports the lifetime prediction function for the main circuit capacitor, IGBT, and cooling fan. During use, the aging state of the wear parts is monitored in real time. When the lifetime of the components reaches the pre-alarm threshold, advance notification is sent to avoid unavoidable loss due to aging of components. The predicted lifetime is calculated based on mathematical models and is used for reference only.

Application scenario

This function applies to applications where the drive needs to output an alarm when the lifetime deadline of critical components is approaching, so as to prevent major faults.

Function description

The life prediction function for the main circuit capacitor, IGBT, and cooling fan of the drive is enabled by default. The component lifetime is affected by environmental factors, especially the internal temperature of the drive. Therefore, the lifetime varies dynamically. When the environment changes, the lifetime changes. The MD630-INT drive detects the surrounding environment in real

time and calculates the theoretical lifetime of the components through mathematical models for your reference. The lifetime decreases from 100%. When the lifetime percentage decreases to the pre-alarm threshold, the drive notifies the user that an unknown fault may be caused by aging of the components. It is best to dispose of aging parts in advance.

Note: All parameters related to lifetime prediction are displayed only the A0-11 [Parameter access level] is set to 1 [Extended] or higher.

Function enable

This function is enabled by default, which can be disabled manually as needed. You can disable the lifetime prediction function through Ad-41 [Component lifetime prediction enable]. The prerequisite for enabling component lifetime prediction is that bit9 of A3-59 [Drive protection command word] is set to 1 (default). Otherwise, this function is invalid even if Ad-41 [Component lifetime prediction] is enabled. Note that if the lifetime prediction function is manually turned off during use of the drive, a large error may occur.

Param.	Name	Default	Setting range	Description
A3-59	AC drive protection command word	0x0392	Bit 0: Reserved 0: Disable 1: Enable Bit 1: Input phase loss detection (software) 0: Disable 1: Enable Bit 2: Derating at low frequencies disabled 0: Enable 1: Disable Bit 3: Whether overvoltage reported at stop 0: Overvoltage alarm during stop 1: No overvoltage alarm during stop Bit 4: Zero drift fault enable 0: Disable 1: Enable Bit 5: Bus voltage acquisition analysis 0: Disable 1: Enable Bit 6: Software overcurrent enable 0: Disable 1: Enable Bit 7: CBC enable 0: Disable 1: Enable (Continued)	Defines whether the protection command word of the drive is valid. The corresponding bit corresponds to the protection command word. Value description: Bit 0: Reserved Set whether the input phase loss detection (software) is enabled through Bit 1. 0: Disable 1: Enable Set whether to turn off derating at low frequencies through Bit 2. 0: Enable 1: OFF - Derating at low frequencies is disabled. Set whether to report overvoltage at stop through Bit 3. 0: Overvoltage alarm during stop 1: No overvoltage alarm during stop Set whether to enable zero drift through Bit 4. 0: Disable 1: Enable - E18.01 current acquisition error is reported when zero drift error is detected. Set whether to enable bus voltage acquisition analysis through Bit 5. 0: Disable 1: Enable Set whether to enable software overcurrent through Bit 6. 0: Disable 1: Enable - When the phase current exceeds the threshold, the custom software overcurrent fault E02.02 is reported. Set whether to enable CBC through Bit 7. 0: Disable 1: Enable - Enable the pulse-by pulse current limit function. (Continued)

Param.	Name	Default	Setting range	Description
A3-59	AC drive protection command word	0x0392	(Continued) Bit 8: Reserved Bit 9: Junction temperature protection enable 0: Disable 1: Enable Bit 10: Capacitor leakage enable 0: Disable 1: Enable Bit 11 to Bit 15: Reserved	(Continued) Bit 8: Overload curve enable 0: Disable 1: Enable Bit 9: Junction temperature protection enable 0: Disable 1: Enable Bit 10: Capacitor leakage enable 0: Disable 1: Enable
Ad-41	Component lifetime prediction function	0x000D	Bit 0: Capacitor life prediction of the main circuit 0: Disable 1: Enable Bit 1: Reserved 0: Disable 1: Enable Bit 2: IGBT life prediction 0: Disable 1: Enable Bit 3: Cooling fan life prediction 0: Disable 1: Enable Bit 4 to Bit 15: Reserved	Set whether to enable the lifetime prediction of the main circuit capacitor, IGBT, and fan (arranged in sequence according to the bit). Value description: Bit 0: Capacitor life prediction of the main circuit 0: Disable - Disable the capacitor lifetime prediction of the main circuit. 1: Enable - Enable the capacitor lifetime prediction of the main circuit. Bit 1: Reserved 0: Disable 1: Enable Bit 2: IGBT life prediction 0: Disable - Disable the IGBT lifetime prediction. 1: Enable - Enable the IGBT lifetime prediction. Bit 3: Cooling fan life prediction 0: Disable - Disable the cooling fan lifetime prediction. 1: Enable - Enable the cooling fan lifetime prediction. Note: If component lifetime prediction is turned off during use of the drive, it will result in inaccurate prediction.

Note: Currently, only T1 to T5 models support the lifetime prediction function. The other models do not support this function.

Display of component lifetime

The product provides theoretical component lifetime for your reference. The drive displays the lifetime of the main circuit capacitor, IGBT, and cooling fan in %. The displayed value decreases from 100%. The cooling fan also provides the remaining lifetime, in units of 10h. As shown in the following table, the data among the main circuit capacitor Ad-45, Ub-12, and L2272 is the same. The same applies to the IGBT and cooling fan.

Param.	Name	Monitoring range
Ad-45	Predicted lifetime margin of main circuit capacitor	0% to 100%
Ad-59	Predicted lifetime margin of IGBT	0% to 100%
Ad-64	Remaining operating time of the cooling fan predicted in real time (x 10 h)	0 to 65535 (x 10 h)
Ad-65	Predicted lifetime margin of fan	0% to 100%
Ub-12	Predicted lifetime margin of main circuit capacitor	0% to 100%
Ub-17	Predicted lifetime margin of IGBT	0% to 100%
Ub-19	Predicted lifetime margin of fan	0% to 100%
L2272	Predicted lifetime margin of main circuit capacitor	0% to 100%
L2276	Predicted lifetime margin of IGBT	0% to 100%
L2278	Predicted lifetime margin of fan	0% to 100%

Component lifetime alarm output

When the drive detects that the lifetime margin (unit %) of the components in the preceding Table 2 is lower than the lifetime pre-alarm threshold, the drive generates a lifetime pre-alarm, indicating that the drive may encounter a fault. If E1-00 (RO1 output function selection), E1-04 (DO1 output function selection), and E1-08 (FMR (HDO) output function selection) select function 46: Component lifetime pre-alarm output, the main circuit capacitance The lifetime pre-alarm is generated by any of the components of the IGBT and cooling fan, corresponding to RO1, DO1, and DO1. FMR generates signal output.

If you want to generate the signal output of RO1, DO1, and FMR when a lifetime pre-alarm occurs on a single component, set "B connector" to L0281 (Main circuit capacitor life pre-alarm output) or L0283 (IGBT lifetime pre-alarm output) or L0284 (Cooling fan lifetime pre-alarm output) in E1-00 (RO1 output function selection), E1-04 (DO1 output function selection) or E1-08 (FMR (HDO) output function selection). For details, see the connector section.

The following tables list the parameters related to component lifetime pre-alarm output. If the main circuit capacitor and IGBT have a lifetime pre-alarm, contact the manufacturer to replace the component. If the cooling fan has a lifetime pre-alarm, contact the manufacturer and replace the cooling fan under the manufacturer's guidance.

Param.	Name	Default	Setting range	Description
Ad-50	Main circuit capacitor lifetime alarm threshold	10.00%	0.00% to 30.00%	Defines the lead value of the main circuit capacitor lifetime. When the predicted lifetime or capacitance measurement value is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-45 is lower than Ad-50, a capacitor lifetime pre-alarm output is generated.
Ad-62	IGBT lifetime alarm threshold	10.00%	0.00% to 30.00%	Defines the lead value of IGBT lifetime alarm. When the predicted lifetime is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-59 is lower than Ad-62, an IGBT lifetime pre-alarm output is generated.
Ad-68	Cooling fan lifetime alarm threshold	10.00%	0.00% to 30.00%	Used to set the advance value for reporting fan lifetime alarm. When the predicted lifetime is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-65 is lower than Ad-68, an IGBT lifetime pre-alarm output is generated.

Param.	Name	Monitoring range
L0280	Lifetime alarm	0 to 1
L0281	Main circuit capacitor lifetime alarm output	0 to 1
L0283	IGBT lifetime alarm output	0 to 1
L0284	Cooling fan lifetime alarm output	0 to 1

5.2.12 Application Macro

5.2.12.1 Introduction to Applications

The application macro is a set of preset parameters. You can select one of the macros as the basis, modify some parameters based on functional requirements, and save the parameters as your own parameter set. This simplifies the commissioning process.

Application Scenario

This product application macro is divided into interface macro and industry macro.

The parameter set in the interface macro is mainly oriented to control interfaces such as digital input (DI), digital output (DO), and analog input (AI), facilitating user commissioning of control interface parameters.

The industry macro is mainly oriented to specific application scenarios, such as fans and pumps, to facilitate commissioning during application.

Description

The interface macro selection is set in A0-48 (Interface macro selection), which provides 18 interface macros, including terminal two-wire control for start/stop and terminal three-wire control for start/stop. The analog input is used as the frequency source, and control interface parameters such as channel 1/2 switchover, terminal module A/B, and channel 1/2 switchover are set.

The industry macro selection is set in A0-50 (Industry macro selection), which provides four industry macros, including fans, pumps, and pumps. Parameter sets for ceramic and logistics industries. Each set of parameters corresponds to a macro number. The user selects a set of macros based on the application scenario, adjusts and modifies the parameters based on actual requirements, and backs up the parameters after the final commissioning through the iFA commissioning software. You can download parameters with one click in the same scenario, greatly simplifying the commissioning process.

A0-48 (Interface macro selection) and A0-50 (Industry macro selection) are triggered macro selection parameters. The parameter set is automatically cleared after it is written correctly to the AC drive. You can view the interface macro and industry macro that were written successfully the last time in A0-49 (Interface macro effective value) and A0-51 (Industry macro effective value).

Related parameters:

The following table shows the related parameters.

Table 5–55 Parameters

Item	Name	Default	Value Range	Descriptions
A0-48	Interface macro selection	0	0 to 200	Used to set interface macro parameters. 0: No operation 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) Additional information: After the parameter operation is completed, this parameter is automatically restored to 0.
A0-49	Effective value of the interface macro	0	0 to 65535	Same as A0-48.

Item	Name	Default	Value Range	Descriptions
A0-50	Industry macro selection	0	0 to 300	0: No operation 201: Regular fan (MD630S 202: Normal water pump (MD630S Packaging Ceramic
A0-51	Effective value of industry macro	0	0 to 65535	Same as A0-50.

Operation Flowchart

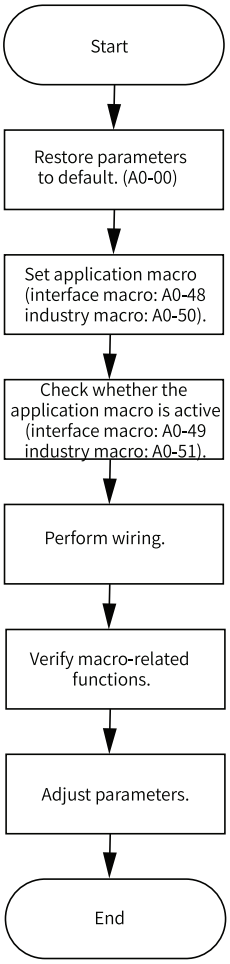


Figure 5-93 Operation Flowchart

Operation steps

It is recommended that users write a macro number from an interface macro or industry macro. Writing multiple macro numbers may result in abnormal functions.

Restore the default settings before writing each group of macros. Failure to comply may result in abnormal functions.

To select the interface macro or industry macro writing procedure:

1. to restore default settings of parameters Restore Parameters to Default Settings
2. Select a macro write, A0-48 (Interface macro selection) or A0-50 (Industry macro selection).
3. Check whether the value of A0-49 is the macro number written in step 2.
4. Whether it is an interface macro or an industry macro, it involves DI, DO, AI, For control interface functions such as AO, wiring is required. For details, see the description of each type of macro in "Interface Macro" and "Industry Macro".
5. Verify the macro function.
   For example, if 106 (Analog speed regulation in two-wire mode 2) is selected, when DI1 is closed and DI2 is disconnected, the motor runs in the forward direction at the speed provided by AI1. When DI1 is disconnected and DI2 is closed, the motor runs in the reverse direction at the speed provided by AI1. Adjust the AI1 input to control the set frequency. The RO function is the fault output, DO is the running output, and AO is the motor speed output.
6. Adjust and modify the parameters according to actual requirements.

Notes

1. To write an interface macro or industry macro, restore the default parameters.
2. It takes time to write parameters. Ensure that the power supply of the AC drive is normal.

5.2.12.2 Interface Macro

5.2.12.2.1 Interface Macro Overview

Scenarios

The MD630 AC drive provides 18 types of interface macros, which can be selected by setting the parameter A0-48 (interface macro selection).

1. Interface macros 102 to 110: Scenarios using terminals as operation commands
2. Interface macros 111 and 112: Scenarios using PID as the frequency source
3. Interface macro 115: Scenarios for switching between different frequency sources and terminal control modes by switching between set channels 1/2 and terminal modules A/B
4. Interface macro 116: Scenarios for switching between different frequency sources and operation command sources by switching between control channels 1/2 and set channels 1/2
5. Interface macro 117: Scenarios using the jogging function
6. Interface macros 113 and 114: Scenarios using Modbus for communication control

Interface macros can be used for the above application scenarios. For other scenarios not covered by these interface macros, you can configure the AC drive according to the actual needs.

Function description

The interface macro functions and parameters of the MD630-INT AC drive are all related to the control interface. To use the interface macros, select a macro number in A0-48 (interface macro selection) and a set of parameters is automatically written to implement the corresponding function, thus simplifying commissioning. For details, see *"Table 5-56 Interface Macros" on page 391*. The written parameters can be queried with the application macro function, as shown in the "Related Application Macro" column of the table below.

Table 5–56 Interface Macros

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	0	No operation	-	-
		101: quick commissioning macro	Scenario: Start/stop the AC drive and set the frequency through the local operating panel. After pressing the RUN key on the operating panel, the AC drive operates.	"5.2.12.2.2 Quick Commissioning Macro (101)" on page 394	MD630S-INT and MD630N-INT
		102: Two fixed speeds in single-wire mode	Scenario: Start/stop the AC drive through the terminal in single-wire mode, and set frequency through multi-reference. • When DI1 is closed, the AC drive runs at the first fixed frequency. • When DI1 and DI4 are closed, the AC drive operates at the second fixed frequency. • When DI1 is open, the AC drive stops.	"5.2.12.2.3 Two Fixed Speeds in Single-wire Mode (102)" on page 395	MD630S-INT
		103: Analog speed regulation in single-wire mode	Scenario: Start/stop the AC drive through the terminal in single-wire mode, and set frequency through analog inputs. • When DI1 is closed, the AC drive runs. • Set the frequency through AI1.	"5.2.12.2.4 Analog Speed Regulation in Single-wire Mode (103)" on page 397	MD630S-INT
		104: Four Fixed Speeds in Two-wire Mode 2	Scenario: Start/stop the AC drive through the terminals in two-wire mode 2, and set frequency through multi-reference. • When DI1 is closed and DI2 is open, the AC drive runs at the forward direction. When DI1 is open and DI2 is closed, the AC drive runs at the reverse direction. • Four fixed frequencies (Multi-speed) can be set through the combination use of DI4 and DI5.	"5.2.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (104)" on page 398	MD630S-INT
		105: Analog speed regulation in two-wire mode 1	Scenario: Start/stop the AC drive through the terminals in two-wire mode 1, and set frequency through analog inputs. • When DI1 is closed, the AC drive runs at the forward direction. Remain DI1 is closed and close DI2, then the AC drive runs at the reverse direction. • Set the frequency through AI1.	"5.2.12.2.6 Analog Speed Regulation in Two-wire Mode 1 (105)" on page 400	MD630S-INT
		106: Analog speed regulation in two-wire mode 2	Scenario: Start/stop the AC drive through the terminals in two-wire mode 2, and set frequency through analog inputs. • When DI1 is closed and DI2 is open, the AC drive runs at the forward direction. When DI1 is open and DI2 is closed, the AC drive runs at the reverse direction. • Set the frequency through AI1.	"5.2.12.2.7 Analog Speed Regulation in Two-wire Mode 2 (106)" on page 402	MD630S-INT

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	107: Analog speed regulation in two-wire mode 3	Scenario: Start/stop the AC drive through the terminals in two-wire mode 3, and set frequency through analog inputs. • When DI1 signal is in the rising edge and DI2 is closed, the AC drive runs. • When DI2 is open, the AC drive stops. • Set the frequency through AI1.	"5.2.12.2.8 Analog Speed Regulation in Two-wire Mode 3 (107)" on page 403	MD630S-INT
		108: Four fixed speeds in three-wire mode 2	Scenario: Start/stop the AC drive through the terminals in three-wire mode 2, and set frequency through multi-reference. • When DI1 signal is in the rising edge and DI4 is closed, the AC drive runs at the forward direction. When DI2 signal is in the rising edge and DI4 is closed, the AC drive runs at the diverse direction. When DI4 is open, the AC drive stops. • Four fixed frequencies (Multi-speed) can be set through the combination use of DI5 and DI6.	"5.2.12.2.9 Four Fixed Speeds in Three-wire Mode 2 (108)" on page 405	MD630S-INT
		109 (analog speed regulation in three-wire mode 1)	Scenario: Start/stop the AC drive through the terminals in three-wire mode 1, and set frequency through analog inputs. • When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed, the AC drive rotates in the reverse direction. When DI2 is open, the AC drive stops. • Set the frequency through AI1.	"5.2.12.2.10 Analog Speed Regulation in Three-wire Mode 1 (109)" on page 407	MD630S-INT
		110: Analog speed regulation in three-wire mode 2	Scenario: Start/stop the AC drive through the terminals in three-wire mode 2, and set frequency through analog inputs. • When DI1 signal is in the rising edge and DI4 is closed, the AC drive runs at the forward direction. When DI2 signal is in the rising edge and DI4 is closed, the AC drive runs at the diverse direction. When DI4 is open, the AC drive stops. • Set the frequency through AI1.	"5.2.12.2.11 Analog Speed Regulation in Three-wire Mode 2 (110)" on page 408	MD630S-INT
		111: Analog PID controller	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through PID regulation. • When DI1 is closed, the AC drive runs. • AI1 is used as the PID reference. • AI2 is used as the PID feedback.	"5.2.12.2.12 Analog PID Controller (111)" on page 410	MD630S-INT
		112: PID controller with fixed reference value	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through PID regulation. • When DI1 is closed, the AC drive runs. • Local PID is used as PID reference. • AI1 is used as the PID feedback.	"5.2.12.2.13 PID Controller with Fixed Reference Value (112)" on page 412	MD630S-INT

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	113: Modbus communication control macro	Scenario: Start/stop the AC drive and set the frequency through Modbus communication.	"5.2.12.2.14 Modbus Communication Control Macro (113)" on page 414	MD630S-INT
		114 (Modbus communication control macro with DI terminal start/stop control)	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through Modbus communication. • When DI1 is closed, the AC drive runs. • Set the frequency through Modbus.	"5.2.12.2.15 Modbus Communication Control Macro with DI Terminal Start/stop Control (114)" on page 415	MD630S-INT
		115: Multi-channel switchover 1	Scenario: Switch between the set channel (frequency reference) and terminal start/stop module (terminal control mode). • Terminal start/stop module A, set channel 1: Start the AC drive through DI1; make the AC drive run at reverse direction through DI2; set the frequency reference through AI1. • Terminal start/stop module B, set channel 2: Make AC drive start in the forward direction through DI6 and AC drive start in the reverse direction through DI7; set the frequency reference through AI2. • When DI4 is closed, the user can switch between set channel 1 and set channel 2. • When DI5 is closed, the user can switch between terminal start/stop module A and B.	"5.2.12.2.16 Multi-channel Switchover 1 (115)" on page 416	MD630S-INT
		116: Multi-channel switchover 2	Scenario: Switch between the two control channels and between the two set channels. • Control channel 1, set channel 1: Terminal control start/stop, frequency set by AI1 • Control channel 2, set channel 2: Communication controls start/stop and frequency reference. • When DI4 is closed, the user can switch between control channel 1 and control channel 2. • When DI5 is closed, the user can switch between set channel 1 and set channel 2.	"5.2.12.2.17 Multi-channel Switchover 2 (116)" on page 418	MD630S-INT
		117: Jog control through DI terminal	Scenario: Jog control through terminals. • When DI1 is closed, the AC drive starts by jogging 1 mode. • When DI2 is closed, the AC drive starts by jogging 2 mode.	"5.2.12.2.18 DI Terminal Jog Control (117)" on page 420	MD630S-INT

Operation steps:

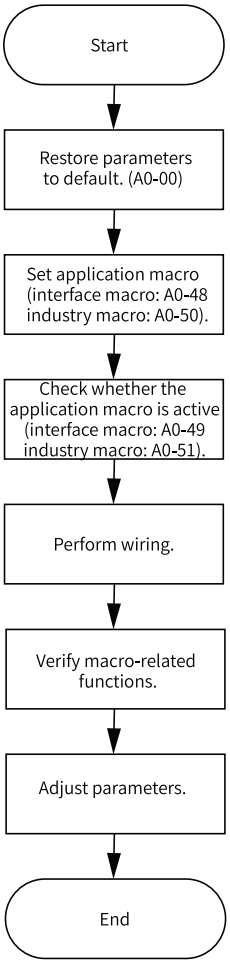


Figure 5-94 Procedure of using application macros

Precautions

1. Restore the default settings before writing a macro number to A0-48 (interface macro selection).
2. The successfully written macro parameter set is displayed in A0-49 (effective interface macro value).

5.2.12.2.2 Quick Commissioning Macro (101)

Scenarios

This macro is mainly used for initial product commissioning to quickly configure the motor to start at a low speed in V/f control mode, the operating panel as the command source, and local digital setting as the frequency reference source.

Wiring diagram

The quick commissioning macro does not involve the control interface function and does not require wiring.

Parameters to be written

After A0-48 (interface macro selection) is set to 101 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–57 Parameter set of quick commissioning macro

Parameter	Description	Default Value	Written Value
F0-01	Control method of motor 1	2: V/f mode	2: V/f mode
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	0: Operating panel
b5-00	Main frequency source	0: Set by the parameter (b5-01)	0: Set by the parameter (b5-01)
b5-01	Digital setting of main frequency	50.00 Hz	5.00 Hz
b7-04	Acceleration time	20.0 s	20.0s
b7-05	Deceleration time	20.0 s	20.0s
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.3 Two Fixed Speeds in Single-wire Mode (102)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, DI4, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

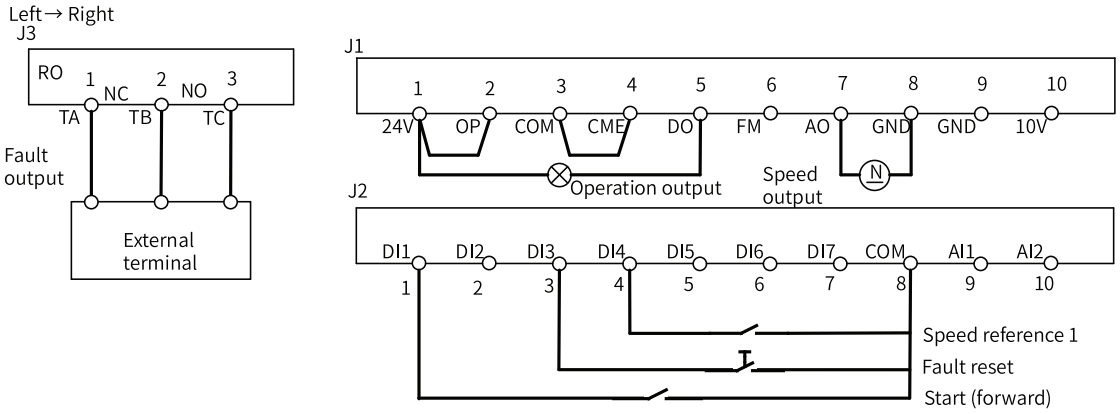


Figure 5-95 Wiring diagram of two fixed speeds in single-wire mode

Function description

- When DI1 is closed, the speed is set to 0.
- When DI1 is open, the AC drive stops.
- When both DI1 and DI4 are closed, the speed is set to 1.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 102 (two fixed speeds in single-wire mode), the AC drive automatically writes the parameters in the following table.

Table 5–58 Parameter set of two fixed speeds in single-wire mode

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.4 Analog Speed Regulation in Single-wire Mode

(103)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“Electrical Wiring” on page 61*.

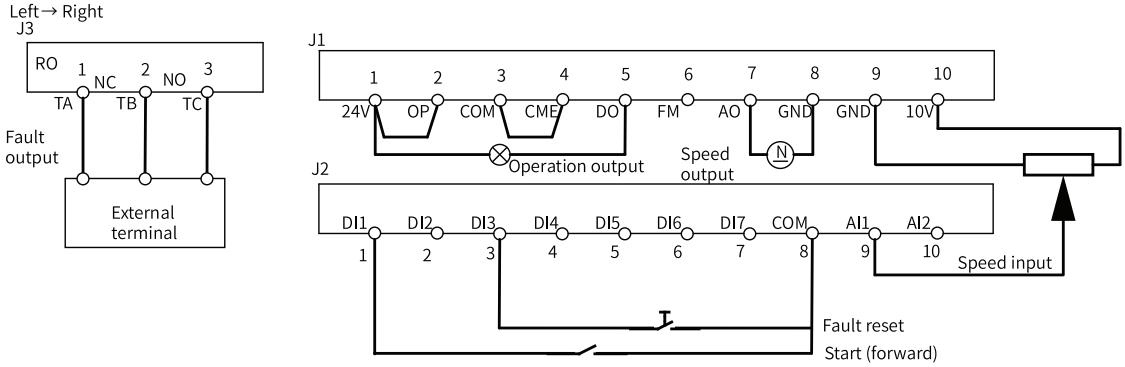


Figure 5-96 Wiring diagram of analog speed regulation in single-wire mode

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 103 (analog speed regulation in single-wire mode), the AC drive automatically writes the parameters in the following table.

Table 5–59 Parameter set of analog speed regulation in single-wire mode

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal

Parameter	Description	Default Value	Written Value
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault ouotput	2: Fault ouotput
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (104)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, DI5, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

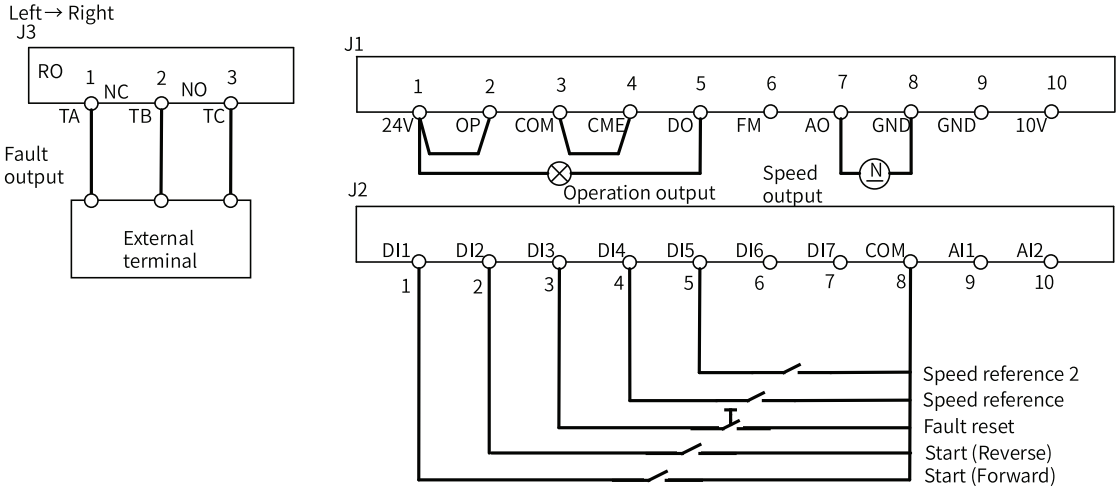


Figure 5-97 Wiring diagram of four fixed speeds in two-wire mode 2

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When DI1 is open and DI2 is closed, the AC drive starts in the reverse direction.
- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI4 and DI5.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 104 (four fixed speeds in two-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–60 Parameter set of four fixed speeds in two-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset

Parameter	Description	Default Value	Written Value
E0-03	DI4 function selection	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function selection	13: Multi-reference terminal 2	13: Multi-reference terminal 2
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
b8-11	Multi-reference 2	0.0%	75.0%
b8-12	Multi-reference 3	0.0%	100.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.6 Analog Speed Regulation in Two-wire Mode 1

(105)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *" Electrical Wiring" on page 61*.

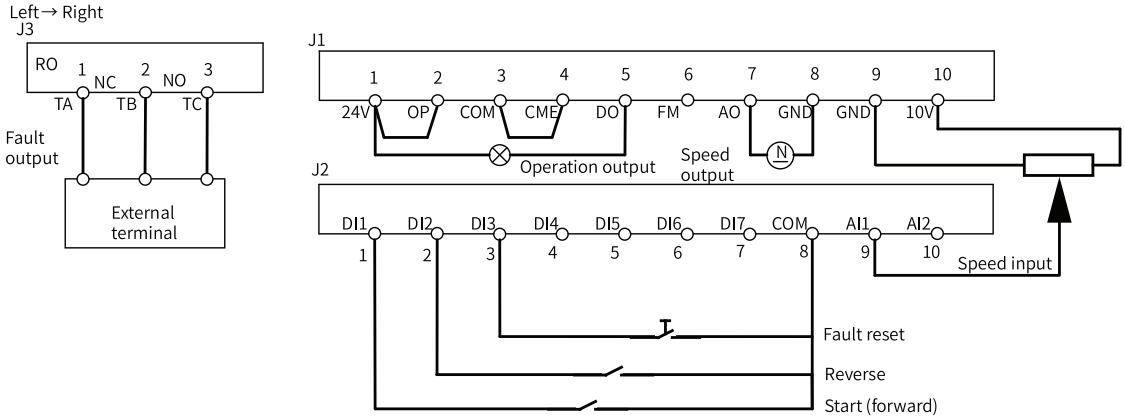


Figure 5-98 Wiring diagram of analog speed regulation in two-wire mode 1

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 105 (analog speed regulation in two-wire mode 1), the AC drive automatically writes the parameters in the following table.

Table 5–61 Parameter set of analog speed regulation in two-wire mode 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to the minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.7 Analog Speed Regulation in Two-wire Mode 2

(106)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *" Electrical Wiring" on page 61*.

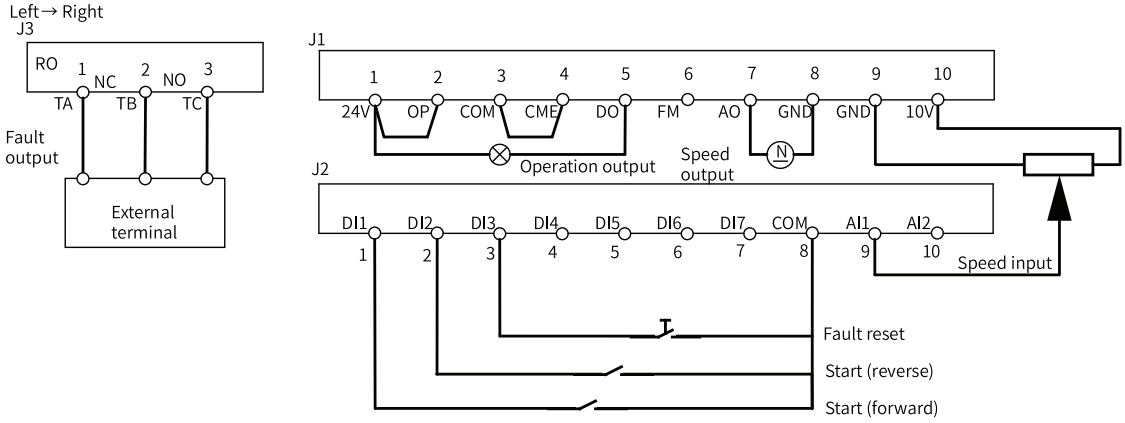


Figure 5-99 Wiring diagram of analog speed regulation in two-wire mode 2

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When DI1 is open and DI2 is closed, the AC drive starts in the reverse direction.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 106 (analog speed regulation in two-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–62 Parameter set of analog speed regulation in two-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1

Parameter	Description	Default Value	Written Value
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.8 Analog Speed Regulation in Two-wire Mode 3

(107)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *" Electrical Wiring" on page 61*.

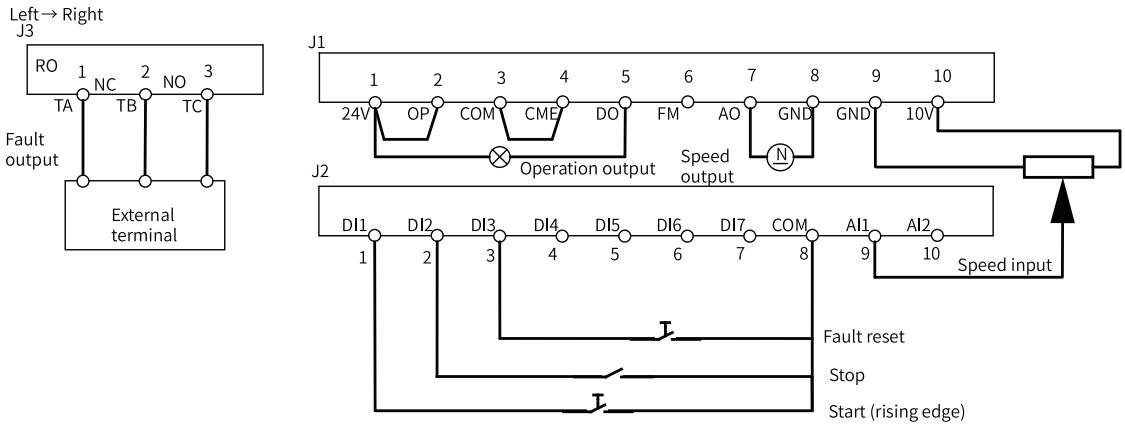


Figure 5-100 Wiring diagram of analog speed regulation in two-wire mode 3

Function description

- When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI2 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 107 (analog speed regulation in two-wire mode 3), the AC drive automatically writes the parameters in the following table.

Table 5–63 Parameter set of analog speed regulation in two-wire mode 3

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1:	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	4: IN1P for (rising edge) start, IN2 for stop
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function

Parameter	Description	Default Value	Written Value
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to the minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.9 Four Fixed Speeds in Three-wire Mode 2 (108)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, DI5, DI6, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

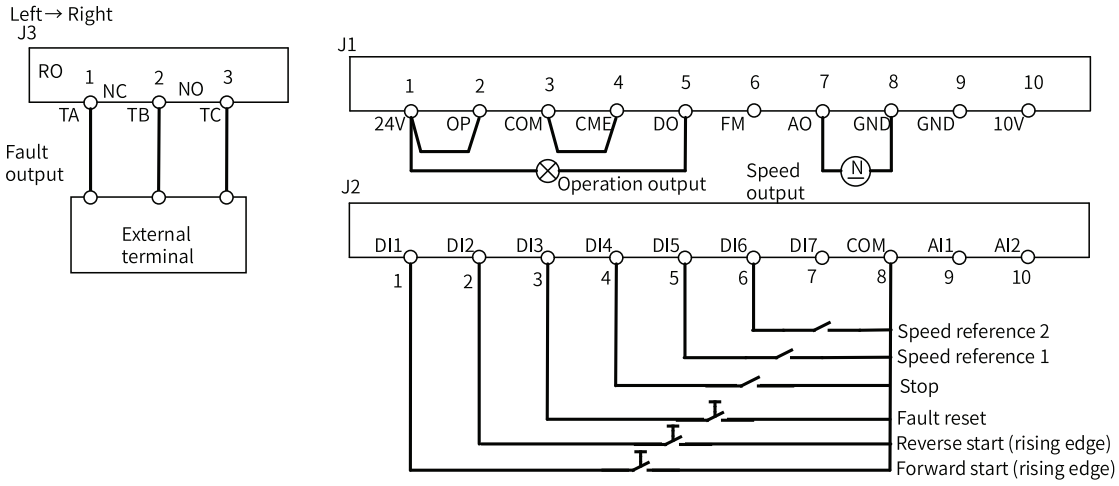


Figure 5-101 Wiring diagram of four fixed speeds in three-wire mode 2

Function description

- When DI4 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed and DI2 transitions from open to closed

(triggered from 0 to 1), the AC drive starts in the reverse direction. When DI4 is open, the AC drive stops.

- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI5 and DI6.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 108 (four fixed speeds in three-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–64 Parameter set of four fixed speeds in three-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	6: IN1P for forward start (rising edge), IN2P for reverse start (rising edge), IN3 for stop
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	12: Multi-reference terminal 1
E0-05	DI6 function selection	0: No function	13: Multi-reference terminal 2
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
b8-11	Multi-reference 2	0.0%	75.0%
b8-12	Multi-reference 3	0.0%	100.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.10 Analog Speed Regulation in Three-wire Mode 1

(109)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“Electrical Wiring” on page 61*.

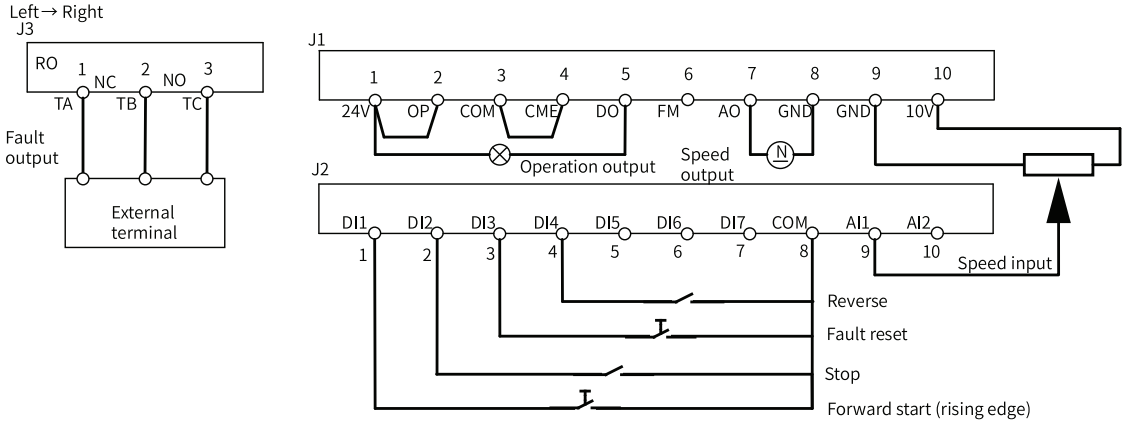


Figure 5-102 Wiring diagram of analog speed regulation in three-wire mode 1

Function description

- When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed, the AC drive rotates in the reverse direction. When DI2 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 109 (analog speed regulation in three-wire mode 1), the AC drive automatically writes the parameters in the following table.

Table 5–65 Parameter set of analog speed regulation in three-wire mode 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	5: IN1P for start (rising edge), IN2 for stop, IN3 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.11 Analog Speed Regulation in Three-wire Mode 2

(110)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In

the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in “ *Electrical Wiring” on page 61*.

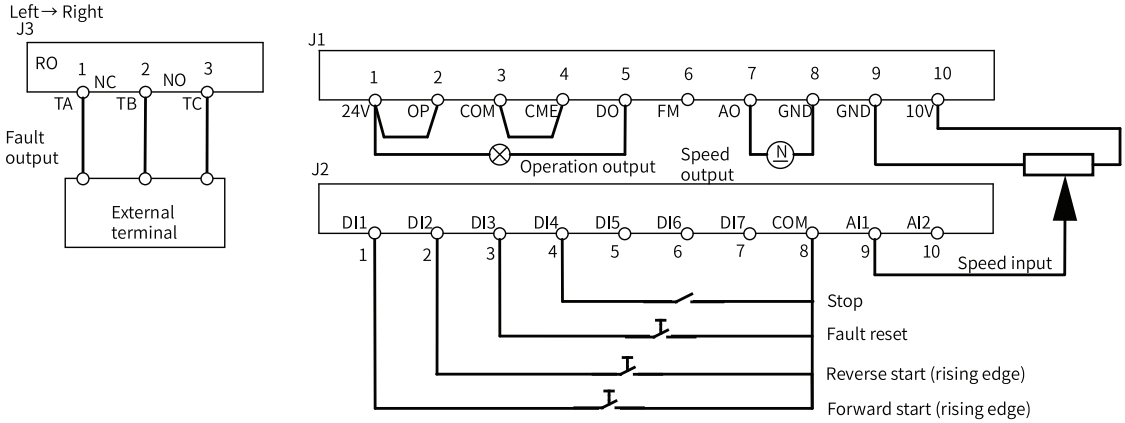


Figure 5-103 Wiring diagram of analog speed regulation in three-wire mode 2

Function description

- When DI4 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed and DI2 transitions from open to closed (triggered from 0 to 1), the AC drive rotates in the reverse direction. When DI4 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 110 (analog speed regulation in three-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5-66 Parameter set of analog speed regulation in three-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	6: IN1P for forward start (rising edge), IN2P for reverse start (rising edge), IN3 for stop

Parameter	Description	Default Value	Written Value
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.12 Analog PID Controller (111)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID controller.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, AI2, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

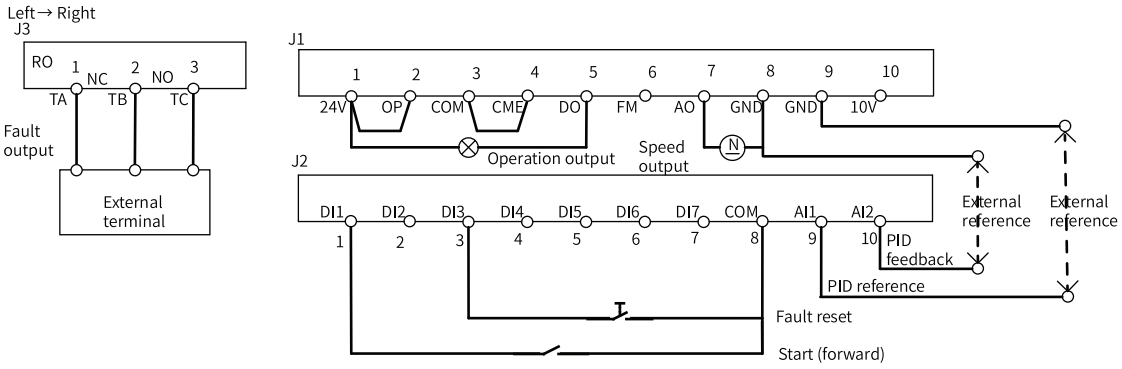


Figure 5-104 Wiring diagram of analog PID controller

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- AI1 is used as the PID reference source and AI2 as the feedback source.
- The frequency is set by the operation result of the PID controller.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 111 (analog PID controller), the AC drive automatically writes the parameters in the following table.

Table 5–67 Parameter set of analog PID controller

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	8: PID
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
P2-00	Process PID enablement	0: Disable	1: Enable
P2-01	PID action direction	0: Forward	0: Forward
P2-02	PID reference source	0: PID digital setting	1: AI1
P2-04	PID feedback source	0: AI1	1: AI2
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%

Parameter	Description	Default Value	Written Value
E2-44	Minimum input of AI curve 2	0.00 V	0.00 V
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0%	0.0%
E2-46	Maximum input of AI curve 2	10.00 V	10.00 V
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.13 PID Controller with Fixed Reference Value (112)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID controller.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

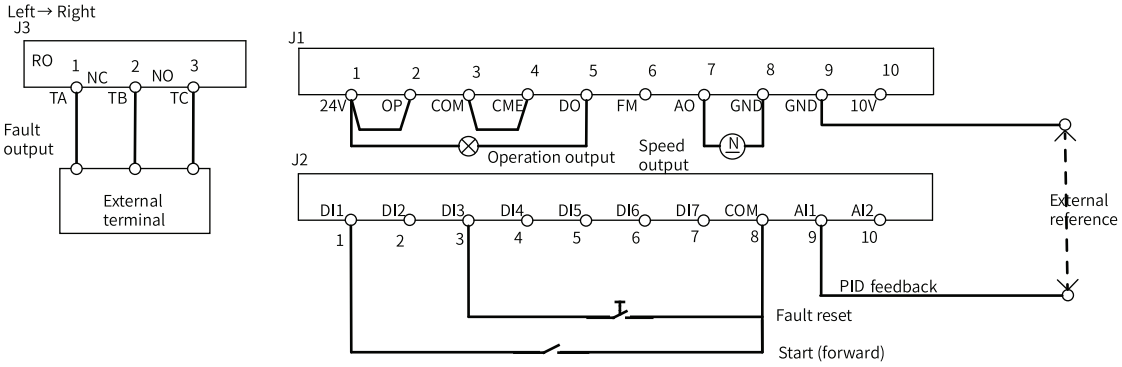


Figure 5-105 Wiring diagram of PID controller with fixed reference value

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- P2-03 (PID digital setting) is used as the PID reference source and AI1 as the feedback source.
- The frequency is set by the operation result of the PID controller.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 112 (PID controller with fixed reference value), the AC drive automatically writes the parameters in the following table.

Table 5–68 Parameter set of PID controller with fixed reference value

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	8: PID
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
P2-00	Process PID enablement	0: Disable	1: Enable
P2-01	PID action direction	0: Forward	0: Forward
P2-02	PID reference source	0: PID digital setting	0: PID digital setting
P2-03	PID digital setting	50.0%	50.0%
P2-04	PID feedback source	0: AI1	0: AI1
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.14 Modbus Communication Control Macro (113)

Scenarios

This macro is mainly used to start/stop the AC drive and set the frequency through Modbus communication.

Wiring diagram

This macro involves the wiring of terminals 485+ and 485-, as shown below. J1, J2, J3, and J5 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

With this macro, all commands and information of the AC drive (including start, stop, and frequency) are supported by the communication link. Therefore, no wiring is required for other control interfaces.

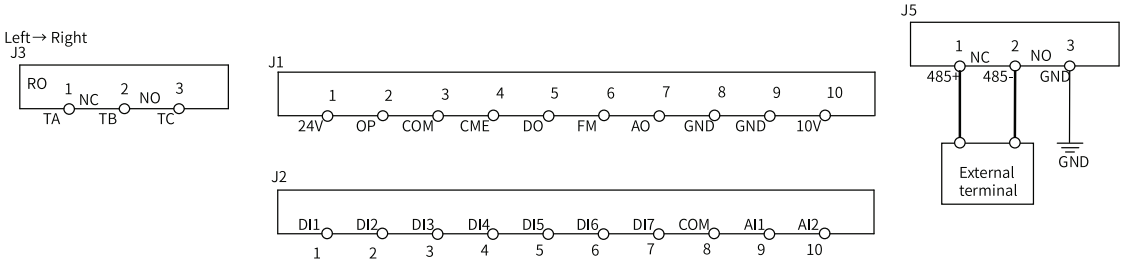


Figure 5-106 Wiring diagram of Modbus communication control macro

Function description

- Modbus communication is used to start/stop the AC drive and set the frequency.
- Modbus communication is used to read the state information of the AC drive.

Parameters to be written

After A0-48 (interface macro selection) is set to 113 (Modbus communication control macro), the AC drive automatically writes the parameters in the following table.

Table 5–69 Parameter set of Modbus communication control macro

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9: Communication
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.15 Modbus Communication Control Macro with DI

Terminal Start/stop Control (114)

Scenarios

This macro is mainly used to start/stop the AC drive through the DI terminal, set the frequency through Modbus communication, and read other information of the drive.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, J3, and J5 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

With this macro, only the frequency information is supported by the communication link. Therefore, other control interfaces need to be wired.

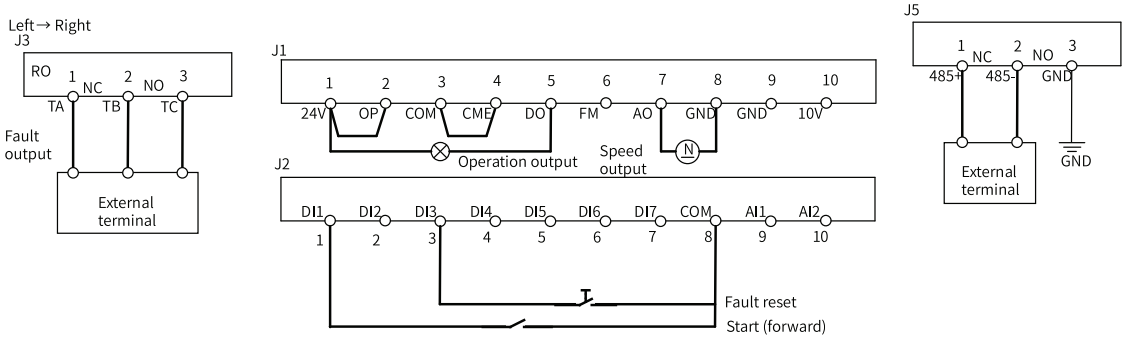


Figure 5-107 Wiring diagram of Modbus communication control macro with DI terminal start/stop control

Function description

- When DI1 is closed, the AC drive starts.
- When DI1 is open, the AC drive stops.
- When DI3 is closed, the AC drive resets the fault.
- Modbus communication is used to control the frequency and read the state information of the AC drive.

Parameters to be written

After A0-48 (interface macro selection) is set to 114 (Modbus communication control macro with DI terminal start/stop control), the AC drive automatically writes the parameters in the following table.

Table 5–70 Parameter set of Modbus communication control macro with DI terminal start/stop control

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal

Parameter	Description	Default Value	Written Value
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9 Communication
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.16 Multi-channel Switchover 1 (115)

Scenarios

This macro is mainly used to switch between two terminal start/stop modules and two set channels.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI7, AI1, AI2, RO, DO, and AO, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

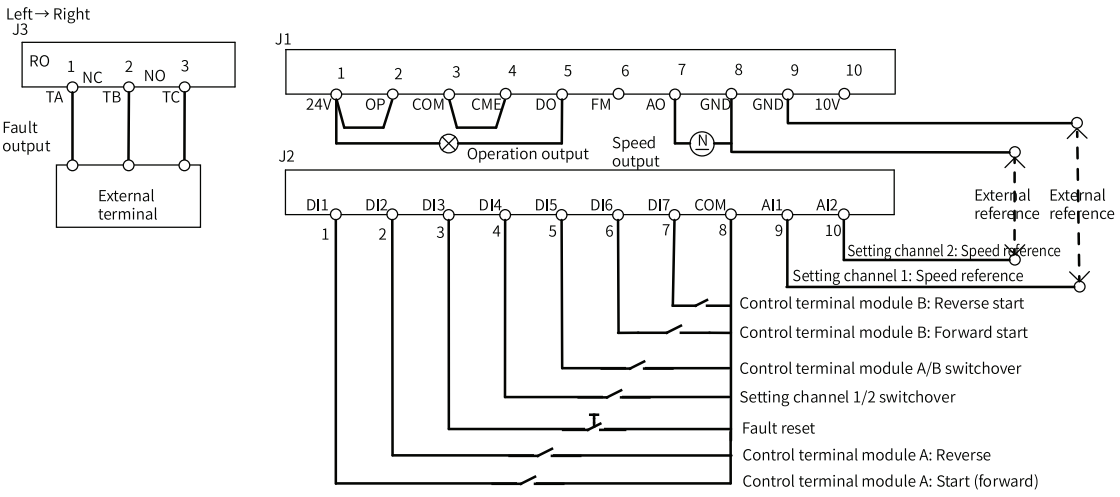


Figure 5-108 Wiring diagram of multi-channel switchover 1

Function description

In both mode 1 and 2, the DI terminal is used as the main command source of the control channel 1. In mode 1, the terminal start/stop module A is two-wire mode 1, and AI1 controls the frequency of set channel 1. In mode 2, the terminal start/stop module B is two-wire mode 2, and AI2 controls the frequency of set channel 2.

- When DI4 is open, the set channel 1 is active and AI1 controls the frequency.
- When DI4 is closed, the set channel 2 is active and AI2 controls the frequency.
- When DI5 is open, the terminal start/stop module A is active, indicating that the AC drive starts in forward direction with DI1 closed and DI2 opened, and it starts in reverse direction with DI1 opened and DI2 closed.
- When DI5 is closed, the terminal start/stop module B is active, indicating that the AC drive starts in forward direction with DI6 closed and DI7 opened, and it starts in reverse direction with DI6 opened and DI7 closed.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 115 (multi-channel switchover 1), the AC drive automatically writes the parameters in the following table.

Table 5–71 Parameter set of multi-channel switchover 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b6-00	Main frequency source	0: Set by the parameter (b5-01)	3: AI2
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
b9-09	Terminal start/stop module B	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	71: Set channel selection
E0-04	DI5 function selection	13: Multi-reference terminal 2	72: Terminal start/stop module A/B selection
E0-05	DI6 function selection	0: No function	61: Terminal start/stop module B_IN1
E0-06	DI7 function selection	0: No function	62: Terminal start/stop module B_IN2

Parameter	Description	Default Value	Written Value
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-44	Minimum input of AI curve 2	0.00 V	0.00 V
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0%	0.0%
E2-46	Maximum input of AI curve 2	10.00 V	10.00 V
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.17 Multi-channel Switchover 2 (116)

Scenarios

This macro is mainly used to switch between two control channels and two set channels.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI5, AI1, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

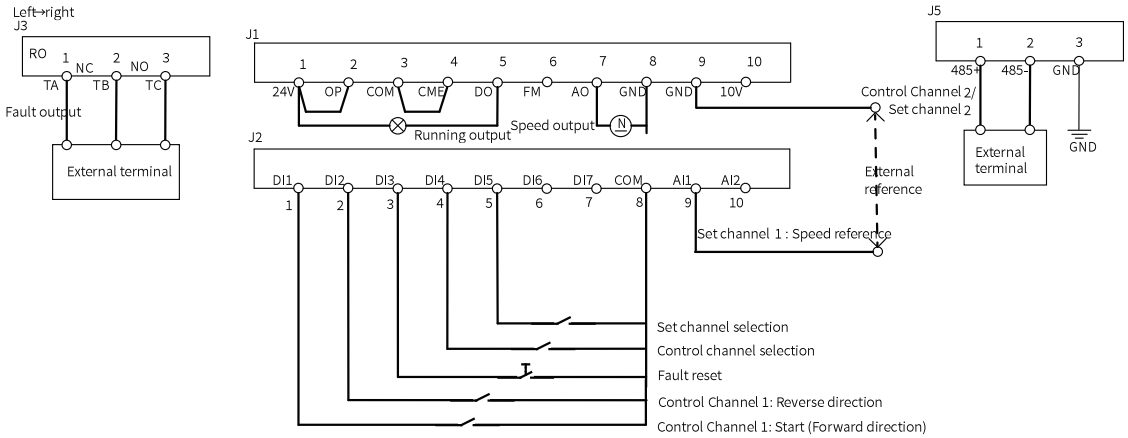


Figure 5-109 Wiring diagram of multi-channel switchover 2

Function description

In mode 1, the main command source of the control channel 1 is the DI terminal and AI1 controls the frequency of set channel 1. In mode 2, the main command source of the control channel 2 is communication and communication controls the frequency of set channel 2.

- When DI4 is open, the control channel 1 is active, indicating that the AC drive starts in forward direction with DI1 closed and DI2 opened, and it starts in reverse direction with DI1 opened and DI2 closed.
- When DI4 is closed, the control channel 2 is active and the Modbus communication controls the start/stop pf the AC drive.
- When DI5 is open, the set channel 1 is active and AI1 analog input controls the frequency.
- When DI5 is closed, the set channel 2 is active and the Modbus communication controls the frequency.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 116 (multi-channel switchover 2), the AC drive automatically writes the parameters in the following table.

Table 5–72 Parameter set of multi-channel switchover 2

Parameter	Description	Default Value	Written Value
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b3-00	Main command source of control channel 2	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b6-00	Main frequency source	0: Set by the parameter (b5-01)	9: Communication
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	70: Control channel selection
E0-04	DI5 function selection	13: Multi-reference terminal 2	71: Set channel selection
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2

Parameter	Description	Default Value	Written Value
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.18 DI Terminal Jog Control (117)

Scenarios

This macro is mainly used to perform jog control through the DI terminal.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI3, AI1, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 61*.

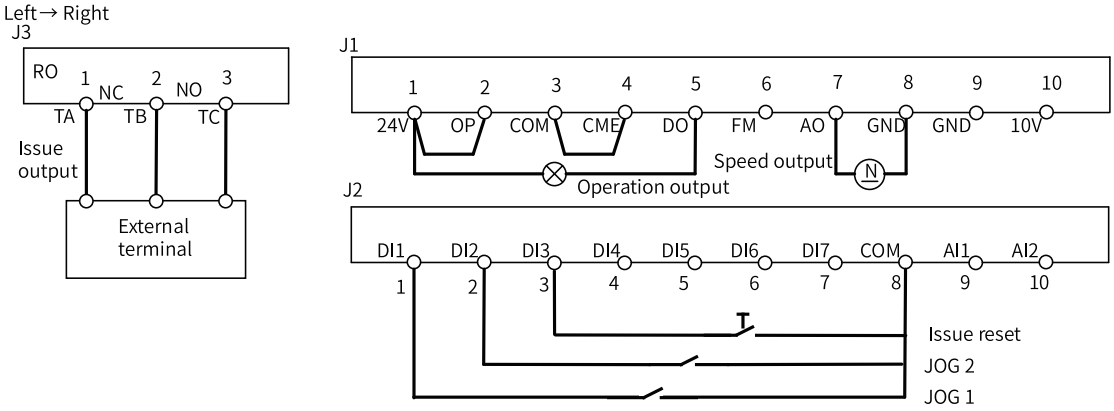


Figure 5-110 Wiring diagram of DI terminal jog control

Function description

- When DI1 is closed, the AC drive operates at the frequency set by jog 1. When DI1 is open, the drive stops.
- When DI2 is closed, the AC drive operates at the frequency set by jog 2. When DI2 is open, the drive stops.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.

- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 117 (DI terminal jog control), the AC drive automatically writes the parameters in the following table.

Table 5–73 Parameter set of DI terminal jog control

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b5-07	Jog 1 frequency source	0: Set by the parameter (b5-08)	0: Set by the parameter (b5-08)
b5-08	Jog 1 frequency	2.00 Hz	2.00 Hz
b5-09	Jog 2 frequency source	0: Set by the parameter (b5-10)	0: Set by the parameter (b5-10)
b5-10	Jog 2 frequency	-2.00 Hz	-2.00 Hz
b7-31	Jog ramp source	0: Ramp time in normal operation mode	1: Ramp time in jog mode
b7-32	Jog ramp acceleration time	20.00 s	20.00 s
b7-33	Jog ramp deceleration time	20.00 s	20.00 s
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	4: Terminal start/stop module A (JOG1)
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	5: Terminal start/stop module A (JOG2)
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.3 Industry Macro

5.2.12.3.1 Industry Macro Introduction

Application scenario

Industry macro selection in parameter A0-50 (Industry macro selection), provides four industry macros for selection according to your needs.

1. For the AC drive as a fan drive, see industry macro 201.
2. For the drive as a water pump drive, see industry macro 202.
3. For the drive as a driver for the packaging industry, see industry macro 203.
4. For the drive as a driver for the ceramic industry, see industry macro 204.

For the above usage scenarios, you can select the appropriate industry macro to simplify the commissioning process according to the requirements. If the current industry macro does not meet the requirements, you can perform other commissioning steps according to the actual situation.

Function description

The industry macro functions and parameters of the MD630-INT AC drive are all related to the control interface. To use the industry macros, select a macro number in A0-50 (industry macro selection) and a set of parameters is automatically written to implement the corresponding function, thus simplifying the commissioning. For industry macros function, see *"Table 5-74 Industry macro" on page 422*. The written parameters can be queried with the application macro function, as shown in the "Related application macro" column of the table below.

Table 5–74 Industry macro

Param.	Name	**Optional parameter**	Description	Related application macro
A0-50	Industry macro selection	0	No operation	-
		201 [Fan application]	Provides a set of common parameters for fan industry.	*"5.2.12.3.2 201 Fan" on page 423*
		202 [Water pump application]	Provides a set of common parameters for water pump industry.	*"5.2.12.3.3 202: Water pump macro" on page 425*
		203 [Packaging application]	Provides a set of common parameters for packaging industry.	*"5.2.12.3.4 (203) Package:" on page 426*
		204 [Logistics application]	Provides a set of common parameters for logistics industry.	*"5.2.12.3.5 204: Ceramic macro" on page 428*

Operation steps

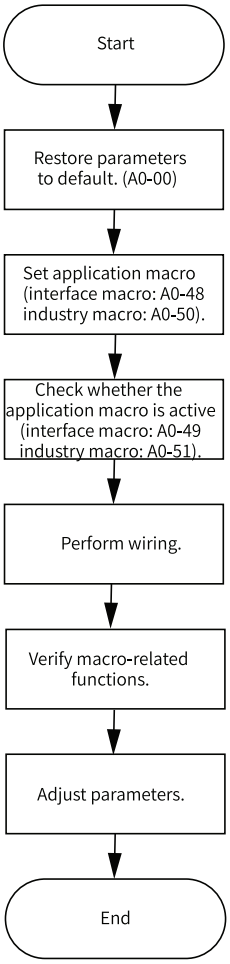


Figure 5-111 Procedure of using application macros

Precautions

1. Restore the default settings before writing a macro number to A0-50 (industry macro selection).
2. The successfully written macro parameter set is displayed in A0-51 (effective industry macro value).

5.2.12.3.2 201 Fan

Application Scenario

The AC drive is used as a fan drive.

Wiring Diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in .

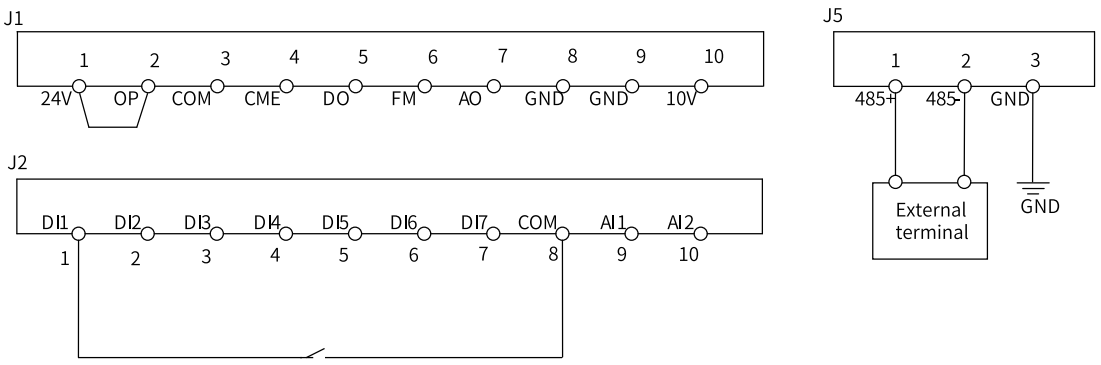


Figure 5-112 Wiring

Function Description:

- The control channel 1 main command source is terminal, and the setting channel 1 frequency (speed) source is set to function code.
- Parameters related to Modbus communication
- Enable automatic fault reset.

Parameters to be written

After A0-50 (interface macro selection) is set to 201 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–75 Parameter collection of fan macro

Parameter Code	Description	Default:	Written Value
F0-01	Motor control mode	2: V/F	2: V/F
F2-15	Start mode	0: Direct startup	1: Flying start
F2-16	Mode of speed tracking	4: Magnetic field oriented flying start	4: Magnetic field oriented flying start
F2-17	OFF1 stop mode	0: Decelerate to stop	1: Coast to stop
F2-43	Undervoltage action selection	0: Not act	1: Undervoltage suppression
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0 (set channel 1)	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	0: Set by the parameter (b5-01)
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
b9-00	Terminal start/stop module selection	0 (module A)	0 (module A)
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
H3-00	Automatic fault reset	1: Enable	1: Enable

Parameter Code	Description	Default:	Written Value
H3-01	Number of automatic fault reset times	0	3
H3-02	Time interval between automatic fault reset	1.0s	10.0s
H3-04	Time to restore the number of automatic fault reset times	10 min	10 min
n2-00	Modbus baud rate	5: 9600bps	5: 9600bps
n2-04	Modbus data format	0: 8-N-2 (no parity check)	3: No check (8-N-1)
n2-02	Modbus local address	1	1

5.2.12.3.3 202: Water pump macro

Application Scenario

The AC drive is used as a water pump drive.

Wiring Diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in .

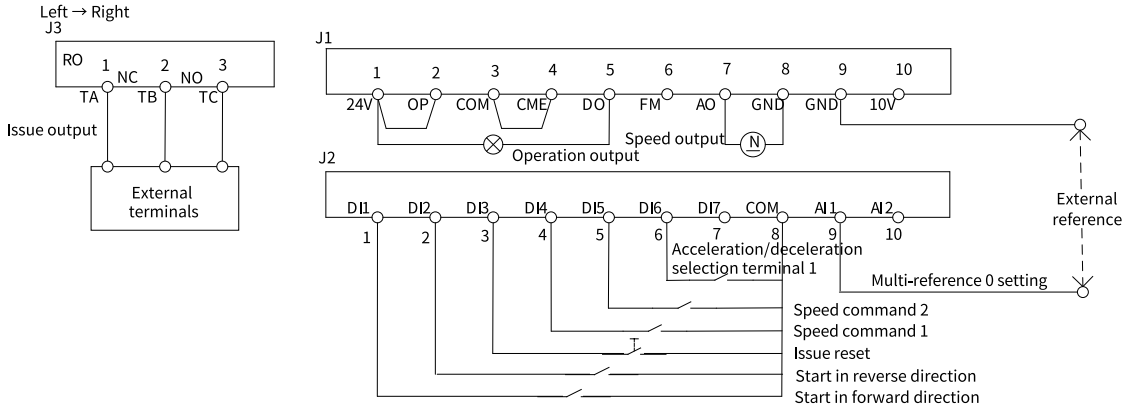


Figure 5-113 Wiring

Function Description:

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI4 and DI5.
- AI1 provides speed information of multi-segment value 0.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-50 (Industry macro selection) is set to 202 (water pump macro), the AC drive automatically writes the parameters in the following table.

Table 5–76 Parameter set of water pump macro

Parameter	Description	Default:	Written Value
F0-01	Motor control mode	2: V/f	2: V/f
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0 (set channel 1)	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module selection	0 (module A)	0 (module A)
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function	9: Fault reset (RESET)	9: Fault reset (RESET)
E0-03	DI4 function	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function	13: Multi-reference terminal 2	13: Multi-reference terminal 2
E0-05	DI6 function	0: No function	16: Terminal 1 for acceleration/deceleration selection
E0-06	DI7 function	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
b7-10	Ramp 2 acceleration time	20.0s	15.0s
b7-11	Ramp 2 deceleration time	20.0s	15.0s
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	1: AI1
b8-10	Multi-reference 1	0.0%	100.0%
b8-11	Multi-reference 2	0.0%	80.0%
b8-12	Multi-reference 3	0.0%	50.0%
E1-00	RO output selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Running frequency	13: Motor speed

5.2.12.3.4 (203) Package:

Application Scenario

The AC drive is mainly used as a drive in the packaging industry.

Wiring Diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in .

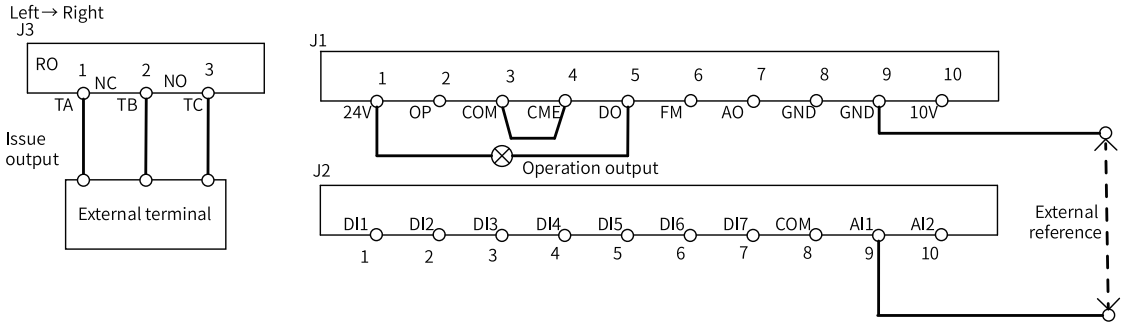


Figure 5-114 Packaging

Function Description:

- The main command source of control channel 1 is communication, and the frequency (speed) source of control channel 1 is communication.
- AI
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.

Parameters to be written

After A0-50 (interface macro selection) is set to 203 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–77 The parameter collection of the macro is packed

Parameter Code	Description	Default:	Written Value
F0-01	Motor control mode	2: V/F	0: SVC
F0-02	Motor control mode:	0: Speed control	0: Speed control
b1-00	Command source of control channel 1	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9 Communication
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
E2-40	Minimum input of AI curve 1	0.00V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E1-00	RO output selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation

5.2.12.3.5 204: Ceramic macro

Application Scenario

The AC drive is mainly used as a drive in the ceramic industry.

Wiring Diagram

This macro involves the wiring of terminals DI1, DI5, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in Electrical design section.

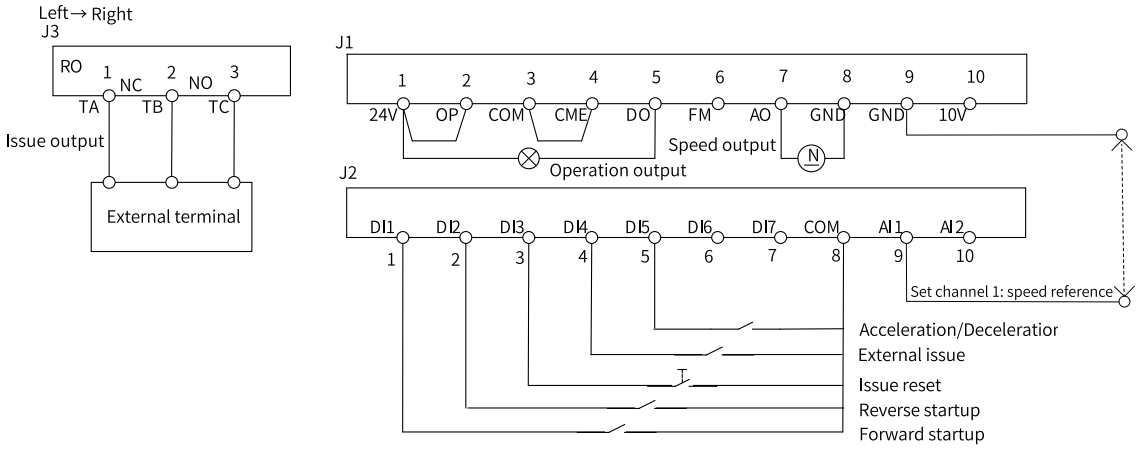


Figure 5-115 Ceramic

Function Description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- When DI3 is closed, the AC drive resets the fault.
- If DI4 is disconnected, the AC drive is normal. If DI4 is closed, the AC drive reports an external fault.
- If DI5 is disconnected, b7-04 and b7-05 are used as ramp acceleration/deceleration time.
- When DI5 is closed, b7-10 and b7-11 are used as ramp acceleration/deceleration times.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.
- The main frequency source of channel 1 is set by AI1

Parameters to be written

After A0-50 (industry macro selection) is set to 204 (ceramic macro), the AC drive automatically writes the parameters in the following table.

Table 5–78 Parameter collection of ceramic macro

Parameter	Description	Default:	Written Value
F0-01	Motor control mode	2: V/F	2: V/F
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0 (set channel 1)	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module selection	0 (module A)	0 (module A)
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function	9: Fault reset (RESET)	9: Fault reset (RESET)
E0-03	DI4 function	12: Multi-reference terminal 1	11: NO input of external fault
E0-04	DI5 function	13: Multi-reference terminal 2	16: Terminal 1 for acceleration/deceleration selection
E0-05	DI6 function	0: No function	0: No function
E0-06	DI7 function	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
b7-04	Ramp 1 acceleration time	20.0s	1.0s
b7-05	Ramp 1 deceleration time	20.0s	1.2s
b7-10	Ramp 2 acceleration time	20.0s	3.5s
b7-11	Ramp 2 deceleration time	20.0s	3.5s
E1-00	RO output selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Running frequency	13: Motor speed

5.3 Motor Control

5.3.1 Vector Control

The dynamic response of vector control is controlled with high precision. The output torque can be adjusted. Vector control includes vector control (SVC) without speed sensor and vector control (FVC) with speed sensor. You can select different control modes by setting the parameter [d0-00].

Parameter Code	Parameter Name	Description	Default	Value range
d0-00	Motor control mode	Description 0: SVC It is the magnetic field oriented vector control mode without sensor. This mode has excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters. 1: FVC 1: FVC (Feedback vector control) - The speed is fed back by the encoder to reach the optimal control performance. 2: V/f It is the open-loop control with the constant voltage-to-frequency ratio. The dynamic performance of this mode is not as good as the SVC mode.	0	0 to 2

Control mode	Advantage	Disadvantage	Application
SVC	The dynamic response is good. Compared with FVC, it is easy to commission. It saves the encoder and encoder cables and encoder cards. After commissioning, the fault rate of long-term running is lower.	Low-speed back potential is too small to run for a long time. The synchronous motor can switch to the low-speed running mode by turning on the SVC speed open-loop mode of the synchronous motor in the low-speed processing mode of d0-85. This ensures long-term running at low speed. In this case, only the speed is controlled and the torque is not controlled. The torque control mode fluctuates near 0 speed.	Except for applications where FVC is required, SVC control can be used for other applications. Such as fans, water pumps, air compressors, air conditioners, Steam turbine, leveling, rough rolling mill, stove roll, Take-up machine, crane trolley, flywheel, and floor lift.
FVC	Compared with SVC, stable running at 0 speed can be achieved for a long time, position control can be achieved, speed control accuracy is slightly higher than SVC, and matching high-precision encoder can achieve higher limit dynamic performance.	The encoder card and cable are required, and the encoder system is expensive. The encoder needs to be installed and commissioned, and the encoder feedback signal is susceptible to interference	Hoist, zero-speed tensor (winding, unwinding, and sleeve), and position control (deviation in SVC low-speed estimated position) Ultra-high precision and dynamic response applications (new-energy vehicle test bench, high-speed precision rolling mill, flying shear)
V/f	Simple and reliable control and simple commissioning	High dynamic speed response, excellent accuracy and high power density The torque cannot be controlled. Only the speed can be controlled. It is recommended to switch to SVC. 50 (asynchronous motor in V/f control mode)	This mode is used for loads such as fans and water pumps that do not require high accuracy.

5.3.1.1 FVC control

Scenarios

Setting [d0-00]=1 enables encoder-based vector control (FVC). The difference between FVC and SVC lies in the fact that the feedback speed for FVC is measured by the encoder, whereas the feedback speed for SVC is calculated from the back EMF and output current. At low speeds, the back EMF is very small, making it difficult to accurately estimate the speed and flux angle. Therefore, the dynamic performance and control accuracy of SVC at low speeds are not as good as those of FVC. FVC must be used in the following scenarios:

1. It is recommended to use FVC for the hoist and elevator-type loads. The SVC may have a stuck or even reported fault when starting or stopping under heavy load.

2. It is recommended to use FVC for the position control-type loads. The position estimated by SVC at low speed may be deviated, and large position deviation will be accumulated during long-term operation.

3. It is recommended to use FVC in scenarios where torque limit is required for a long time at zero speed. The SVC can only run at low speed within a short time. If torque control is not implemented in the SVC open loop (d0-85) state, speed cycle fluctuation may result.

4. It is recommended to use FVC for applications requiring ultra-high dynamic response and precision, for example, the motor system test bench of an electric vehicle that requires very high dynamic response.

Working principle

The following figure shows the control block of FVC.

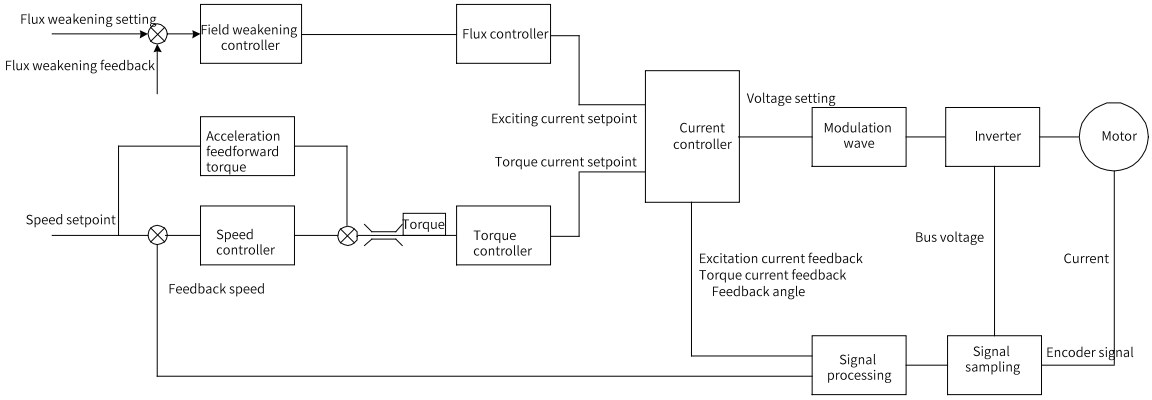


Figure 5-116 Feedback vector control (FVC)

High/low-speed model switching of asynchronous motor FVC

The asynchronous motor FVC has a low-speed model and a high-speed model. The model has different characteristics:

Model	Advantage	Disadvantage
Low-speed model	The low-speed model is simple, and has better stability. It can operate across the entire speed range.	The impact of encoder interference is more severe than that of high-speed models. The motor temperature rise affects the rotor resistance, which in turn affects the torque accuracy.
High-speed model	The high-speed model has better torque accuracy, and the motor temperature rise has less impact on the model.	The high-speed model relies on more motor parameters than low-speed model, which can affect accuracy at low speeds. The motor harmonics are too large, which may affect the stability of the model.

Typical problem-solving scenarios:

1. The motor harmonics affect the speed and torque fluctuation of the high-speed model. You can set the switching frequency of the asynchronous motor FVC model (d6-12) to exceed the maximum running speed to allow the motor to run in the low-speed model. It improves steady state performance.

2. If the motor temperature rise is significant and high torque accuracy is required, you can reduce both [d6-12] (asynchronous motor FVC model switching frequency) and [d6-13] (asynchronous motor FVC model switching hysteresis) to allow the high-speed model to cover the commonly used operating range. It is not recommended to operate the high-speed model at speeds below 5% of the rated motor speed. You can also refer to the motor temperature model parameter setting to reduce the impact of temperature rise on motor control.

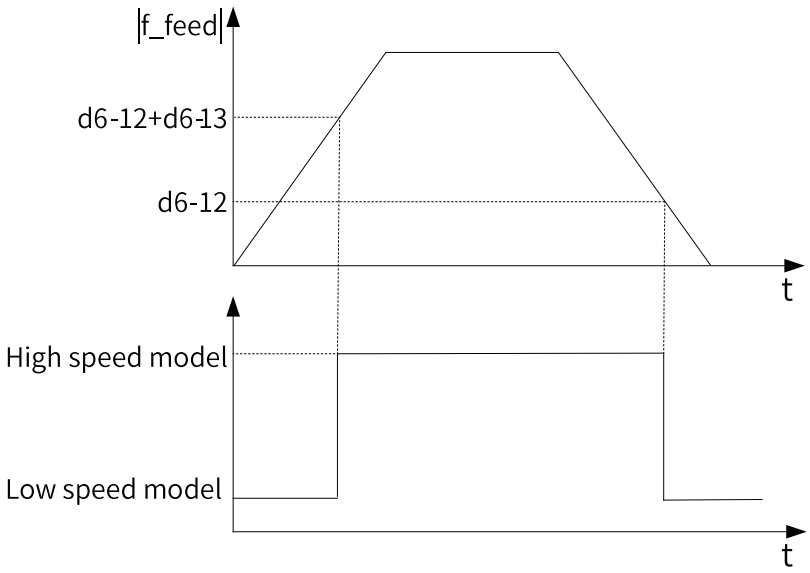


Figure 5-117 High/low-speed model switching of asynchronous motor FVC

Encoder fault: FVC switches to SVC

If frequent encoder disconnection faults occur during FVC operation, to ensure uninterrupted motor operation after encoder failure, set parameter [d7-02] (FVC to SVC switching mode) to 2 (passive switching). After an encoder fault is detected, the motor control mode will automatically switch from FVC to SVC, ensuring continuous motor operation.

If the encoder feedback speed fluctuates slightly at low speeds and significantly at high speeds, causing abnormal operation, you can set parameter [d7-02] (FVC to SVC switching mode] to 1 (active switching), using FVC control at low speeds and switching the motor control method to SVC at high speeds to ensure normal operation even when the encoder feedback speed fluctuates significantly at high speeds. The switching between FVC and SVC has a hysteresis interval. The switching process is shown in the following figure.

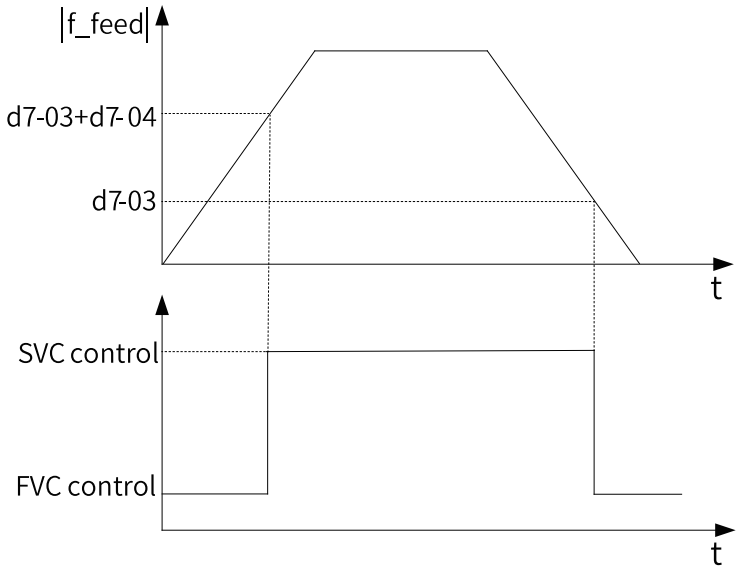


Figure 5-118 Switching between FVC and SVC

Related parameters

Param.	Name	Remarks	Default	Value Range
d7-02	FVC to SVC switching mode	-	0	0: No switching 1: Active switching 2: Passive switching (Switches to SVC upon encoder disconnection detection; does not revert to FVC if encoder recovers during operation; reverts to FVC after shutdown if encoder recovers)
d7-03	Frequency for switching from FVC to SVC	-	50%	10 to 500
d7-04	Hysteresis loop for switching from FVC to SVC	-	10%	10 to 100

Application example

Switching to SVC upon encoder fault

The continuous production line of the metallurgical rolling mill operates with multiple drives working in coordination. If the encoder of a motor experiences a disconnection or interference, it may cause one of the drives to report a fault and shut down, leading to the entire production line stopping and causing significant losses. To avoid this, set [d7-02] = 2 to enable passive switching from FVC to SVC, so that the motor can still operate normally when the encoder fails, until the speed is reduced to a very low speed and the fault is reported.

Active switching to SVC upon encoder speed fluctuation at high speed

If encoder misalignment causes stable low-speed operation but significant speed fluctuations at high speeds, and on-site calibration of encoder radial runout is not feasible, set [d7-02] = 1 to

enable active switching to SVC. This ensures the motor operates unaffected by encoder speed fluctuations after startup.

5.3.1.2 SVC Control

Scenarios

In applications of fans, water pumps, air compressors, air conditioners, and crushers, SVC control can be used except for applications where FVC is mandatory.

Vector control usually requires the encoder to collect the motor speed and position. Sensorless vector control (SVC) can perform excellent vector control without encoder feedback. You need to set the control mode (d0-00) to SVC control (0).

The SVC and V/f control mode both do mot require encoder signal feedback. The difference is mainly as follows:

- [d0-00] is set to 0 [SVC control]. The SVC mode is a kind of speed, torque closed-loop control. This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters.
- [d0-00] is set to 2 (V/f control). V/f control is an open loop control of the constant voltage frequency ratio. This mode is not highly dependent on parameters. It is simple, reliable, and easy to use, but has poor dynamic performance and speed accuracy compared with SVC. The V/f control of the asynchronous motor does not control the torque. Therefore, the setting related to the torque limit does not take effect.

Working principles

The following figure shows the sensorless vector control (SVC), including sampling and wave generation, loop control, and model observation.

- Sampling and wave generation: signal sampling and modulation wave generation
- Loop control: field weakening controller, flux controller, speed controller, torque controller, and current controller
- Model observation: Observer

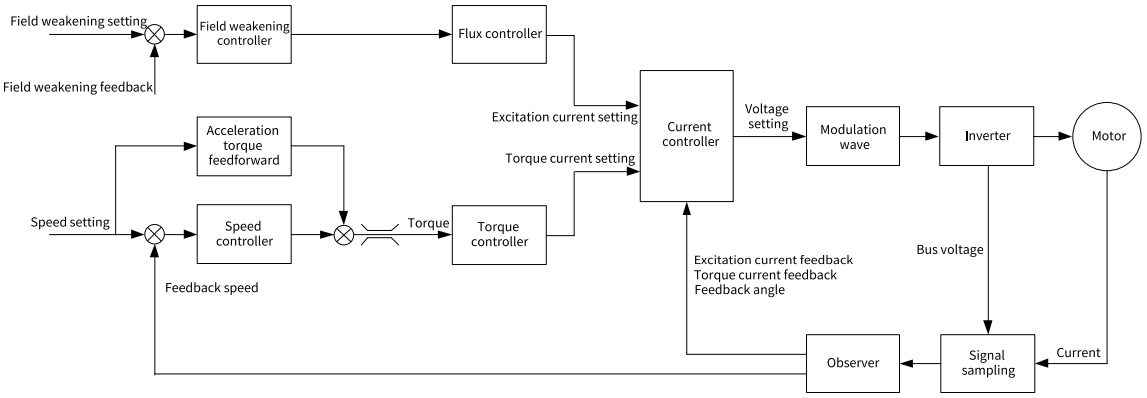


Figure 5-119 Block diagram of sensorless vector control (SVC)

In the SVC control mode, the feedback speed and angle required for vector control are estimated by the motor model and output current. The estimation is through the observer module.

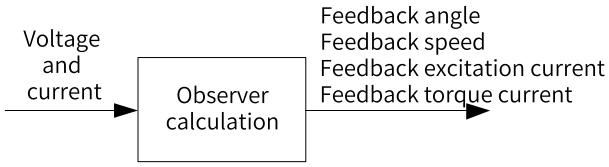


Figure 5-120 Diagram of the observer module

Related parameters

Param.	Name	Description	Default	Value range
d0-00	Control mode	Defines the motor control mode. Description 0: SVC - Sensorless vector control This mode has excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters. 1: FVC - Feedback vector control The speed is fed back by the encoder to reach the optimal control performance. 2: V/f - open loop control with the constant voltage-to-frequency ratio The dynamic performance of this mode is not as good as the SVC mode.	2	0: SVC 1: FVC 2: VF

Function application

The SVC control is estimated based on motor voltage, current, and motor parameters. Therefore, complete motor parameters are required for SVC control. It is recommended to perform dynamic auto-tuning before operation. Failure to perform dynamic no-load auto-tuning may result in oscillation or overcurrent due to inaccurate motor parameters.

- Stator resistance, rotor resistance, leakage inductance, mutual inductance, and dead zone auto-tuning curve of the drive need to be auto-tuned for asynchronous motors.
- Stator resistance, d-axis inductance, q-axis inductance, rated back EMF, and dead zone auto-tuning curve of the drive need to be auto-tuned for synchronous motors.

During low-speed operation, the motor speed and angle cannot be accurately calculated, affecting the control accuracy and even result in observation failure and unstable operation.

In some applications, the asynchronous motor directly stabilizes the motor at zero speed and stops. When the motor needs to run, set a speed reference again. As shown in the following figure, prolonged stay at zero speed may result in startup error or even startup failure caused by observer failure.

In this case, you can set the SVC observer model of the asynchronous motor [d6-27] to 2, as shown in the following figure. This is to make the asynchronous motor run at 0 speed. However, in this case, sufficient torque cannot be provided to ensure that the rotor stays at its original position when an external force is present. For long-term low-speed or zero-speed tension requirement, it is recommended to install an encoder to run in FVC mode.

The related function code is set in the following table.

Param.	Name	Description	Default	Value range
d6-27	Asynchronous motor SVC observer mode	Defines the asynchronous motor observer mode in SVC mode.	0	0 to 3

For synchronous motors, low-speed open loop IF control can be enabled if long-term operation at low or zero speed is present. Low-speed IF control, also known as current/frequency control, is open loop control whose control accuracy and dynamic performance are not as high as closed-loop control mode. For long-time low-speed or zero-speed operation, it is recommended to install the encoder to run in FVC mode.

IF control related parameters:

Param.	Name	Description	Default	Value range
d0-85	Low speed handling mode	Used to enable the low speed open loop mode. In SVC mode, set the tens of d0-85 to 1 to enable open loop control.	101	0 to 121
d0-86	Speed open loop current	Defines the speed open loop current. Set this parameter to a value higher than 20% of the load.	100%	0% to 800%
d0-87	Speed open loop switchover frequency.	Defines the speed open loop switchover frequency as a percentage to the rated frequency. If the percentage of the operating frequency to the rated frequency is lower than d0-87, switch to speed open loop control. The default value is 10% of the rated frequency based on the low-speed operation band of speed open loop.	10.0%	0.0% to 100.0%
d0-88	Speed open loop switchover hysteresis frequency	Defines the speed open loop switchover hysteresis, which is a percentage to the rated frequency. If the percentage of the operating frequency to the rated frequency is higher than "d0-87 + d0-88", switch to SVC speed closed-loop control. The default value is 2.5% of the rated frequency according to the actual required hysteresis band.	2.5%	0.0% to 100.0%

When the speed open loop IF function is enabled, the motor switches to speed open loop control when operating at low speed, and the drive outputs the current set by d0-86. The SVC control applies during operation at high speed. There is a hysteresis band during switchover between the speed open loop IF control and SVC control. The switchover process is shown in the following figure.

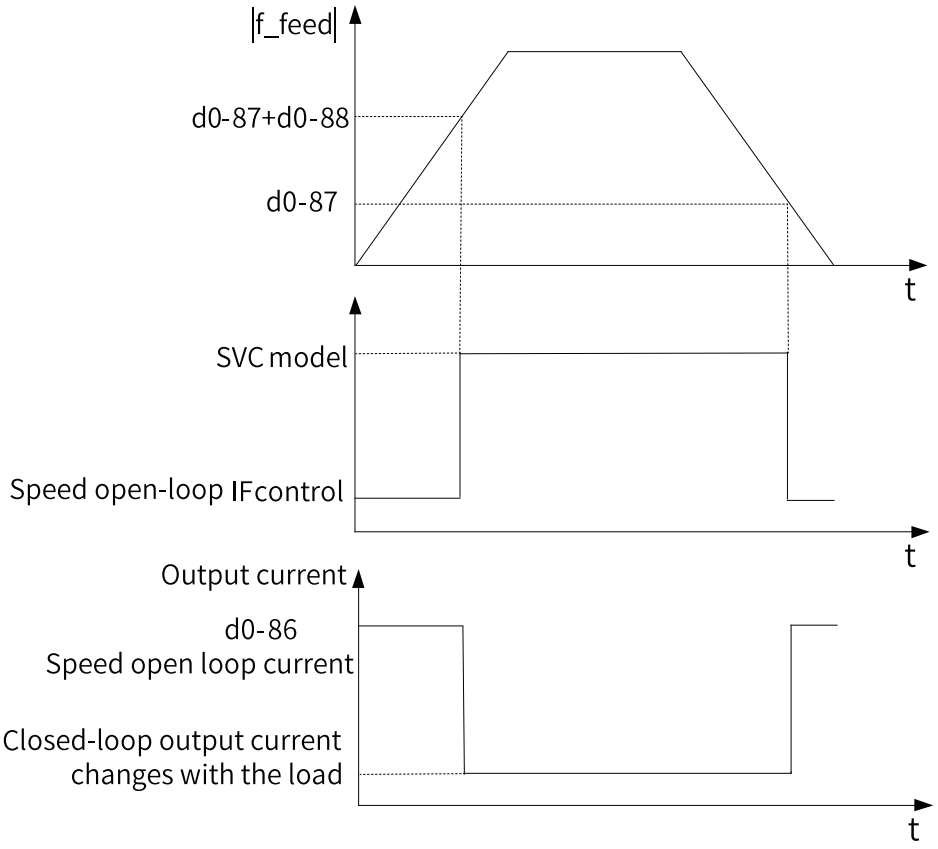


Figure 5-121 Switching between IF control and SVC control

Application instance

A film winding/unwinding machine runs without an encoder. During establishing tension, the drive that controls unwinding must keep the unwinding device running at zero speed. When the SVC mode is used, long-term stable operation at zero speed is not available. In this case, you need to the the speed open loop IF as follows.

1. Set bit1 of [d0-85] to 1 to enable SVC speed open loop function.

2. Observe that the torque corresponding to the tension, which is about 50% during normal operation. Therefore, set d0-86 to 70%.

3. During normal acceleration/deceleration, for precise control and rapid response, you can set the switchover frequency to a low value (d0-87 = 2%, d0-88 = 2%).

The torque limit is controlled by SVC speed to maintain the tension. Cyclic fluctuation occurs during low-speed operation. In this case, the material tension is higher than the set tension. The reason is that bit1 of [d0-85] is turned on to enable the SVC speed open loop control mode. The torque limit is no longer active. The motor only runs at the set speed. The torque output of the speed open loop control will be higher than the set torque. The material can be broken in severe cases.

1. Try changing bit1 of [d0-85] to 0 to disable the speed open loop function. Observe whether the problem can be solved in a stable manner.

2. If this is not possible, try changing bit1 of [d0-85] to 1 and reducing the open loop switchover frequency [d0-87] to an acceptable range.

3. If none of the above is possible, install an encoder and use FVC control.

5.3.1.3 Speed Control

5.3.1.3.1 Speed Control

Scenarios

In most applications, the motor speed needs to be controlled. In vector control, the speed can be controlled accurately.

Working Principle

The following figure shows the typical speed control diagram. The speed reference passes the speed limit, ramp generator (RFG), speed controller, and after superimposing additional torque, it goes through the torque limit and then through the current controller (ACR), and finally outputs voltage to the motor to complete the speed control.

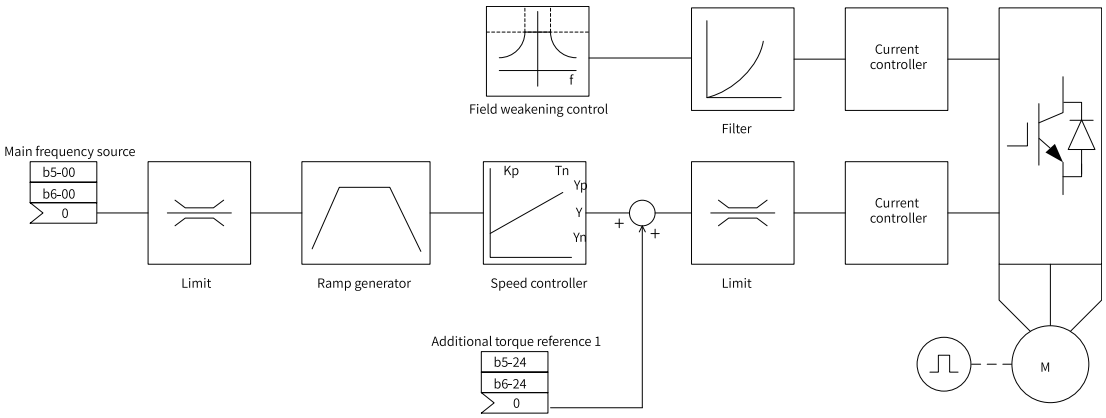


Figure 5-122 Typical block diagram of speed control

In the speed control mode, the speed setting value is generated according to the following figure. After superposition of the main frequency source and the auxiliary frequency source, it is processed by the ramp function generator (RFG). Add an additional frequency as L3002 (Final motor speed reference).

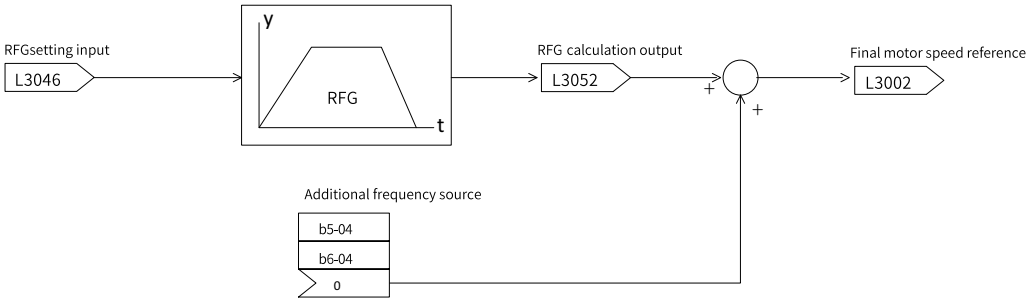


Figure 5-123 Speed reference

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
F0-01/d0-01	Motor control mode	0: SVC, which stands for sensorless vector control. It is an open-loop vector control mode, which is applicable to high-performance control applications. In this case, one AC drive can drive only one motor. This mode applies to such loads as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in the SVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. It is a closed-loop vector control mode. The motor must be configured with an encoder and the AC drive must be installed with a PG card matching the encoder type. This mode is applicable to high-accuracy speed control or torque control applications, where one AC drive can drive only one motor. It is used for loads such as high-speed papermaking machinery, hoisting machinery, and elevators. Parameter auto-tuning is required in the FVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. 2: V/f, which stands for voltage/frequency control. It is an open loop control mode based on constant voltage and frequency ratio. This mode is applicable to scenarios without high requirements on load control performance, such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simply and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.	2	0: SVC 1: FVC 2: V/f

5.3.1.3.2 Speed Controller (Speed Loop)

Scenarios

Under vector control, speed control can be implemented through the speed controller.

Working Principle

The speed controller obtains the speed reference (L3002) from the reference channel, receives the feedback speed value (L3000) in the feedback channel, and then generates the torque reference (L3100) from the deviation of the reference and feedback through the PI controller, and sends it to the current controller. The function diagram of the speed controller is as follows:

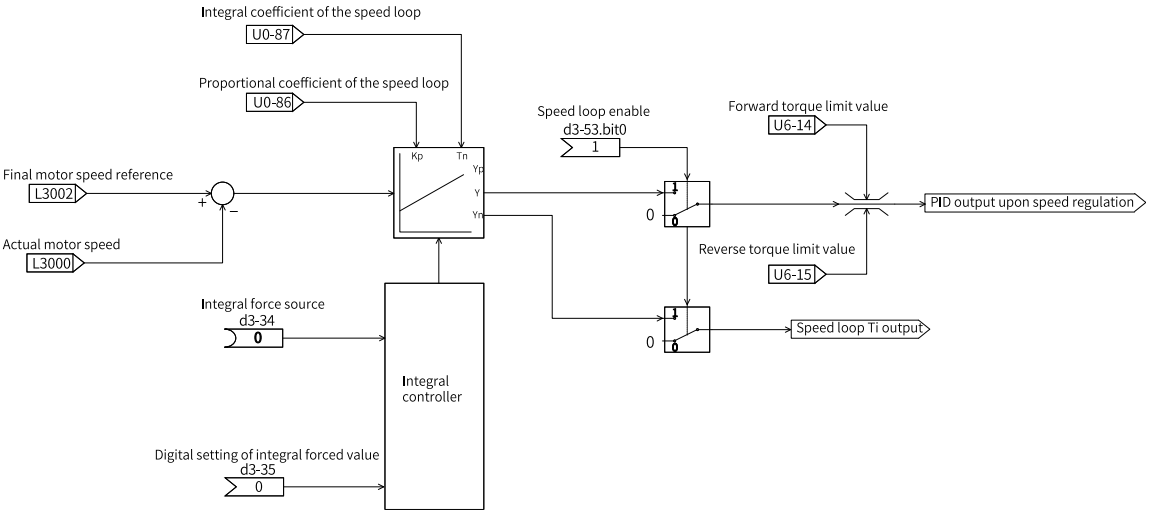


Figure 5-124 Speed controller function diagram

Under FVC control, you can adjust the strength of the speed controller by using d3-00 (FVC speed loop proportional gain) and d3-01 (FVC speed loop integral time).

Under SVC control, the speed controller can be controlled by parameters d3-02 (Speed loop Kp in SVC mode) and d3-03 (Speed loop Ti in SVC mode). The relationship between the output of the speed controller and Kp and Ti is shown in the following table.

$$Out = k_P \Delta f + \int \frac{k_P}{T_i} \Delta f dt$$

The torque setting is shown in the following figure. For the speed deviation of Δf, the torque setting value of the proportional output is KpΔf. After Ti time, the torque setting value of the integral output is set to KpΔf.

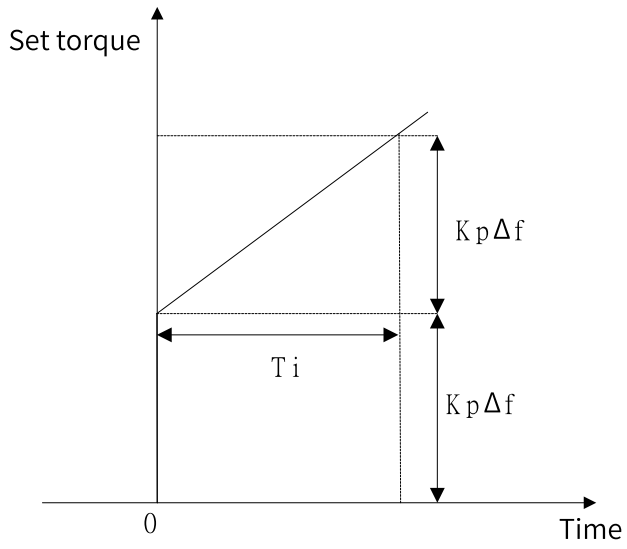


Figure 5-125 Torque reference diagram

The parameters Kp and Ti of the speed loop PI regulator can be optimized through the following auto-tuning.

- c2-00 = 2 (Dynamic auto-tuning of asynchronous motors)
- C2-00 = 12 (No-load dynamic auto-tuning of permanent magnet motor)

If you are still dissatisfied with the control effect after auto-tuning is completed, you can manually optimize the controller parameters. The effect of Kp and Ti on the controller is as follows:

- When Kp is small, the feedback speed overshoot is large. When Kp increases, the adjustment will become faster and the overshoot will decrease. If Kp is too large, the output torque and feedback speed will oscillate.
- When Ti decreases, the adjustment of the controller accelerates, and if Ti is too small, the output torque and feedback speed oscillation will also occur.

The speed loop regulator may need special processing when it is used with the PLC to set the integral parameters. The following three functions are involved.

Speed loop integral forcing enable: Controlled by d3-33. d3-34 sets the integral forcing value, and the integral output value will be forced to the value set by d3-34 after the integral forcing is enabled.

Related parameters:

Parameter	Name	Description	Default	Value range
0.00s to F2-00 (d3*00)	FVC speed loop proportional gain	/	8.0	0.0 to 6000.0
0.00s to F2-01 (d3*01)	FVC speed loop integral time	/	0.080s	0.000 to 20.000
F2-02/d3-02	SVC speed loop Kp	Defines the speed loop proportional gain in the SVC mode. Additional information: A larger value indicates a higher value of the speed loop gain and better speed following performance, but a greater possibility of oscillation.	5.0	0.0 to 6000.0
F2-03/d3-03	SVC speed loop Ti	Defines the speed loop integral time in the SVC mode. Additional information: A smaller value indicates a higher value of the speed loop gain and better speed following performance, but a greater possibility of oscillation.	0.127s	0.000s to 20.000s

Parameter	Name	Description	Default	Value range
d3-33	Forcibly change speed loop integral	This parameter determines whether to forcibly change the speed loop integral. Value description 0: Disabled. 1: Enable When this function is enabled, the speed loop integral is determined by d3-34 (Integral forced value source) and d3-35 (Digital setting of integral forced value). Others: B connector Whether to forcibly change speed loop integral depends on the value of the B connector.	0	0 to 1

Parameter	Name	Description	Default	Value range
d3-34	Integral force source	This parameter sets the source of the speed loop integral forced value. Value description 0: Set by the parameter (d3-35) 2：AI1 - The forced integral value of speed loop is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3：AI2 - The forced integral value of speed loop is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5：HDI pulse reference - The forced integral value is set through the pulse frequency of DI and calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6：Multi-reference - When multi-reference is used as the source of forced integral value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7：Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8：PID - The forced integral value is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9：Communication - The forced integral value is set through communication. The positive frequency upper limit can be input through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources.	0	0 to 9

Parameter	Name	Description	Default	Value range
d3-35	Digital setting of integral forced value	Defines the speed loop forced integral value. Additional information: When d3-33 (integral force) is enabled and d3-34 (integral force source) is set to "digital setting", the output of the speed loop integral comes from the setpoint of this parameter.	0.0%	-800.0%-800.0%

5.3.1.3.3 Speed Controller Adapter

Scenarios

Speed controller adapters can optimize speed loop parameters to suppress the overshoot or oscillation that may occur in the speed controller.

Working Principle

The adapter includes speed adaption and adaptive adaption.

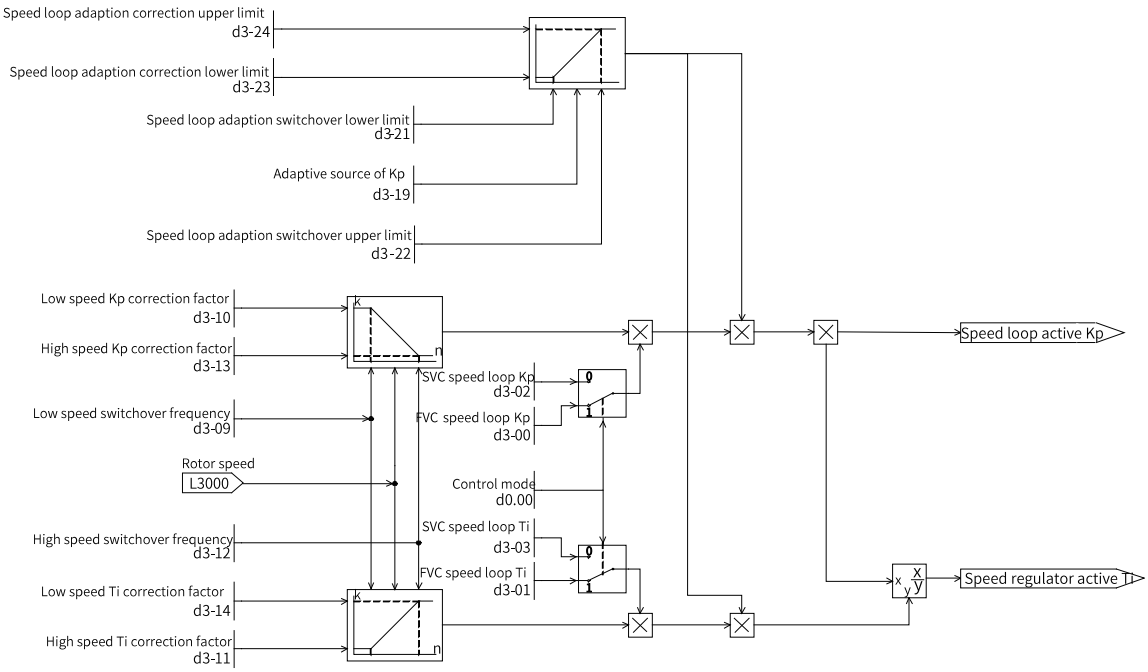


Figure 5-126 Speed Controller Adapter

When U0-01 (Set frequency) is lower than d3-06 (Zero speed switchover frequency), adjust the speed loop using the "Zero speed adaption" rule.

When U0-01 (Set frequency) is higher than d3-06 (Zero speed switchover frequency), adjust the speed loop using the "Low-High speed adaption" rule.

Zero speed adaption: When zero speed is reached, the speed loop is adjusted according to the set frequency. The adjustment rules are as follows:

- The active velocity loop parameters U0-86 (velocity loop effective proportional coefficient) and U0-87 (velocity loop effective integral coefficient) are set in the original velocity loop parameters

d3-00 (FVC velocity loop proportional gain) and d3-01 (FVC velocity loop integral time). d3-02 (SVC speed loop Kp) and d3-03 (SVC speed loop Ti) are adjusted by the corresponding correction coefficient "d3-07 (zero speed Kp correction coefficient) and d3-08 (zero speed Ti correction coefficient)".

Low-speed adaption: Adjust the speed loop based on the feedback speed. During operation at high speed, current control becomes weak, resulting in decrease of the speed loop bandwidth. In this case, the enabled Kp and Ti parameters need to be adjusted in real time based on the feedback speed. The adjustment rules are as follows:

- When L3000 (actual motor speed) is lower than d3-09 (low-speed switchover frequency), the speed loop parameters U0-86 (speed loop effective proportional coefficient) and U0-87 (speed loop effective integral coefficient) are valid. In the original speed loop parameter d3-00 (FVC speed loop proportional gain), d3-01 [FVC speed loop integral time], d3-02 [SVC speed loop Kp], and d3-03 [SVC speed loop Ti] are used to adjust the corresponding low-speed correction coefficient "d3-10 [low-speed Kp correction coefficient], and d3-11 [low-speed Ti correction coefficient]".
- When the actual motor speed is higher than d3-12 (high-speed switchover frequency), the active speed loop parameters U0-86 (speed loop effective proportional coefficient) and U0-87 (speed loop effective integral coefficient) are set in the original speed loop parameter d3-02 (SVC speed loop Kp). d3-03 (SVC speed loop Ti) is adjusted using the high-speed correction coefficient d3-13 (high-speed Kp correction coefficient) and d3-14 (high-speed Ti correction coefficient).
- When the actual speed is between the low speed and the high speed, the speed loop correction factors vary linearly.

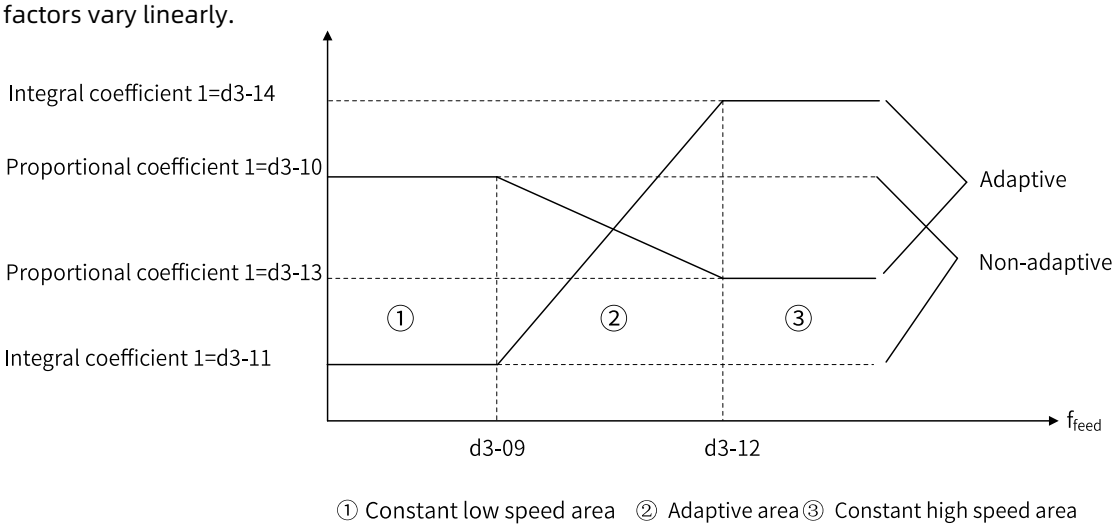


Figure 5-127 Speed adapter

Adaptive adaption: The principle of adaptive adaptation and speed adaptation is the same, but the adjustment reference value range of the speed adapter is wider. For example, if the speed loop controller needs to be modified when the roll diameter changes during winding and unwinding, the roll diameter can be used as the adjustment reference. The adaptive adapter outputs an adjustment coefficient, which acts on Kp of the speed adaptation output.

The adjustment rules for adaptive adaption are as follows:

- When d3-19 (Speed loop Kp adaptive source) is lower than d3-21 (Speed loop adaptive switchover lower limit), the speed loop kp item is corrected with d3-23 (Speed loop adaptive lower limit).
- When the value of d3-22 (Upper limit of speed loop auto-tuning) is higher, the value of d3-24 (Upper limit of speed loop auto-tuning) is used to correct the value of d3-24 (Upper limit of speed loop auto-tuning).
- When the value defined by the selected source is between d3-21 and d3-22, the Kp correction coefficient varies linearly between d3-23 and d3-24.

The adaptive correction coefficient is calculated as follows:

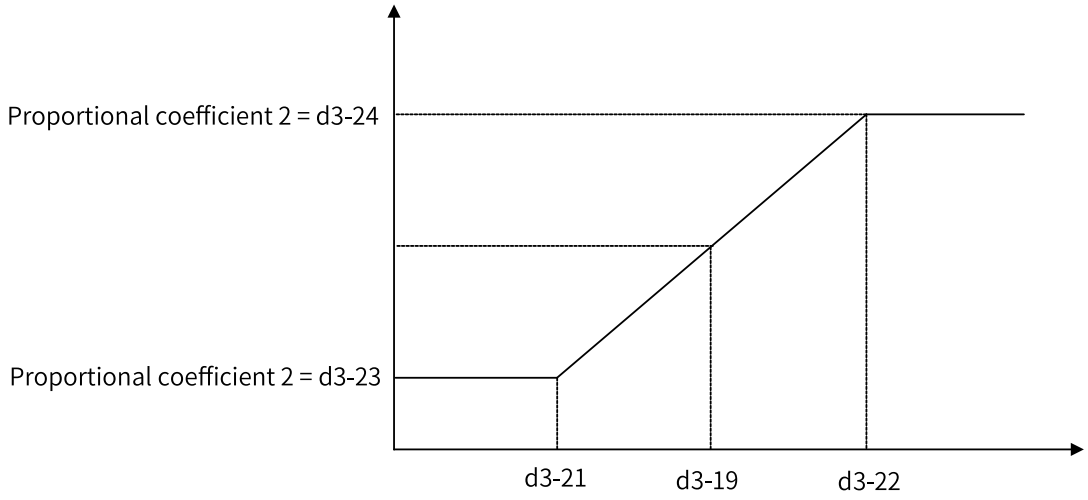


Figure 5-128 Adaptive adapter

The final active Kp and Ti are calculated as follows:

The final effective K_p = d3 x proportional coefficient 1 x proportional coefficient 2

The final effective T_i = d3 x integral coefficient 1

Related parameters:

Parameter	Name	Description	Default	Value range
F2-04/d3-06	Zero speed switchover frequency	Defines the zero speed switchover frequency of the speed loop.	1.0%	0.0% to d3-09
F2-05/d3-07	Zero speed Kp correction factor	Defines the proportional correction coefficient of the speed loop at zero speed.	100.0%	0.0%–1000.0%
F2-06/d3-08	Zero speed Ti correction factor	Defines the integral correction factor of the speed loop at zero speed.	100.0%	0.0%–1000.0%

Parameter	Name	Description	Default	Value range
F2-07/d3-09	Low speed switchover frequency	Defines the low speed switchover frequency of the speed loop.	10.0%	0.0% to d3-12
F2-08/d3-10	Low speed Kp correction factor	This parameter sets the proportional correction factor of the speed loop at low speed.	100.0%	0.0%–1000.0%
F2-09/d3-11	Low speed Ti correction factor	Defines the integral correction factor of the speed loop at low speed.	100.0%	0.0%–1000.0%
F2-10/d3-12	High speed switchover frequency	Defines the high speed switchover frequency of the speed loop.	100.0%	d3-09 to 400.0%
F2-11/d3-13	High speed Kp correction factor	This parameter sets the proportional correction factor of the speed loop at high speed.	100.0%	0.0%–1000.0%
F2-12/d3-14	High speed Ti correction factor	Defines the integral correction factor of the speed loop at high speed.	100.0%	0.0%–1000.0%

Parameter	Name	Description	Default	Value range
d3-19	Adaptive source of Kp	Sets the speed loop Kp self-adaption source. Value description 0: Disabled. 2: AI1 The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The forward frequency upper limit is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse - The positive frequency upper limit is set through the pulse frequency of the DI. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. - When multi-reference is used as the forward frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC- Multi-reference used to control the running time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The forward frequency upper limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication - The self-adaptive reference source is communication. The running frequency is input through remote communication. The AC drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources.	0	0 to 9
d3-21	Defines the lower limit of speed loop adaptive switchover.	This parameter sets the adaptive switchover lower limit of the speed loop.	40.0%	0.0%-1000.0%
d3-22	Defines the upper limit of speed loop adaptive switchover.	Defines the adaptive switchover upper limit of the speed loop.	100.0%	0.0%-1000.0%

Parameter	Name	Description	Default	Value range
d3-23	Lower limit of speed loop adaptive correction	Defines the adaptive correction lower limit of the speed loop.	100.0%	0.0%–1000.0%
d3-24	Speed loop adaption correction upper limit	Defines the adaptive correction upper limit of the speed loop.	100.0%	0.0%–1000.0%

Application case:

In the application of the wire drawing machine, the faulty mechanical installation caused the mechanical vibration of the stand. The higher the speed, The more obvious the vibration is. On-site commissioning reveals that the speed loop needed to be strengthened at low speed to suppress speed fluctuation as much as possible, and the speed loop needed to be reduced at high speed to reduce vibration.

Based on the actual commissioning, the speed loop parameters are adjusted automatically by using the low-speed and high-speed speed loop adaption function.

The steps are as follows:

1. Set F2-07/d3-09 (Low speed switchover frequency) = 5 Hz.
2. Set low-speed loop proportional correction factor to 100%. Set F2-08/d3-10 to 100% and F2-09/d3-11 to 100%.
3. Set F2-10/d3-12 (High speed switchover frequency) = 15 Hz.
4. According to the commissioning results, the high-speed speed loop proportional factor (F2-11/d3-13) is reduced to 30%, and the integral correction factor (F2-12/d3-14) remains unchanged: 100%.

5.3.1.3.4 Acceleration Feedforward Torque

Scenarios

According to the formula, to make the motor accelerate and decelerate in accordance with the given RFG curve, it is necessary to provide the motor with a suitable acceleration torque $T_a = T_e - T_L$. It cannot obtain a satisfactory effect by relying completely on the speed regulator, which may result in overshoot at the end of acceleration and speed lag at the beginning of acceleration.

Acceleration torque compensation can resolve this problem. In this solution, the required acceleration torque is directly calculated based on the auto-tuned moment of inertia and the expected acceleration, and then superimposed on the output of the speed regulator. This decreases the adjustment of the speed regulator and improves the speed following performance.

Working Principle

Acceleration torque feedforward is implemented according to the motor motion equation. The motor motion equation is:

$$T_e - T_L = J\frac{d\omega}{dt}$$

where

T_e: motor electromagnetic torque

T_L: load torque and friction torque

J: moment of inertia, displayed in parameter d2-00 after auto-tuning. The per unit value is equal to the electromechanical time constant (d2-05).

: motor speed change rate, which is calculated automatically in the system and related to the acceleration/deceleration time.

The speed change rate of the motor needs to be obtained. Therefore, the output acceleration rate of RFG is used for acceleration torque compensation. When the speed reference is generated only by RFG, this method can obtain accurate acceleration torque. The diagram of feedforward torque generation is shown below.

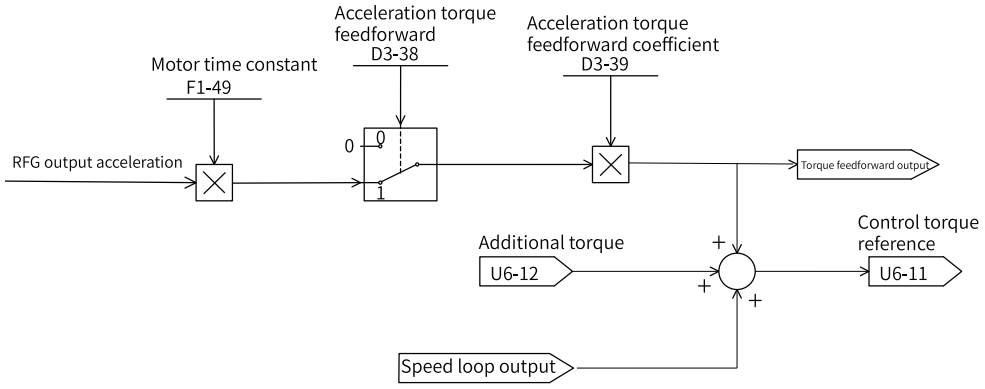


Figure 5-129 Feedforward torque

Related parameters

Parameter Code	Name	Description	Default	Value range
d3-38	Acceleration feedforward torque	This parameter sets whether to enable acceleration feedforward torque. In the speed mode, enabling feedforward torque can significantly improve the acceleration following effect. Description 0: Disable 1: Enable Additional information: To ensure the feedforward effect, complete auto-tuning or inertia auto-tuning is required.	0	0 to 1
d3-39	Acceleration feedforward torque coefficient	Defines the magnitude of feedforward torque.	100.0%	0.0%-6553.0%
d3-40	Feedforward acceleration speed source	Sets the feedforward torque calculation source Description 0: RFG setting The speed reference source is the RFG module. This option ensures better results. 1: Automatic calculation If the speed reference source is not the RFG module, this parameter must be set to "Automatic calculation". Additional information: When the speed reference source is the RFG module, it is recommended to set this value to 0 as the acceleration torque source.	0	0 to 1

Instances

In the textile production line, the SVC speed control mode is used. The host controller sends the speed reference and the communication cycle is 50 ms. After the SVC is activated and the system accelerates to the set speed, there is a large overshoot in speed. Customers wish to minimize this overshoot.

To solve the above problems, reduce overshoot by enabling acceleration torque feedforward function. The frequency ramp change function needs to be turned on, considering that the speed reference is sent through the PLC.

Follow the steps below.

1. Ensure that the motor performs complete overload auto-tuning or inertia auto-tuning. If not, perform inertia auto-tuning by setting C2-00 to 4.
2. After auto-tuning is performed, set b5-11 to 1 to enable the frequency ramp change function.
3. The frequency ramp change interval is set to 50 ms by setting b5-12 to 50, since the communication period with the PLC is 50 ms.
4. Enable acceleration feedforward torque function by setting set d3-38 to 1.
5. Select the acceleration feedforward torque source. Set d3-40 to 0 because the speed source is RFG when in speed mode.

After the preceding operation is completed, the frequency ramp change and acceleration torque feedforward functions are enabled simultaneously.

If the speed is not set by the PLC or if the PLC sends the final target speed without an active ramp command from the host controller, skip steps 2 and 3 in the preceding steps and do not enable frequency ramp change function. Only RFG feedforward is enabled.

5.3.1.3.5 Frequency Ramp Change

Application scenarios

If the speed setting is set through PLC communication, the RFG output speed may not be smooth due to the long communication period between the PLC and the AC drive. The calculated acceleration is not continuous. For the acceleration torque feedforward function, the calculated jump feedforward torque will oscillate the motor output torque, which may damage the rigid structure connected with the gear. You can solve this problem by using the frequency ramp function.

Operation principles

When b5-11 (Frequency ramp enable) is enabled, the speed ramp slope is controlled during the change of the speed setpoint, resulting in a continuous ramp rate. When the signal update interval (PLC release interval) of the external control system is consistent with the slope change rate b5-12, the RFG output speed is set to a straight line.

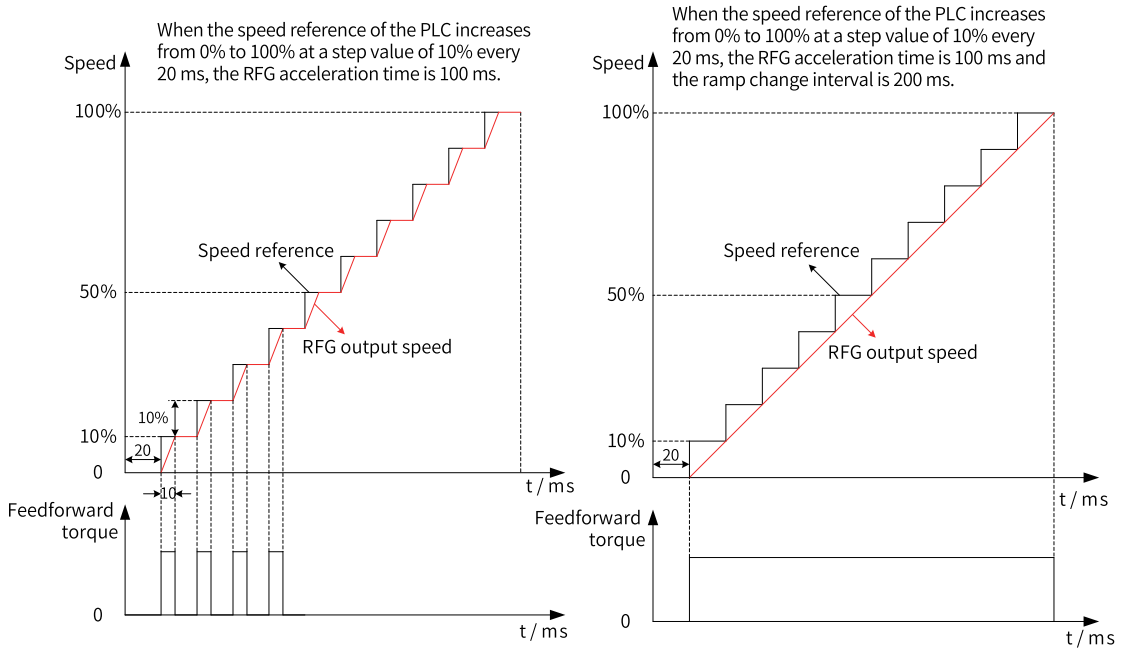


Figure 5-130 Ramp change diagram

Related parameters

Parameter	Name	Description	Default Value	Value Range
b5-11	Frequency ramp change enable	Defines whether frequency ramp change function is enabled. When the bit signal is 0, the function is disabled. When the bit signal is 1, the function is enabled. Value description 0: Disable The function is disabled. 1: Enable - The function is enabled. 3: Depends on DI1 terminal state - 0 is disabled and 1 is enabled. 4: Depends on DI2 terminal state - 0 is disabled and 1 is enabled. 5: Depends on DI3 terminal state - 0 is disabled and 1 is enabled (only MD630S is active). 6: Depends on DI4 terminal state - 0 is disabled and 1 is enabled (only MD630S is active). 7: Depends on DI5 terminal state - 0 is disabled and 1 is enabled (only MD630S is active). 8: Depends on DI6 terminal state - 0 is disabled and 1 is enabled (only MD630S is active). 9: Depends on the terminal state of DI7 - 0 is disabled and 1 is enabled (only MD630S is active). Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window. When the value of the connector is 0, it is forbidden. When it is 1, it is enabled. Additional information: When the set speed is sent to the AC drive through communication, the frequency ramp change function shall be enabled simultaneously if the acceleration torque feedforward function needs to be enabled.	0	0 to 9
b5-12	Frequency ramp change interval	Defines the frequency ramp change interval. Additional information: Frequency ramp interval = communication period given by speed	50 ms (default value)	2 ms to 10000 ms

Application examples

Frequency ramp change is generally used in conjunction with the acceleration torque feedforward function. For example, see *"5.3.1.3.4 Acceleration Feedforward Torque" on page 450*.

5.3.1.3.6 Speed control optimization under vector control

During commissioning of the AC drive, the speed fluctuates frequently. This can be improved by increasing or decreasing the speed loop PI parameter. In high inertia systems and fast acceleration/deceleration scenarios, it is difficult to solve the speed tracking difference by adjusting the PI parameter. If the parameter adjustment method is incorrect when adjusting the PI parameter of the speed loop, This may cause the system to deteriorate.

The speed control performance under vector control is divided into two main categories: The performance of speed following a given change, and the resistance to load disturbance. The commissioning sequence is to optimize the performance of the speed following the given change, and then optimize the anti-load disturbance performance.

1. The ability of the speed to follow a given change

   When the speed is changed, the feedback speed follows the given capability. The main phenomenon is that the speed cannot be followed during acceleration/deceleration.

   Acceleration feedforward is mainly used to improve the speed following capability. To improve the poor speed following performance, acceleration feedforward is preferred.

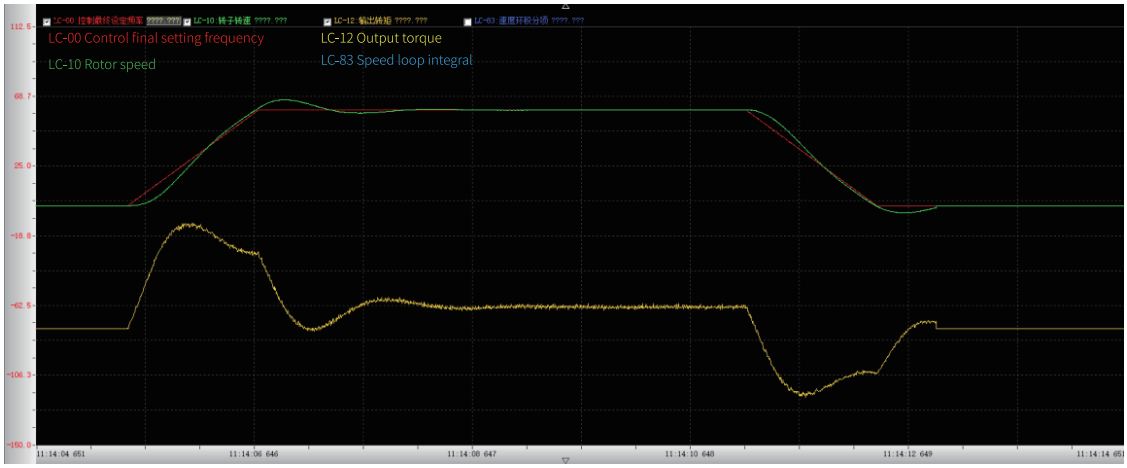


Figure 5-131 Poor speed following performance

2. Anti-load disturbance performance

   If the speed is stable when the load changes, as shown in the following figure, the main phenomenon is that the speed changes with the load.

   The speed loop PID is used to improve the speed anti-load disturbance performance. If the speed cannot maintain stably as the load changes, the speed loop PID parameters need to be set.

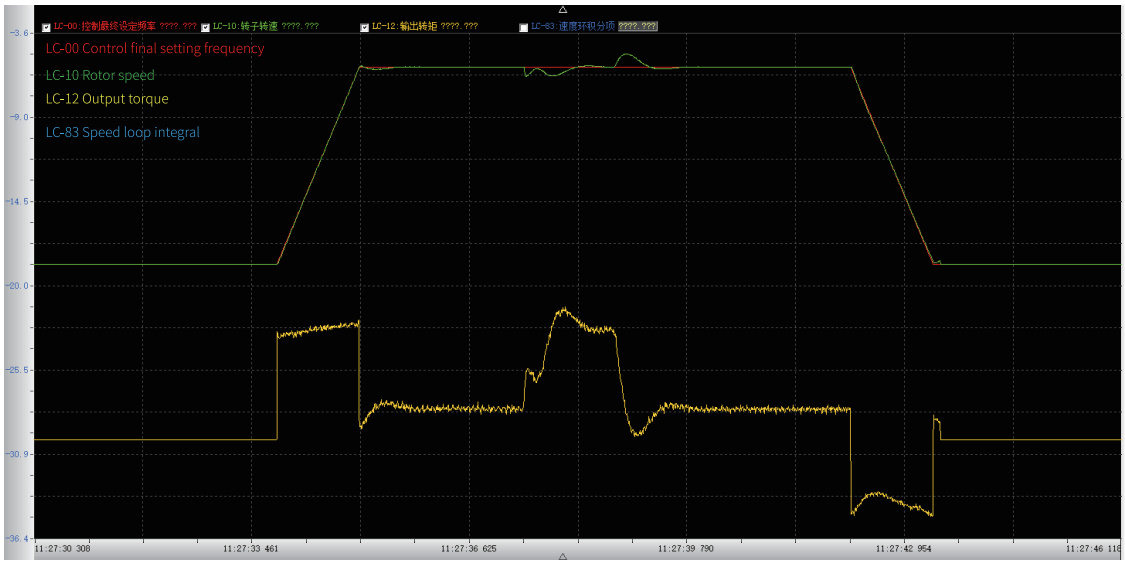


Figure 5-132 Poor speed anti-load disturbance performance

Speed following performance optimization

Application scenario: Speed following performance indicates that the feedback speed cannot follow the speed reference during acceleration or deceleration. Multiple oscillations occur upon high overshoot or after the speed reaches the reference. To optimize speed control, first adjust the speed loop to a lower value. For example, in FVC control mode, set speed loop Kp (F2-00) to 5 and Ti (F2-01) to 2.0 s, or in SVC control mode, set speed loop Kp (F2-02) to 5 and Ti (F2-03) to 2.0 s. This setting adjusts the acceleration torque feedforward and can greatly improve the speed following performance.

The acceleration torque feedforward calculation formula is as follows: $T_e = Ja$

T_e: Motor output acceleration torque

J: Inertia, which is a system parameter requiring auto-tuning or manual adjustment

a: Acceleration, that is, acceleration/deceleration time

As shown in the preceding formula, the acceleration/deceleration time "a" is known. The feedforward torque can be calculated by obtaining the system inertia "J". The system inertia "J" can be obtained through inertia auto-tuning. If auto-tuning is not possible, the acceleration torque feedforward coefficient (d3-39) can be manually adjusted to obtain accurate inertia compensation.

For devices that can be auto-tuned for dynamic inertia, the commissioning acceleration feedforward process is shown in the following figure.

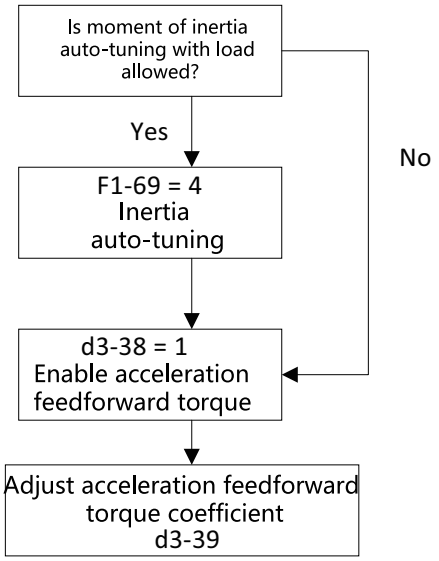


Figure 5-133 Acceleration feedforward commissioning process for devices that can be auto-tuned

The moment of inertia is an important parameter for acceleration feedforward. The following precautions are taken for inertia auto-tuning.

1. The system of fixed inertia such as inertia plates and rollers can be directly used for inertia auto-tuning.
2. The inertia system can perform partial inertia compensation (acceleration feedforward compensation) and then adjust PI parameters without inertia auto-tuning for travel limits.
3. Inertia auto-tuning is not performed for changing inertia systems (such as winding and unwinding machines, reciprocating cam slider mechanisms).

4. Systems with large load changes, such as fans and water pumps, can reduce the inertia auto-tuning speed. If C2-10 is set to 10% and C2-11 is set to 15% (the difference between the two cannot be less than 3%; otherwise, the auto-tuning accuracy may be affected), the effect of load change can be reduced.

For devices that cannot be auto-tuned for dynamic inertia, the commissioning acceleration feedforward process is shown in the following figure.

If inertia auto-tuning is not performed, the system will use a default moment of inertia. The acceleration torque feedforward can be also commissioned by adjusting acceleration feedforward torque coefficient (d3-39) during running. Set the weak speed loop Kp (F2-02 = 5) and Ti (F2-03 = 2.0 s) before adjusting the feedforward torque.

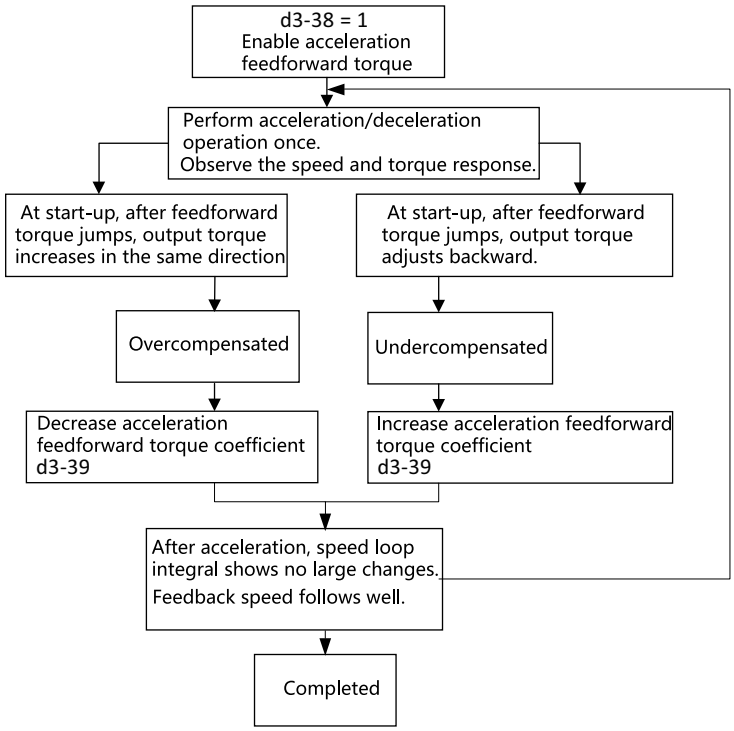


Figure 5-134 Acceleration feedforward commissioning process for devices that cannot be auto-tuned

Feedforward undercompensation: When acceleration/deceleration is started and reached, the feedforward torque jump does not reach the required level. After the speed reaches, the integral value of the speed loop changes significantly. The compensation coefficient of d3-39 must be increased.

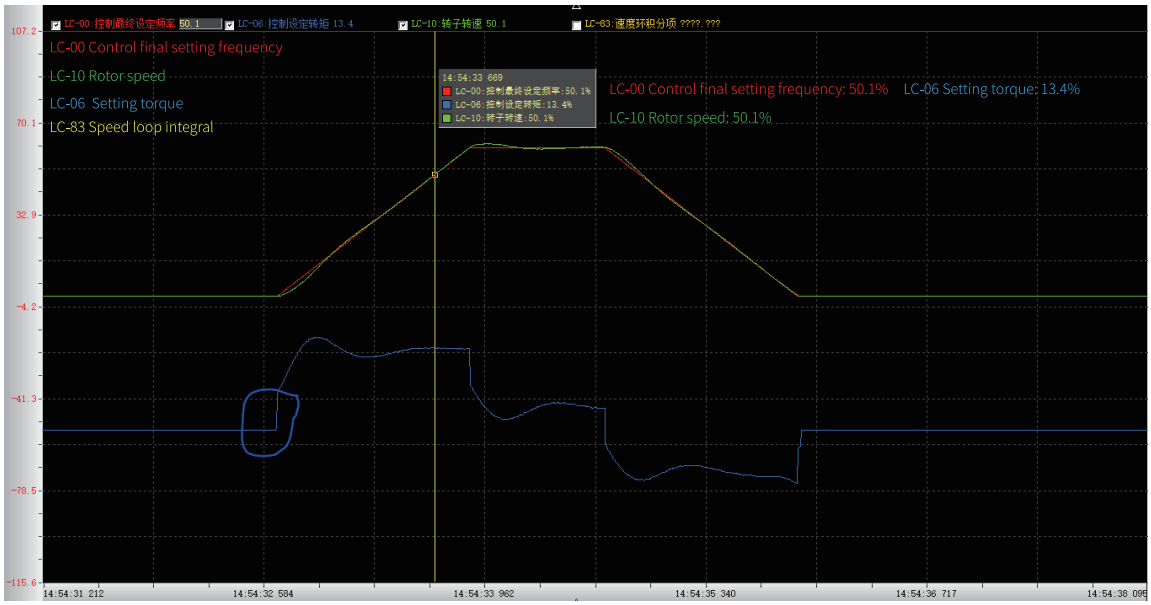


Figure 5-135 Acceleration torque feedforward undercompensation

Feedforward overcompensation: When acceleration/deceleration is started and reached, the feedforward torque jump exceeds the required level, and the speed loop integral value changes significantly after the speed is reached. Reduce the compensation coefficient d3-39.



Figure 5-136 Acceleration torque feedforward overcompensation

As shown in the following figure, feedforward torque is close to the required torque. When the speed reference changes, the feedback speed follows accurately.

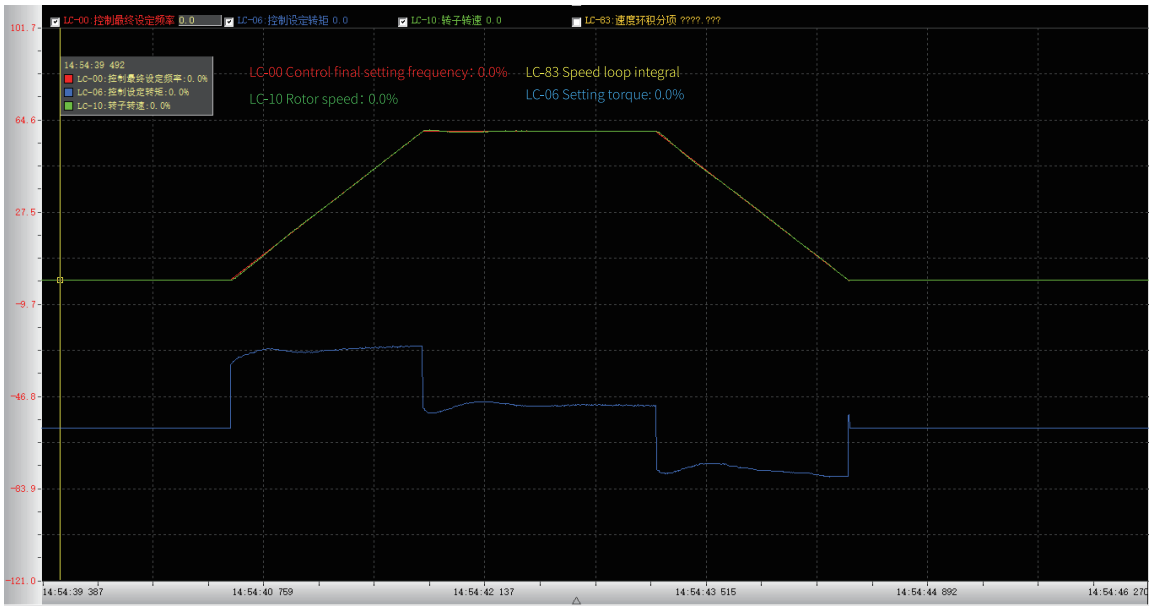


Figure 5-137 Normal effect of acceleration torque feedforward

For flexible loads, sudden changes of feedforward torque will cause acceleration shock, mechanical oscillation, or abnormal noise. You can enable the S curve (b7-00 = 1). The value of b7-13/b7-14 can be set to 10% of the acceleration time (b7-04). For example, b7-04 = 20s, b7-13/b7-14 = 2s. The value of b7-15/b7-16 can be set to 10% of the deceleration time. The torque changes linearly, which can greatly reduce the torque shock and reduce mechanical oscillation.

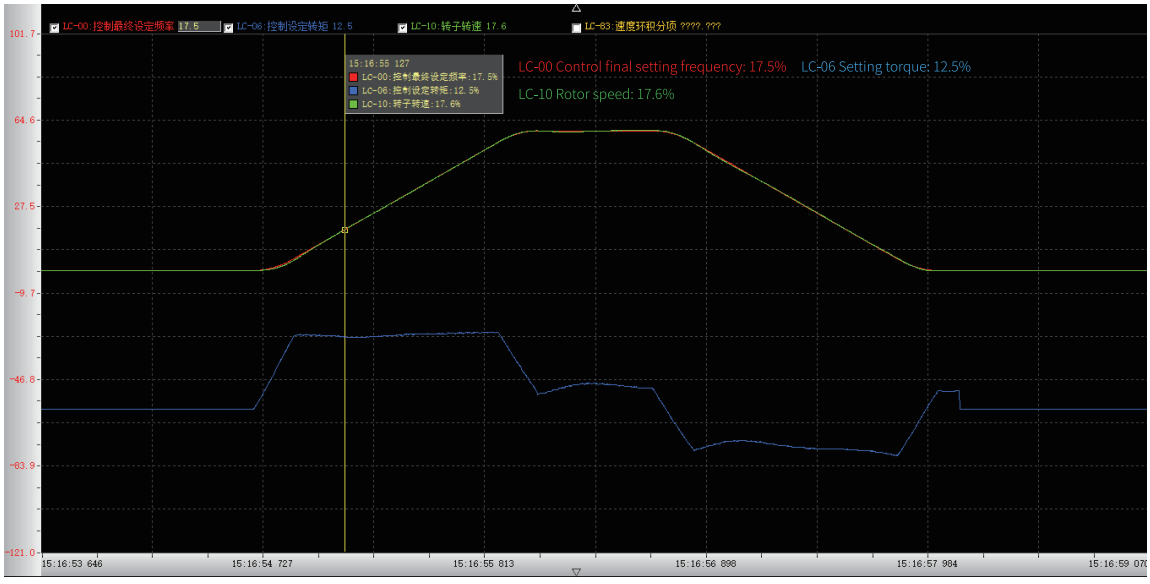


Figure 5-138 Normal effect of acceleration torque feedforward with S curve enabled

The PLC writes the speed at a slow cycle. For example, if the speed is set once for 100 ms, the feedback speed step will jump, and the output torque will also fluctuate greatly. For details, see *"5.3.1.3.5 Frequency Ramp Change" on page 453*. This issue is common in metallurgy, papermaking, test bench, chemical, and textile industries, where the speed reference is set by PLC. In this case, you can enable the ramp change function (b5-11) and set the cycle of the speed set by PLC through b5-12 (measurement interval in the commissioning software oscilloscope). The ramp change function reduces the torque ripple during acceleration/deceleration.

Anti-load disturbance performance

Application scenario: Load changes will cause speed fluctuations. For example, speed drops significantly when a crusher encounters large loads or when metallurgical rods and wires or wide and thick plates enter or exit a rolling mill. In ports, RTGs and the large and small vehicles of quay cranes experience high friction during startup, which may result in poor speed following. In electric vehicle powertrain test benches, sudden increases in torque on the test piece can cause speed drops. In systems with low inertia, the default speed loop parameters may be too strong, leading to torque oscillations and mechanical noise during startup. These phenomena require adjustment of the speed loop PI parameters.

For PI parameter adjustment, see the following steps:

1. Set the weak speed loop parameters. The speed loop parameters in FVC mode are Kp (F2-00 = 3) and Ti (F2-01 = 2.0s). The speed loop parameters in SVC mode are Kp (F2-02 = 3) and Ti (F2-03 = 2.0s). To prevent oscillation caused by high PI parameters, set the weak speed loop parameter as the starting point. For some motors, such as direct-drive motors, the Kp of the high-speed loop output torque needs to be set to a weaker position.
2. Increase the speed loop Kp gradually and observe U6-00 (actual motor speed) and U6-23 (set torque current). The speed fluctuation of normal waveform should be within 0.3% and the torque setting current within 3%.
3. During the incremental increase of Kp, the fluctuation of U6-23 (set torque current) should not exceed 3%. After modifying Kp, observe whether the torque current fluctuation occurs in different speed running waveforms.
4. When the torque current setpoint fluctuates by 3%, decrease Kp by 1/3 and perform Kp value commissioning.
5. Reduce the speed loop integral time Ti gradually according to the load. For common applications, the integral time must not be less than 0.5 s. For scenarios with high dynamic response, It is recommended that the integral time is not less than 0.1 s.
6. In systems with a high inertia ratio or large mechanical systems, the bandwidth is typically lower. After loading, sudden load-off can cause repeated speed fluctuations. This can lead to bus voltage pumping, causing overheating and overloading of the braking IGBT and braking resistor. It is recommended that the system integral time be set to 2 s. The integral time should be set relatively long.

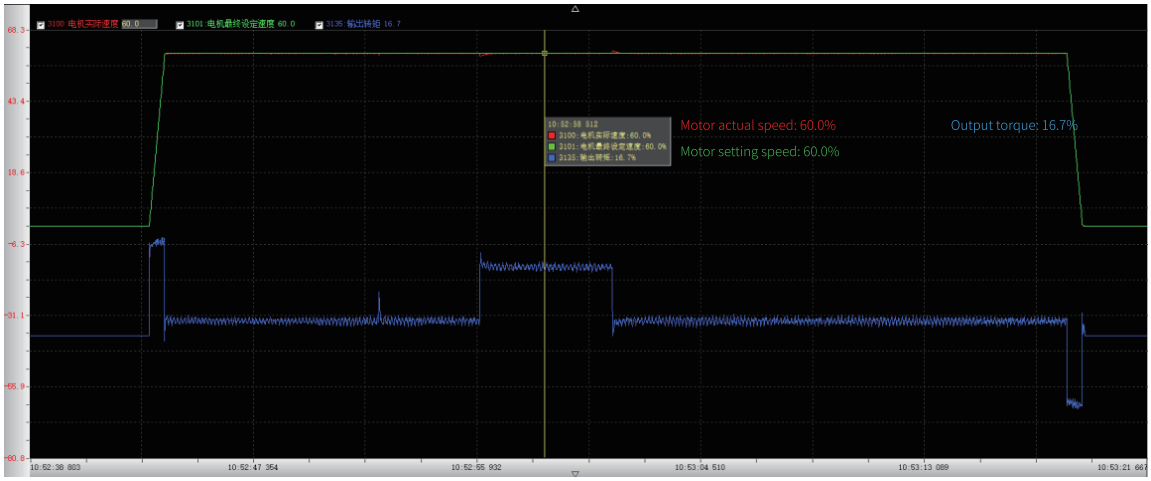


Figure 5-139 Waveform effect of sudden load/unload after commissioning

5.3.1.4 Torque Control

5.3.1.4.1 Torque Control

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control includes torque reference and overspeed control. The torque reference includes torque reference setting, gain calculation, filtering, and acceleration/deceleration. Overspeed control includes setting speed limit, filtering, acceleration/deceleration, speed offset mode, and speed offset value.

Torque control must be combined with overspeed control. When the motor output torque is not greater than the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent the motor from overspeed, the motor speed must be limited under torque control. When the motor speed exceeds the limit, the motor speed control is used. When the motor speed returns below the limit, the torque control is used.

5.3.1.4.2 Torque Reference

Scenarios

Switch the torque control mode through d0-01. In the torque control mode, set the torque reference filter and acceleration/deceleration time through b5-16, b5-17, and b5-18. In torque control mode, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. The motor speed may change quickly, resulting in loud noise or high mechanical stress.

Proper acceleration/deceleration time helps smooth changes in the motor speed. The acceleration/deceleration time in torque control represents the time needed for the torque to increase from 0 to the rated motor torque.

Working Principle

In the torque control mode, torque reference source is torque control command. In the torque control mode, the torque reference from the torque control reference which can be set by digital setting or other setting methods in the following table.

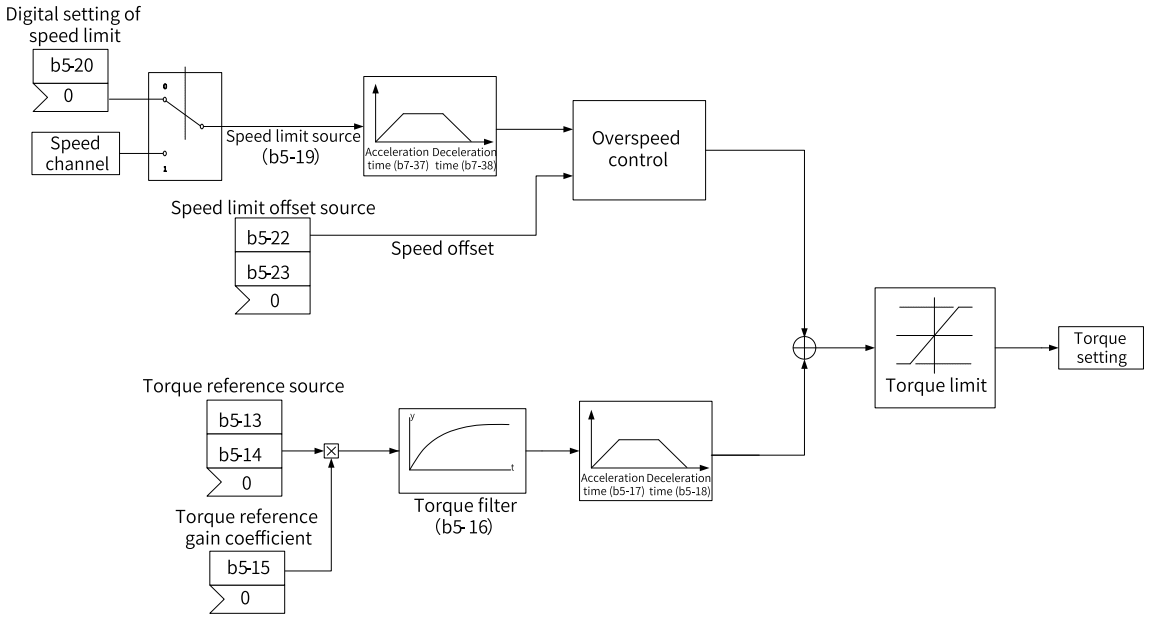


Figure 5-140 Torque control diagram

Related parameters:

Param.	Parameter Name	Default	Value Range	Description
F0-02/d0-01	Motor control mode:	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 9: DI1 to DI7 - Depends on the terminal state of the DI. 0: speed control; 1: torque control. Others: B connector The control method depends on the status of B connector. 0 indicates speed control and 1 indicates torque control.
b5-13	Torque reference source	0	set by the parameter (b5-14) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the torque reference source. Default to 0 (Select the torque reference source set by the parameter (b5-14))
b5-14	Digital setting for torque reference	0.0%	-800.0%–800.0%	This parameter defines the torque reference in the torque control mode. The torque reference uses relative value. The value 100.0% corresponds to the rated motor torque. Value Range: The setting range is -800.0% to 800.0%, indicating that the maximum torque of the drive is 8 x rated torque of the motor. When the torque reference value is positive, the drive operates in the forward direction. When the torque reference value is negative, the drive operates in the reverse direction.

Param.	Parameter Name	Default	Value Range	Description
b5-15	Torque reference gain factor	0	0: 100% 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of the torque reference gain factor. The default gain factor is 100%.
b5-16	Torque filter time	0	0 ms to 10000 ms	Defines the torque filter time, which can be used to filter out interference given by the torque reference. This parameter can be used to filter out interference generated by the torque reference. Set this parameter according to the actual reference signal quality. The larger the value, the better the filtering effect, but the longer the torque reference delay.
b5-17	Torque acceleration time	0.000s	0.000s to 60.000s	This parameter sets the torque acceleration time.
b5-18	Torque deceleration time	0.000s	0.000s to 60.000s	This parameter sets the torque deceleration time.

Instances

In torque control mode, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. The motor speed may change quickly, resulting in loud noise or high mechanical stress. Therefore, the motor speed may change quickly, causing noise or excessive mechanical stress. Proper acceleration/deceleration time and filter time (defined by b5-17 and b5-18) helps smooth changes in the motor speed. The acceleration/deceleration time in torque control represents the time needed for the torque to increase from 0 to b5-14.

In the torque control mode, the acceleration/deceleration time is not required for start with small torque. For applications requiring quick torque response, set the acceleration/deceleration time to 0.00s.

For example, two AC drives are connected to drive the same load. To balance the load distribution, set one AC drive as the master and select the speed control mode. Set the other one as the slave and select the torque control mode. The slave receives the output torque of the master as the torque command and follows the master rapidly. In this case, the acceleration/deceleration time of the slave in the torque control mode is set to 0.00s.

5.3.1.4.3 Overspeed Control

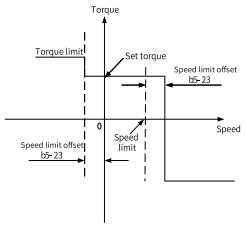
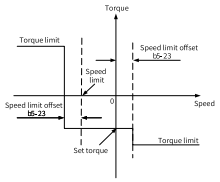
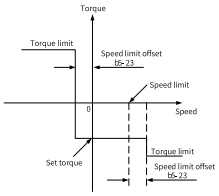
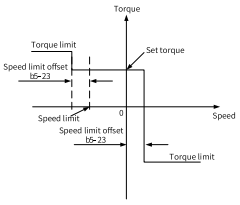
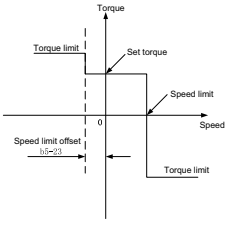
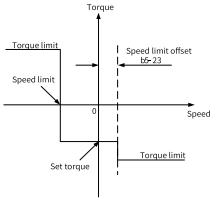
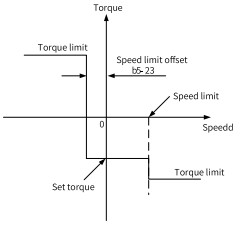
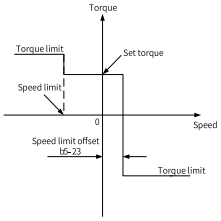
Scenarios

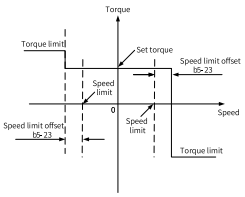
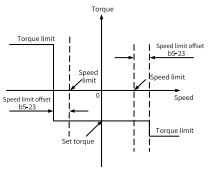
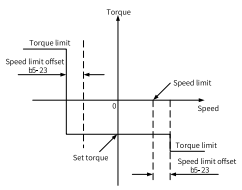
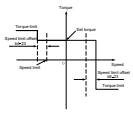
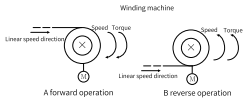
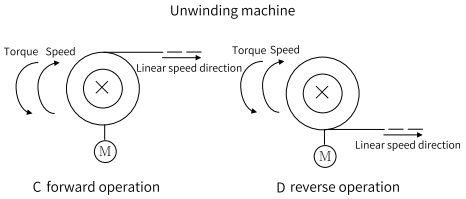
In the torque control mode, if the load torque is lower than the output torque of the motor, the motor speed keeps increasing. Therefore, the motor speed (that is, the frequency upper limit) must be restricted to prevent accidents such as runaway.

Overspeed control is used to protect against overspeed under torque control. After the motor runs at a speed greater than the overspeed limit, overspeed control is activated. In this case, speed control takes effect and the motor torque cannot be output according to the torque setpoint. If the speed returns to the overspeed limit range, torque control is restored.

Working Principle

The speed limit parameters of overspeed control include the speed limit and speed offset. In different speed limit and offset settings and motor running states, the overspeed control states of torque control are as follows:

Items	Operating Condition			
Operation Command	Forward running	Forward run	Forward run	Forward run
Torque reference direction	+	/	/	+
Speed Limit Direction	+	/	+	/
Normal Running Direction	Forward run	Reverse run	Forward run	Reverse run
Bi-directional speed limit offset (b5-21 = 0)				
Uni-directional speed limit offset (b5-21 = 1)				

Items	Operating Condition			
Overspeed control mode (b5-21 = 2)				
Instances				

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Related parameters:

Param.	Parameter Name	Description	Default	Value Range
b5-19	Speed limit source	This parameter sets the speed limit source. Description 0: Digital setting - In torque mode, the speed limit source is digital setting and the speed limit set by the "b5-20 (digital setting of speed limit)" parameter takes effect. 1: Speed channel - The speed limit in the torque mode is set through the speed channel.	0	0: Digital setting 1: Speed channel
b5-20	This parameter defines the digital setting of the speed limit.	This parameter defines the digital setting of the speed limit. It is valid when b5-19 is set to 0.	0.0%	-800.0%–800.0 %
b5-21	Speed limit offset mode in torque mode	This parameter sets the speed limit offset mode in the torque mode. Value description 0: The offset is valid for both directions (forward and reverse directions). 1: The offset is valid only for unidirectional direction (opposite to the limit direction). 2: The offset is valid in both directions (forward and reverse directions). The absolute value of the positive and negative speed limit is the speed limit plus the offset.	0	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control mode

Param.	Parameter Name	Description	Default	Value Range
b5-22	Speed limit offset source	This parameter sets the speed limit offset source.	0	0: Digital setting 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector
b5-23	Digital setting of speed limit offset	Defines the speed limit offset as a percentage to the rated speed. This parameter is activated when b5-22 [Speed limit offset source] is set to 0 [b5-23].	5.0%	0.0%–800.0%

Instances

Example 1: Tension control torque mode winding and unwinding is a typical application of torque control.

As shown in the following figure, the application example "A-forward" is used to prevent the motor from accelerating continuously and from the reverse rotation of the motor.

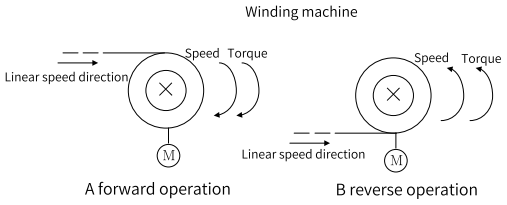


Figure 5-141 Winding/unwinding machine torque control diagram 1

If the master controls the winding machine to run in the forward direction at a speed between 0% and 100%, the winding requires 20% torque. Reverse rotation is not allowed. The main parameters of torque control are as follows:

Param.	Name	Value
b5-14	Digital setting for torque reference	20.0%
b5-20	This parameter defines the digital setting of the speed limit.	100.0%
b5-21	Speed limit offset mode in torque mode	1
b5-23	Digital setting of speed limit offset	0.0%

Example 2: As shown in the application example "C forward" in the following figure, the motor pulls the unwinder forward.

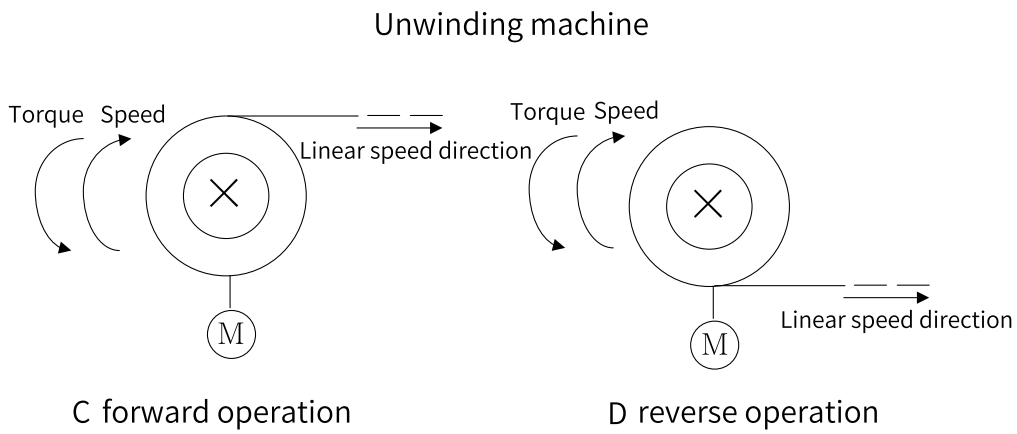


Figure 5-142 Winding/unwinding machine torque control diagram 2

For example, 20% torque is required for unwinding and 5% speed reverse rotation is allowed. The main parameters of torque control are configured as follows:

Param.	Name	Value
b5-14	Digital setting for torque reference	-20.0%
b5-20	This parameter defines the digital setting of the speed limit.	100.0%
b5-21	Speed limit offset mode in torque mode	1
b5-23	Digital setting of speed limit offset	5.0%

Example 3: As shown in the following table, the motor runs in the forward direction. The torque setting of the motor is set by b5-14 and the speed limit of overspeed control is set by b5-20. The speed limit offset mode is unidirectional offset.

Assume that:

Before t1, the motor output torque is equal to the value of b5-14 and the motor running speed is lower than b5-20.

The load decreases abruptly at t1, and the load torque is smaller than the motor output torque. The motor accelerates, reaching b5-20 at t2. The speed limit is reached, and overspeed control takes effect.

After t2, the speed is stable at b5-20. The motor torque cannot be output according to the value set by b5-14. The actual output torque is determined by factors such as the actual load torque and friction.

At t3, the load continuously decreases or an external force is used to drag the motor in the forward direction. To prevent the speed from exceeding the speed limit range, the output forward torque decreases rapidly controlled by the PI control. After the final output torque reaches the negative torque limit, the overspeed control fails. After this, the speed exceeds the speed limit setting. In this case, check the system configuration.

The positive motoring dynamic example of unidirectional limit offset can be compared to the example of the positive motoring overspeed control of unidirectional limit offset in Figure (a), where

the control before t3 corresponds to area I in Figure (a). In this case, within the speed limit, the output torque is the torque setpoint, and the output torque at the speed limit is smaller than the torque setpoint.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed limit.

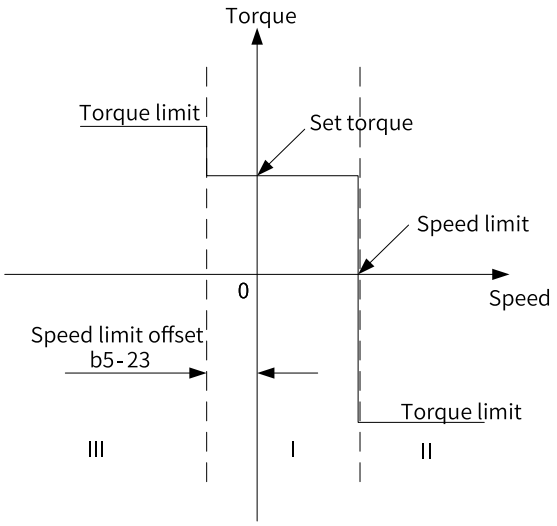


Figure 5-143 (a) Example of positive motoring overspeed control of unidirectional limit offset

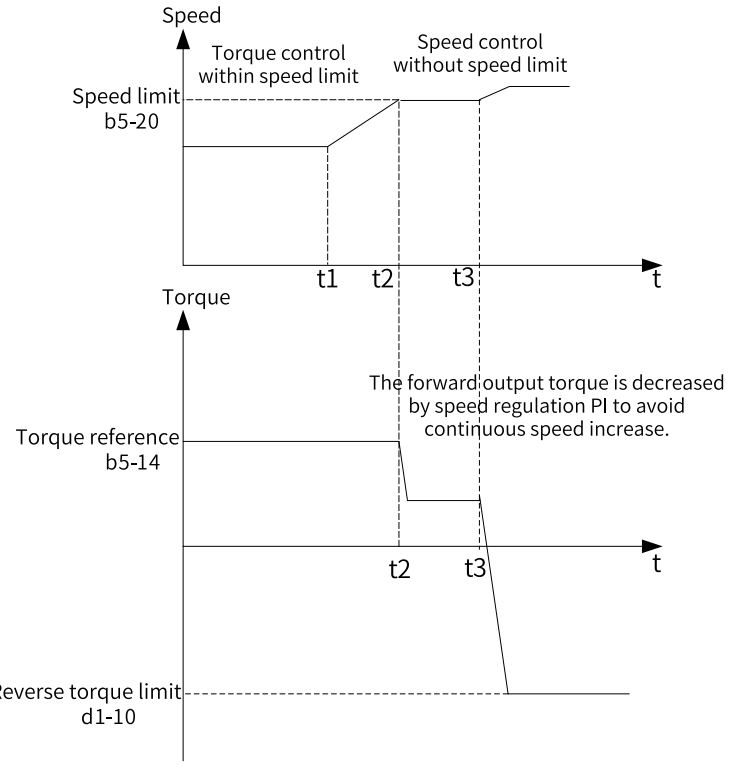


Figure 5-144 (b) Example of positive motoring dynamic of unidirectional limit offset

Example 4: As shown in the following figure, the setting and running state before t1 is the same as in the preceding example.

At t2, the load increases suddenly. Since system does not allow the reverse direction of higher speed, unidirectional speed offset is set. In this case, the motor output torque increases in the forward direction by the speed regulation PI, and the speed reaches the speed offset setting speed.

At t3, the load increases further or external force is used to drag the motor. To prevent the speed from exceeding the speed offset, the output forward torque increases controlled by the speed regulation PI. When the final output torque reaches the forward torque limit, the overspeed control fails, and the speed will exceed the speed offset setting. In this case, check the system configuration.

The positive motoring dynamic example of unidirectional limit offset can be compared to the example of the positive motoring overspeed control of unidirectional limit offset in Figure (c), where the control before t3 corresponds to area I in Figure (c). In this case, within the speed limit and speed offset, the output torque is the torque setpoint, and the output torque at the speed offset is larger than the torque setpoint.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed offset.

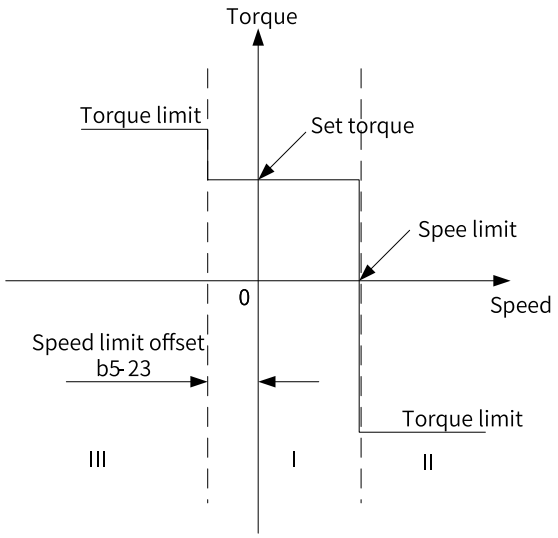


Figure 5-145 (c) Example of positive motoring overspeed control of unidirectional limit offset

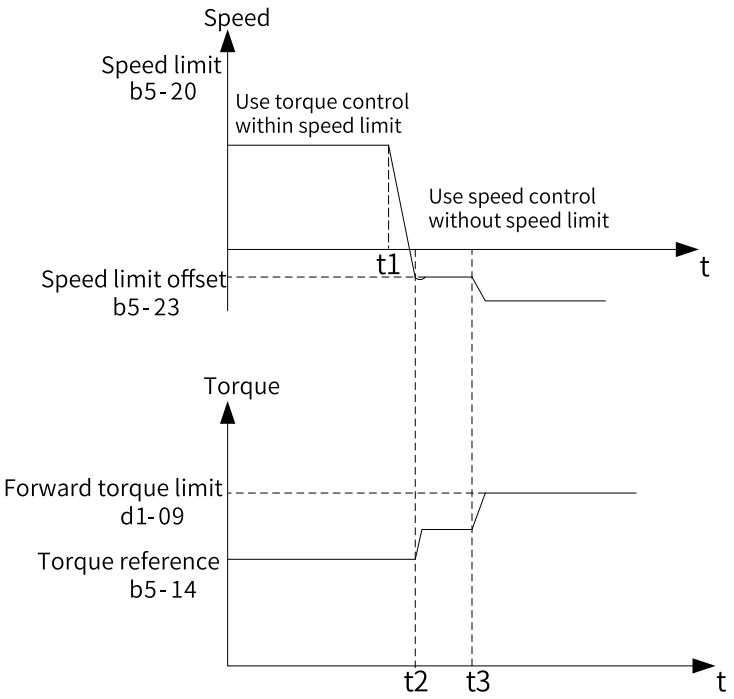


Figure 5-146 (d) Example of positive motoring dynamic of unidirectional limit offset

5.3.1.5 Current Limit

Scenarios

In the case where the motor running current needs to be limited during FVC or SVC control, set the maximum motor current (F1-13) and the maximum AC drive current (A3-05) to ensure that the motor current during normal operation does not exceed the minimum values in F1-13 and A3-05.

Working principle

The current regulator automatically controls the current, ensuring that the total current output does not exceed the limit value.

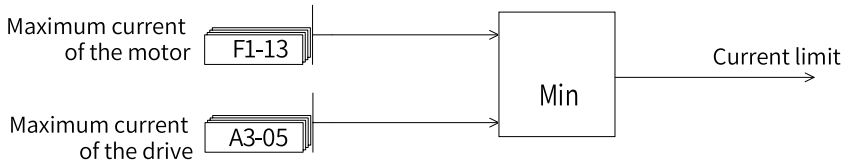


Figure 5-147 Current limit effective

Related parameters

Param.	Name	Description	Default	Value Range
F1-13	Maximum motor current	Sets the maximum limit of the motor current. The value 100% corresponds to the rated motor current. Note: The current limit is the smaller value of F1-13 and A3-05.	1000.0%	0.0% to 1000.0%
A3-05	Maximum AC drive current	Sets the maximum current of the AC drive. Output current upper limit of AC drive = maximum current of the AC drive x rated current of the AC drive. Note: This parameter uses the rated AC drive current as the base value in percentage. The lower value between F1-13 and A3-05 is used as the effective current limit.	150%	0% to 600%

Precautions

- When the maximum motor current is limited, the overload capacity of the motor may be affected and the motor torque output will be reduced.
- The current limit of the motor is valid only in vector control. In V/f control mode, the overcurrent suppression function needs to be enabled to ensure that the current is lower than the maximum current.
- When the current limit is valid, it is recommended to set b7-46 to 1 to prevent excessive deviation between the set speed and the actual speed.

5.3.1.6 Torque Limit

Scenarios

For FVC or SVC control, in some process applications, the motor output torque needs to be limited. In some cases, the motor torque limit needs to be adjusted to achieve torque control while the motor runs in the speed mode.

Working Principle

The torque limit can be achieved by limiting the output of the speed loop. The following figure shows setting the torque limit.

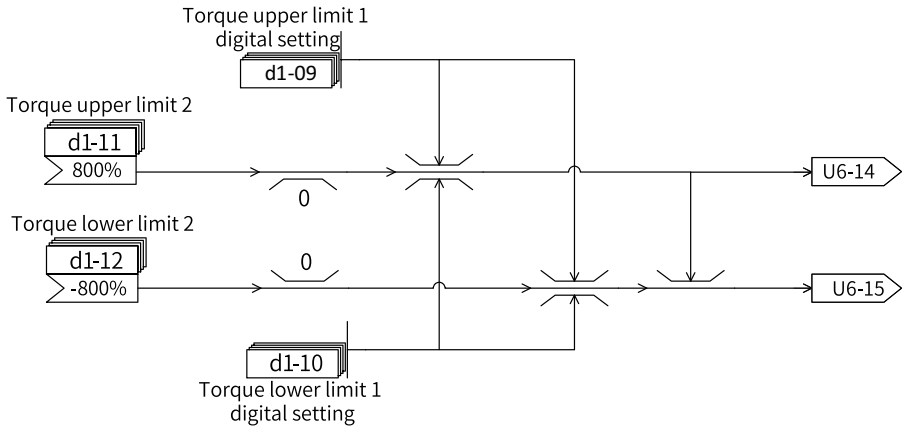


Figure 5-148 Torque limit diagram

The following figure shows how the torque limit takes effect.

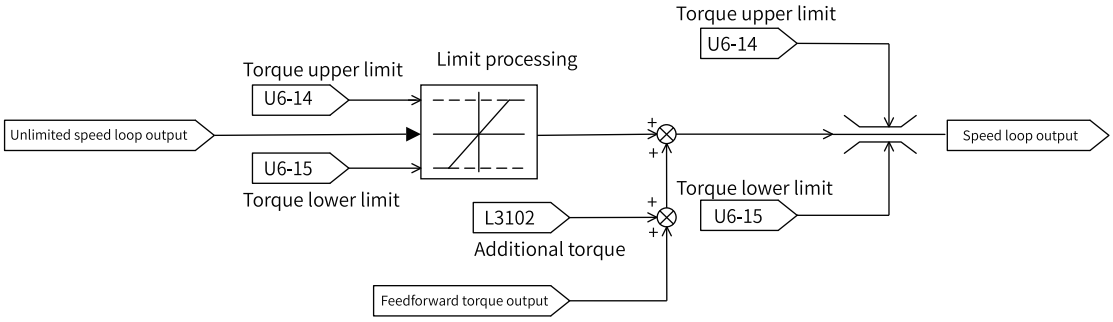


Figure 5-149 Speed loop with output torque limit

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d1-09	Digital setting of torque upper limit 1	Used to limit the maximum positive output torque. It is a per-unit value based on the rated torque of the motor. Additional information: The effective forward torque limit is the smaller value between d1-09 and d1-11.	200.0%	0.0%–800.0%
d1-10	Digital setting of torque lower limit 1	Used to limit the maximum negative output torque. It is a per-unit value based on the rated torque of the motor. Additional information: The effective negative torque limit is the lower value between d1-10 and d1-12.	-200.0%	-800.0%–0.0%

Parametor Code	Parameter Name	Description	Default:	Value range
d1-11	Source of torque upper limit 2	Used to set the torque upper limit 2. It is the per unit value based on the rated torque of the motor. F2-32 is the mapping of d1-11 [Selection of torque upper limit 2] in group F. The two parameters have the same function. Description 0: 800% Set the forward torque limit to 800%. 2: AI1 - The positive torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The positive torque limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The forward torque limit is set through the pulse frequency of the DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the forward torque limit source, combinations of different DI states correspond to different forward torque limits. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The forward torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID The forward torque limit is set through PID. 9: Communication - The positive torque limit is set through communication. The forward frequency upper limit can be input through remote communication. Others: F connector. - The reverse frequency upper limit is set through the F connector. Additional information: The effective forward torque limit is the smaller value between d1-09 and d1-11.	0: 800%	0: 800% 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector

Parametor Code	Parameter Name	Description	Default:	Value range
d1-12	Source of torque lower limit 2	Used to set the torque lower limit 2. It is the per-unit value based on the rated torque of the motor. F2-33 is the mapping of d1-12 [Selection of torque lower limit 2] in group F. The two parameters have the same function. Description 0: -800% Set the reverse torque limit to -800%. 1: Opposite to forward torque upper limit 2 - Reverse the forward torque limit value of d1-11. 2: AI1 - The negative torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The negative torque limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The reverse torque limit is set through the pulse frequency of the DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the reverse torque limit, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. The reverse torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID The reverse torque limit is set through PID. 9: Communication - The negative torque limit is set through communication. Others: F connector. - The reverse frequency upper limit is set through the F connector. Additional information: The effective reverse torque limit is the smaller value between d1-10 and d1-12.	1: Opposite to the forward torque upper limit	0: -800% 1: Opposite to the forward torque upper limit 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector

Precautions

- The motor torque limit is active only in vector control modes. It is inactive in V/f mode.
- The actual torque restriction of the motor is affected by the current limit, torque limit, and power limit. The preceding figure takes the motoring working condition as an example to illustrate the impact of the three limits on the actual torque limit. The actual torque limit is determined by the most restrictive conditions among the limits. In the figure, in order to facilitate comparison, the effective torque limit is slightly lower, and the curve of the actually effective torque limit is coincident with the curve of the minimum torque limit.

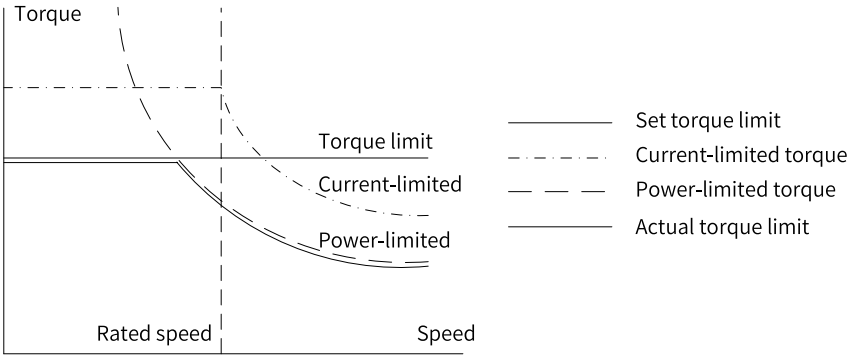


Figure 5-150 Torque limit diagram

5.3.1.7 Power Limit

Scenarios

In SVC control, the power limit can restrict the total power output by the motor. It is suitable for process applications where the output power of the motor needs to be limited separately.

Operation principles

The power limit is internally converted to the torque limit. The output torque limit decreases as the motor speed increases due to the power limit.

The following figure describes the difference between the generating power and the motoring power. When the motor speed direction and torque direction are both positive or negative, that is, when the speed direction and torque direction are consistent, the motor is in the motoring mode and is limited by the motoring power. When the speed direction is opposite to the torque direction, the motor is in the generating mode and is limited by the generating torque.

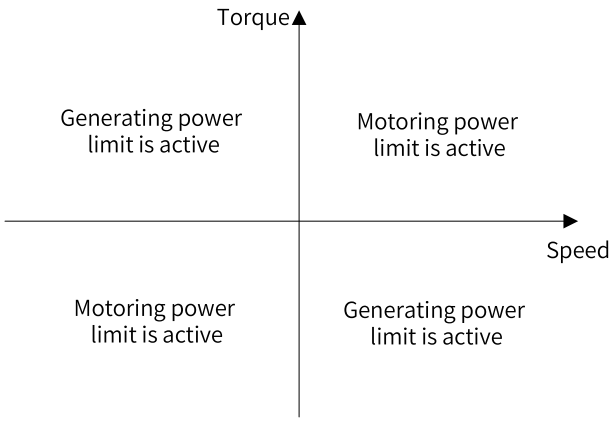


Figure 5-151 Effective range of power limits

The generating power limit is the minimum value of d1-14 (generating power limit 1) and d1-17 (generating power limit 2).

Whether d1-17 is enabled and the actual range is determined by d1-15 (generating power limit 2 setting).

For example, generating power limit 2 (d1-17) is disabled when d1-15 (generating power limit 2 setting) is set to 0.

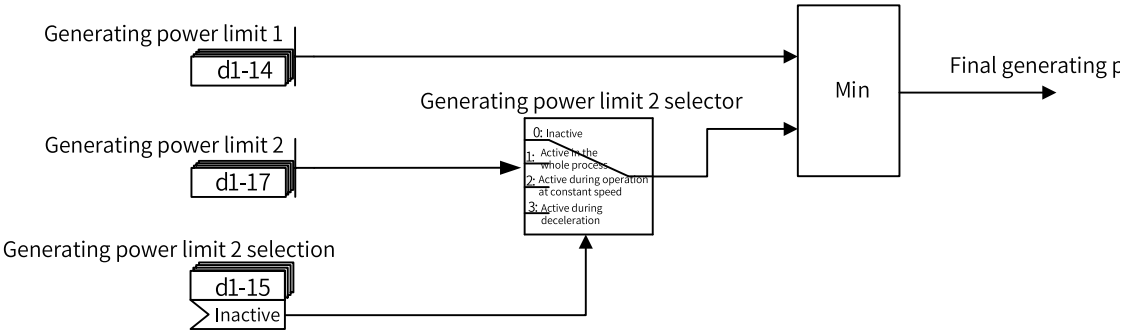


Figure 5-152 Generating power limit diagram

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d1-13	Motoring power limit	This parameter limits the output power of the motor in the motoring state. It is the per unit value based on the rated motor power.	400.0%	0.0 to 1000.0%
d1-14	Generating power limit 1	This parameter limits the output power of the motor in the generating state. It is the per unit value based on the rated motor power.	400.0%	0.0 to 1000.0%
d1-15	Generating power limit 2	Sets whether the motoring power limit is effective. Description Inactive: Disabled during motor running Active all the way: Active during motor running Constant speed: Active when the motor is running at a constant speed Deceleration effective: Active during motor deceleration. Additional information: The effective generating power limit is the smaller value between generating power limit 1 and generating power limit 2.	0: Disabled	0: Disabled. 1: Enabled in whole process 2: Enabled at constant speed 3: Enabled during deceleration
d1-17	Generating power limit 2	This parameter limits the output power of the motor in the generating state. It is the per unit value based on the rated motor power.	20.0%	0.0 to 800.0%

Precautions

The motor power limit is active only in vector control modes. It is inactive in V/f mode.

5.3.1.8 Overvoltage Suppression

Scenarios

In high inertia or rapid deceleration applications, overvoltage may occur during deceleration. When the motor is in the power generation state, the DC bus voltage rises. Under FVC or SVC control, overvoltage suppression can be turned on to suppress the rise of the DC bus voltage.

Operation principles

When the overvoltage suppression function is enabled, the actual deceleration speed of the motor is limited by PID control of the bus voltage after the bus voltage exceeds d1-56. This function is used to suppress the rise of the bus voltage and prevent overvoltage. In this case, the deceleration time will be longer than the setting.

The following figure shows the overvoltage suppression process.

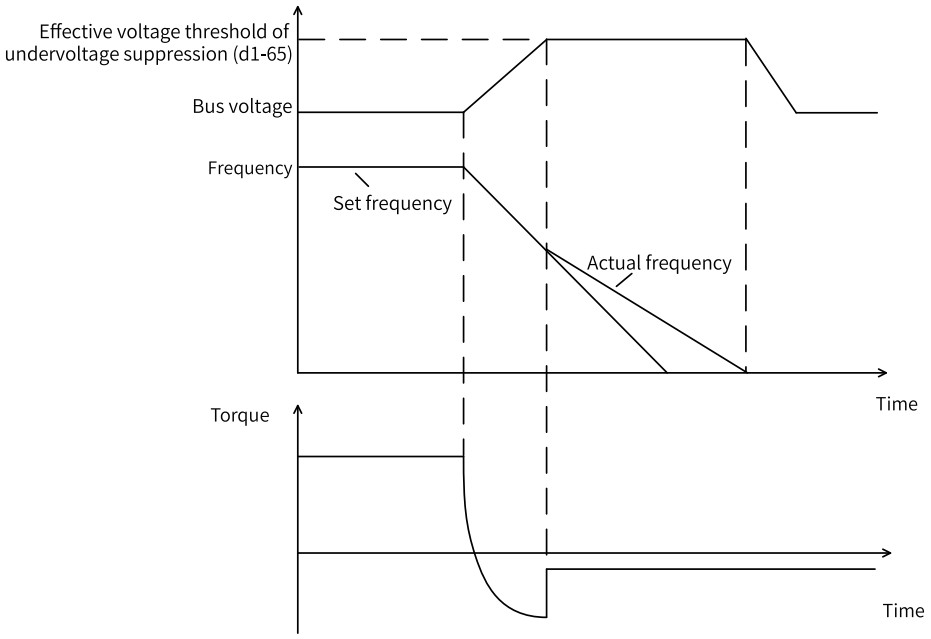


Figure 5-153 Overvoltage suppression control process

Technical data

Parametor Code	Parameter Name	Description	Default:	Value range
d1-54 (F2-39)	Overvoltage suppression	Sets whether overvoltage suppression is enabled. F2-39 is the same parameter as d1-54. After F2-39 is modified, d1-54 is updated synchronously.	1: Enable	bit 0: V/f overvoltage suppression • 0: Disable • 1: Enable bit 1: vector overvoltage suppression • 0: Disable • 1: Enable
d1-55 (F2-40)	Overvoltage suppression action voltage	Defines the bus voltage threshold for overvoltage suppression. The effective value is displayed in d1-56. F2-40 is the same parameter as d1-55. After F2-39 is modified, d1-54 is updated synchronously.	770.0V	600.0 V to A3-57
d1-56	Effective voltage threshold for overvoltage suppression	Displays the actual voltage when overvoltage suppression is triggered. This parameter is obtained automatically by the system and cannot be changed. When the bus voltage is greater than this value, the overvoltage suppression function takes effect.	770.0V	600.0 V to A3-57
d1-57	Overvoltage suppression Kp adjustment	Defines the proportional coefficient of the overvoltage suppression control loop. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.	100%	0.0% to 1000%
d1-58	Overvoltage suppression Ki adjustment	Defines the integral coefficient of the overvoltage suppression control loop. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.	100%	0.0% to 1000%

Precautions

- Note 1: Set E9.02 for VdcMax control to a relatively large value to prevent incorrect trigger in the case of large grid voltage fluctuations. Note 2: It is recommended that the trigger voltage be verified during application.
- Use the V/f overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value less than the overvoltage suppression action voltage or disable the overvoltage suppression.
- In the case of common bus, enable the overvoltage suppression function on only one drive unit, typically the drive unit with the largest inertia, and disable this function on other drive units.
- In the torque control mode, exert caution before enabling the overvoltage suppression function. If the torque cannot adjust the system bus, the torque may be adjusted to the limit.

- In case of proactive load such as the lifting load, disable the overvoltage suppression function. Because overvoltage suppression will restrict the power generation torque, which may cause motor driven by the load, resulting in serious consequences such as heavy object falling.

Instances

In the case of short deceleration time and large motor inertia, an overvoltage fault may occur during deceleration or during speed overshoot.

Overvoltage suppression is enabled by default. The bus voltage rise is suppressed by suppressing the generating torque and reducing the generating power. The bus voltage will basically remain close to d1-56 (Overvoltage suppression actual effective action voltage), which can be reduced by setting d1-55 (Overvoltage suppression action voltage).

If the bus voltage cannot be suppressed, increase d1-57 (Overvoltage suppression Kp adjustment) and d1-58 (Overvoltage suppression Ki adjustment) to limit the generating power and improve the bus voltage control effect.

5.3.1.9 Undervoltage Suppression (Vector)

Scenarios

In the FVC or SVC control mode, when the power supply or DC bus incurs short-term power-off, undervoltage will occur if the fault is not handled in time, causing coast to stop. After the undervoltage suppression function is enabled, undervoltage can be suppressed in a short period, preventing stop upon instantaneous power-off. When the power supply or DC bus incurs long-term power failure, you need to enable the undervoltage suppression function for power generation to compensate for bus energy loss until all motors stop reliably.

Working principle

After the bus voltage falls below the undervoltage suppression action voltage, the PID control of the bus voltage makes the motor decelerate and enter the power generation state to compensate for energy loss to stabilize the voltage in the DC bus.

The following figures show the overvoltage suppression process.

- If d1-63 is set to 1 (Undervoltage suppression. Restore to normal operation after voltage recovery), when the running frequency is higher than d1-72 plus d1-73, undervoltage suppression is performed. When the bus voltage recovers and the running frequency is higher than d1-72, the speed is accelerated to the original speed according to the set acceleration time after the bus voltage is restored, as shown in the following figure curve ①.
- If d1-63 is set to 2 [decelerate to stop], when undervoltage occurs, the operating frequency is higher than d1-72 plus d1-73. The AC drive performs decelerate to stop according to the time set by d1-69. The stop remains when the bus voltage recovers until the stop is completed.

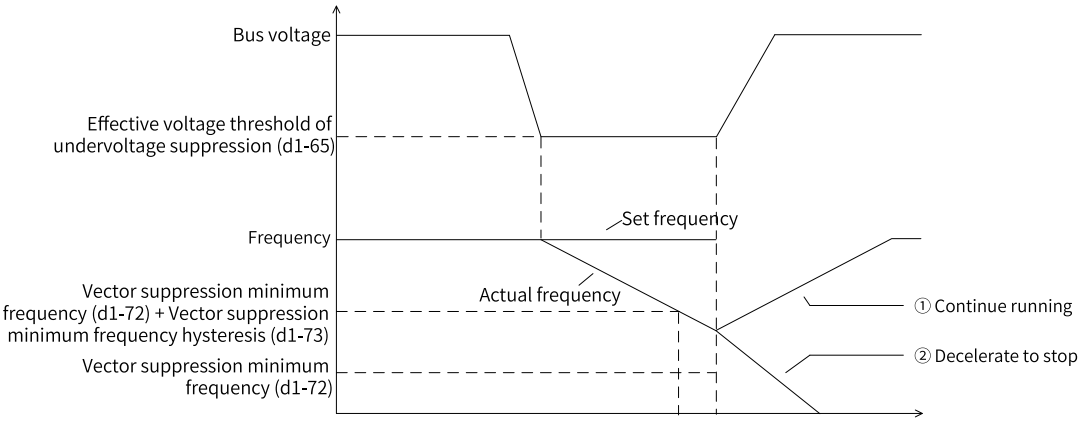


Figure 5-154 Undervoltage suppression. Restore to normal operation or decelerate to stop after voltage recovery.

- When the undervoltage action enable is selected, the running frequency is higher than d1-72 plus d1-73 when the undervoltage occurs. When the running frequency reaches d1-72 and the bus voltage is not restored, the undervoltage fault is reported and the motor stops.

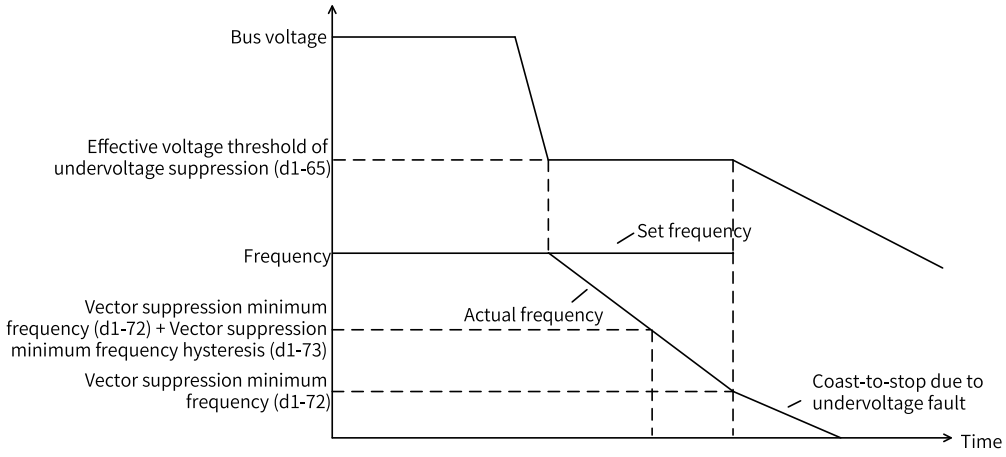


Figure 5-155 When undervoltage is suppressed, running frequency lower than minimum frequency of undervoltage suppression

- When the undervoltage action is enabled and the running frequency is lower than d1-72 plus d1-73 when undervoltage occurs, the undervoltage suppression function is disabled. The motor continues to run until the bus voltage is below A3-56 when the undervoltage fault is reported and the motor stops.

Related parameters

Param.	Name	Description	Default	Value Range
d1-63 (F2-43)	Undervoltage action	Defines the response when the bus voltage reaches the undervoltage suppression point due to power failure. F2-43 is the mapping of d1-63 [Undervoltage action selection] in group F. The two parameters have the same function. 0: No action. 1: Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. If the bus voltage is restored during this period, the motor restores to the target speed according to the acceleration time. 2: Decelerate to stop - When the bus voltage drops to the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is restored during this period, the motor still stops.	0: No action.	0: No action. 1: Undervoltage suppression. Restore to normal operation after voltage recovery. 2: Decelerate to stop. Decelerate to stop after voltage recovery.
d1-64 (F2-44)	Undervoltage suppression action voltage	Defines the voltage threshold for undervoltage suppression. F2-44 is the mapping of d1-64 [Overvoltage suppression action voltage] in group F. The two parameters have the same function. Note: Defines the response when the bus voltage is lower than the undervoltage suppression threshold due to power failure.	430.0V	A3-55 to 500.0 V
d1-65	Effective voltage threshold of undervoltage suppression	Displays the actual voltage of the undervoltage suppression threshold. Ready-only, unchangeable	430.0V	A3-55 to 500.0 V
d1-66	Undervoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage of Kp. Kp is calculated through the loop calculation method. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or even unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through the loop calculation method, which is the result of Kp x d1-66 [Overvoltage suppression Kp adjustment].	100%	0–1000%
d1-67	Undervoltage suppression Ki adjustment	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation method. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation method, which is the result of Ki x d1-67 [Overvoltage suppression Ki adjustment].	100%	0–1000%

Param.	Name	Description	Default	Value Range
d1-72	Minimum frequency for undervoltage suppression (SVC)	Defines the minimum frequency of vector undervoltage suppression in SVC mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit reached] will be reported.	3.00 Hz	0.00 Hz to 10.00 Hz
d1-73	Minimum frequency hysteresis for undervoltage suppression (SVC)	Defines the minimum frequency hysteresis for undervoltage suppression in SVC mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit reached] will be reported.	3.00 Hz	0.00 Hz to 10.00 Hz

Precautions

Set E9.05 for undervoltage control to a relatively small value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is recommended that the trigger voltage be verified during application.

Instances

In the field where the mains voltage is unstable, direct stop may occur due to undervoltage faults, causing technical problems. In this case, set d1-63 to 1 to decelerate during undervoltage to maintain the bus voltage.

If you want to restart operation after the bus resumes to normal, d1-63 can set to 1: Undervoltage suppression, and restore to normal operation after voltage recovery.

If you need to stop normally after the bus is restored and wait for manual restart, set d1-63 to 2: Decelerate to stop. After voltage recovery, the AC drive decelerates to stop.

When undervoltage suppression is active, the motor enters the deceleration and power generation state and to keep the bus volatge at d1-65. If you want the bus voltage to maintain at a higher level, increase the value of d1-64.

If the bus voltage cannot be maintained when the load inertia is appropriate and the power generation is normal, increase d1-66 and d1-67.

5.3.1.10 Flux Control

5.3.1.10.1 Asynchronous Motor Field Weakening Control

Scenarios

Under SVC control, the asynchronous motor field weakening control mode is triggered when the motor needs to increase speed beyond the maximum voltage output capacity or the current running speed is not supported through the reduced voltage.

Operation principles

When the motor speed increases, the motor back EMF also increases. When the motor back EMF exceeds the maximum output voltage, the AC drive loses the ability to regulate the current, and the motor will run out of control. Reducing the magnetic flux can reduce the back EMF, preventing the motor from running out of control, so that the motor speed can rise to a high level.

The maximum available voltage is calculated from the bus voltage, and a voltage margin (d5-00) is provided to ensure the current regulation capability. The maximum output voltage is calculated as follows:

$$V_{max} = \frac{Bus\ voltage}{\sqrt{2}}(100\% - [d5 - 00])$$

The voltage margin for field-weakening (d5-00) can be manually adjusted when the output voltage capability is insufficient.

When the voltage reaches the maximum output voltage and the output frequency increases, the field weakening region is entered. The back EMF is reduced by setting the magnetic flux according to the curve, thus ensuring that the motor does not lose control at high speed.

When the output frequency enters the field weakening region, the back EMF is reduced by setting the magnetic flux according to the following curve, thus ensuring that the motor does not lose control at high speed.

$$\Psi_{set} = \begin{cases} \Psi_N & \cdots\cdots f_{syn} < f_N \\ \Psi_N \dfrac{f_N}{f_{syn}} & \cdots\cdots f_{syn} \geqslant f_N \end{cases}$$

Ψ_N , Ψ_{set}: Rated magnetic flux and magnetic flux setpoint;

f_N , f_{syn}: Rated frequency and output frequency

As shown in the following figure, the output voltage (Vout) has reached the maximum output voltage (Vmax). The frequency continues to increase and enters the field weakening region. After entering the region, the flux decreases.The output voltage (Vout) no longer increases.

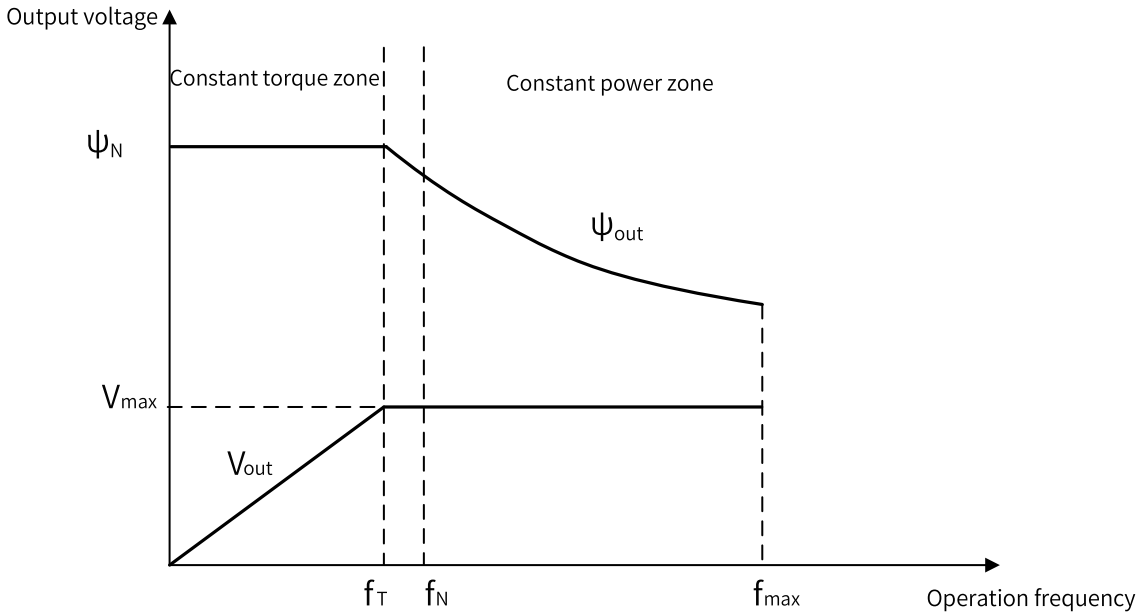


Figure 5-156 Flux frequency characteristics of the motor under voltage constraints

The following figure shows the process for obtaining the final flux setting in the field weakening phase after the maximum output voltage is obtained.

Rated motor flux x Rated flux adjustment coefficient = Actual motor flux applied.

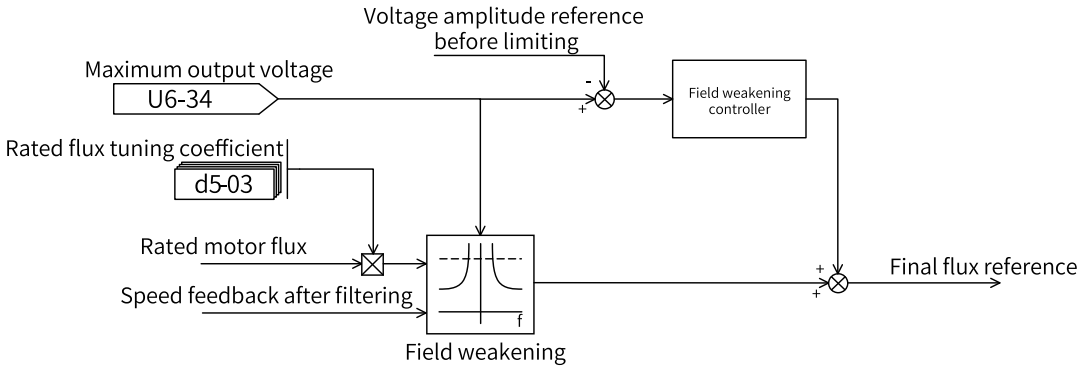


Figure 5-157 Final flux calculation flowchart

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d5-00	Voltage margin for field-weakening through adjustment method	Sets the voltage margin for field-weakening. Additional information: Decrease this value to improve the voltage utilization. The current is lower when the same load is applied in the weak magnetic zone. Note that an excessively low setpoint can affect dynamic performance.	3.0%	0.1 to 50.0%
d5-03	Rated flux tuning coefficient	Defines the flux tuning coefficient of the asynchronous motor. Additional information: This parameter adjusts the operation flux of the asynchronous motor. Decreasing the value of this parameter will put the motor in the under-excitation state, while increasing the value will put the motor in the over-excitation state.	100.0%	50.0% to 200.0%

Precautions

The reserved voltage margin (d5-00) cannot be set too large; otherwise it will affect the high-speed load capacity of the motor.

5.3.1.10.2 Synchronous Motor Field Weakening Control

Scenarios

Under SVC control, the synchronous motor field weakening control mode is triggered when the motor needs to increase speed beyond the maximum voltage output capacity or the current running speed is not supported through the reduced voltage.

Operation principles

A synchronous motor's back EMF increases with its running speed. When the back EMF exceeds the maximum voltage that can be output by the AC drive, the synchronous motor enters the field weakening control state. In the field weakening control mode, the synchronous motor increases the demagnetization current to reduce the magnetic chain of the motor stator and then to reduce the motor back EMF voltage. A higher demagnetization current means a higher output current and speed.

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d5-00	Voltage margin for field-weakening	Sets the voltage margin for field-weakening. Additional information: Decrease this value to improve the voltage utilization. The current is lower when the same load is applied in the weak magnetic zone. Note that an excessively low setpoint can affect dynamic performance.	3.0%	0.1 to 50.0%
d5-17	Demagnetization current limit	This parameter is used to limit the demagnetization current of synchronous motors to prevent faults such as overload. The value 100% corresponds to the rated motor current.	300%	0.0% to 500%

5.3.1.11 Energy-saving control

Scenarios

Some process applications are sensitive to energy consumption. Energy-saving control can be enabled to reduce energy consumption of the asynchronous motor at no-load and light-load running.

Operation principles

The output current is reduced by reducing the excitation current of the motor to reduce the energy consumption of the asynchronous motor during no-load and light-load running.

The following figure shows the function of enabling the energy saving control setting.

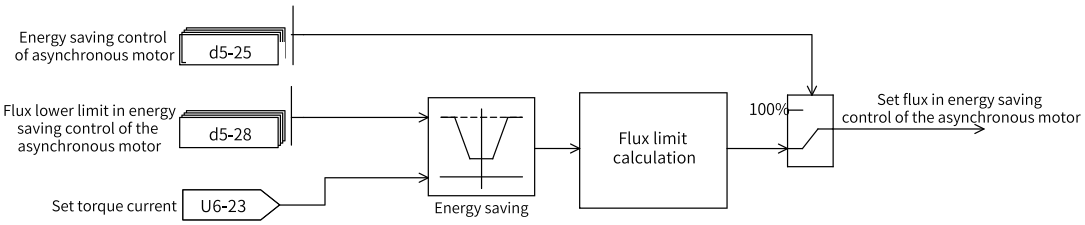


Figure 5-158 Energy-Saving Control

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d5-25	Asynchronous motor energy-saving control	Defines whether to enable energy saving for the asynchronous motor in the vector control mode. Description 0: Disable Energy saving is disabled. 1: Enable Energy saving is enabled. Additional information: After energy saving is enabled, the current in no-load or light-load mode can be reduced.	0: Disable	0: Disable 1: Enable
d5-28	Flux lower limit in energy-saving control of asynchronous motor	Defines the flux lower limit in energy-saving control of the asynchronous motor. Additional information: Defines the minimum flux linkage allowed in energy saving control. The smaller the value, the more saved energy will be at no load. However, this affects the dynamic response after load.	50.0%	10.0% to 100.0%

Precautions

The function is applicable to stable load conditions. For frequent sudden load addition and sudden unloading, it is not recommended to enable the function.

5.3.1.12 Overexcitation

Scenario

For high-inertia loads, overexcitation gain in the vector control mode can speed up the motor deceleration.

Working Principle

Increase the overexcitation current to consume the excess energy on the motor to accelerate motor deceleration. After enabling overexcitation, overexcitation control takes effect in the motor power generation state.

Related parameters

Param.	Parameter Name	Description	Default	Value range
d0-39	Overexcitation selection (vector)	Sets whether to enable vector control over-excitation.	0: Disabled	0: Disabled 1: Enabled
d0-40	Overexciting current (vector)	Defines the target current after overexcitation is activated in vector mode. 100% corresponds to the motor rated current.	100%	0%–800%

Precautions

The higher the overexcitation current, the more obvious the effect of motor deceleration. However, overexcitation gain increases the output current of the AC drive and leads to motor wear and tear.

5.3.1.13 Current Loop

Scenarios

In the SVC control mode, as the regulator of the inner loop, the current loop is used to enable the current closely follow the current reference, that is, the output of the outer loop regulator. During the dynamic process, current loop ensures that the maximum current allowed is obtained to accelerate the dynamic response.

Working Principle

The output of the speed loop PID is the input of the current loop. The output current of the AC drive is fed back negatively. The difference between the input and feedback is processed by the current loop PI controller, which adjusts the final voltage output.

Current loop parameters are automatically obtained after auto-tuning. The auto-tuned parameters apply to most of applications.

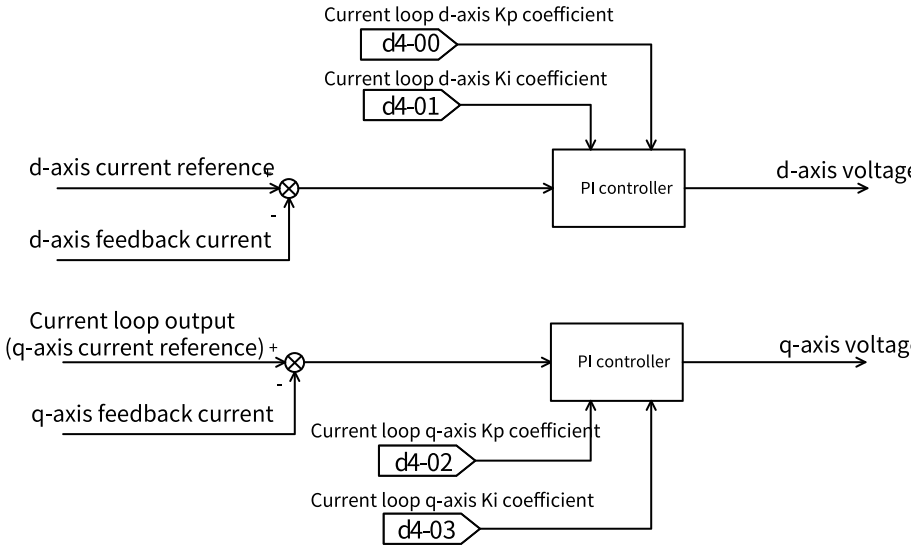


Figure 5-159 Current loop

The current loop self-adaption PI parameters are applicable to the auto-tuning of current loop parameters under heavy load.

When the current exceeds d4-06 (Current loop kp adaptive lower limit) and d4-05 (Current loop kp adaptive upper limit), the actual effective d-axis kp coefficient and q-axis kp coefficient of the current loop. It is obtained through calculation. Calculation method: The adaptive coefficient is calculated linearly based on the actual current size. The adaptive coefficient is multiplied by the set kp coefficient (d4-00, d4-02) to be the effective d-axis kp coefficient. q-axis kp coefficient

When the current exceeds the value of d4-05, the actual current loop D-axis Kp coefficient remains at d4-00 x d4-04. The actual current loop Q-axis Kp coefficient is kept at d4-02 x d4-04.

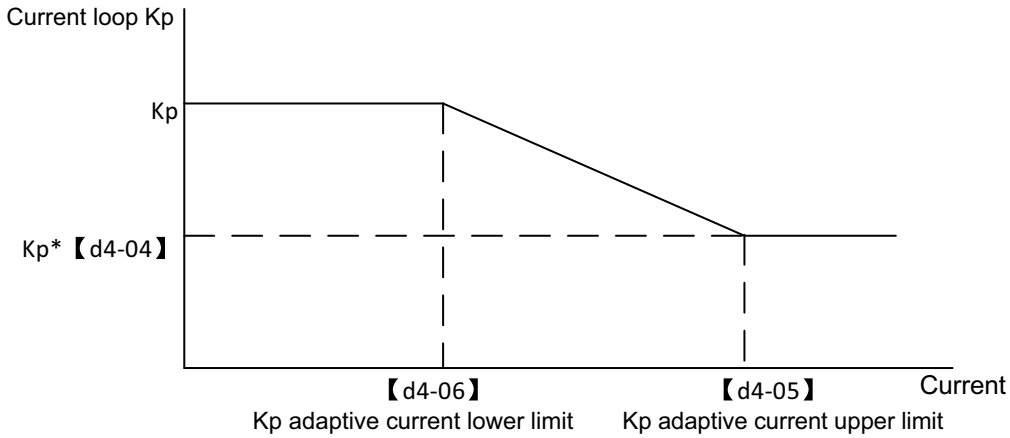


Figure 5-160 Current loop self-adapation Kp

Related parameters:

Parametor Code	Parameter Name	Description	Default:	Value range
d4-00	Current loop D-axis Kp coefficient	Defines the current loop d-axis Kp coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.	100%	1 to 1000%
d4-01	Current loop D-axis Ki coefficient	Defines the current loop d-axis Ki coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.	100%	1 to 1000%
d4-02	Current loop q-axis Kp adjustment	This parameter sets the current loop Q-axis Kp coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.	100%	1 to 1000%
d4-03	Current loop q-axis Ki adjustment	This parameter sets the current loop Q-axis Ki coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.	100%	1 to 1000%
d4-04	Kp adaptive upper limit coefficient of current loop	Defines the Kp adaptive upper limit coefficient of current loop.	50%	1 to 100%

Parametor Code	Parameter Name	Description	Default:	Value range
d4-05	Kp adaptive current upper limit of current loop	Defines the Kp adaptive current upper limit of current loop.	200%	d4-06 to 300%
d4-06	Kp adaptive current lower limit of current loop	Defines the Kp adaptive current lower limit of current loop.	100%	10% to d4-05

Instances

In heavy-load applications, current oscillation may occur due to the large current loop parameters. In this case, you can set d4-05 (Current loop Kp self-adaption current upper limit) and d4-06 (Current loop Kp self-adaption current lower limit) to limit the current loop parameters after the current exceeds d4-05. In addition, adjust the current loop attenuation level by setting d4-04 (Current loop Kp self-adaption upper limit coefficient). It helps the current loop to return to stable operation.

5.3.1.14 Droop control

Scenarios

In working conditions such as belt conveyor transmission, roller bed transmission, and continuous casting machines, when multiple motors drive the same load together, a slight deviation occurs between the motors even at the same speed reference due to different mechanical behaviors. In addition, the output torque is much different, and even motors may drive each other.

Droop control can be applied to all motors to enable automatic balanced load distribution between motors, requiring no communication between motors. Motors with higher speed bear higher torque. The negative feedback helps to automatically reduce speed reference and distribute torque to other motors.

Droop control

- Simple application, without need for communication between motor controllers.
- Multiple motors can be in stiffness or flexible connection to drive the same load.
- When multiple motors need to implement redundant running, the faulty device can be stopped while other devices can properly run.
- The adjustment range of the speed is generally not greater than the rated motor slip.
- The speed cannot be exactly followed. The actual speed has a static difference with the reference, which is proportional to the load.
- Precise load distribution cannot be ensured during the dynamic process.

Operation principles

Droop control is a control method that uses the output torque of the motor to reduce the motor speed reference by negative feedback. See the following figure.

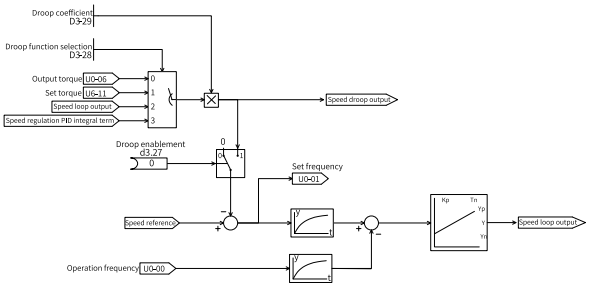


Figure 5-161 Droop control block diagram

The droop control provides four droop sources (output torque, torque setpoint, speed loop output, and speed loop Ti output). You can set this parameter through the d3-28 function code. The relationship between the four droop sources is shown in the following figure.

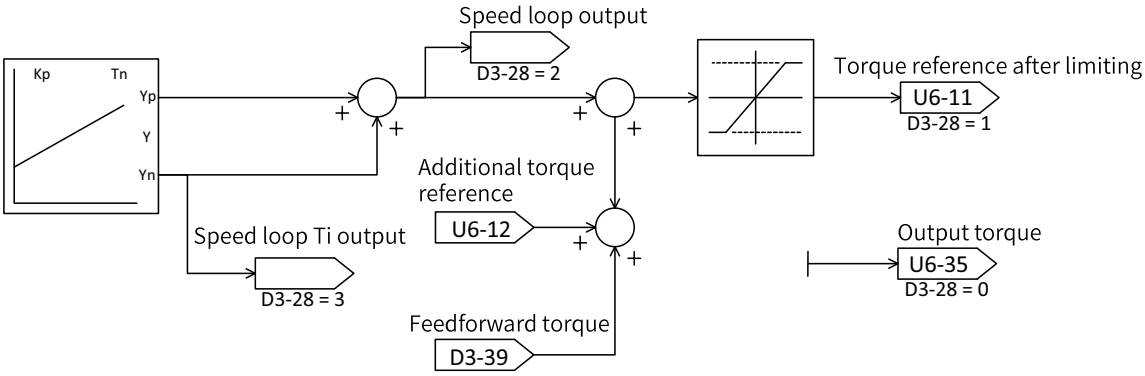


Figure 5-162 Four different droop sources

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d3-27	Droop function	Set whether the droop function of speed control is enabled. Value description 0: Disable 1: Enable Note: When multiple motors are used to drive the same load, the load distribution between multiple motors can be achieved after this function is enabled.	0	0 to 1
d3-28	Droop source	Droop source Description 0: Select the actual output torque of the motor as the droop source. 1: Select the final torque setpoint of the motor as the droop source. 2: Select the output of the speed loop as the droop source. 3: Select the integral item of the speed loop as the droop source.	1	0 to 3
d3-29	Droop coefficient	Defines the droop coefficient. Large droop coefficient may lead to obvious droop effect, but the speed accuracy will be affected and speed oscillation will occur. Additional information: Droop speed change = d3-28 [Droop source]×d3-29 [Droop coefficient].	0.0%	0.0% to 50.0%

Application Cases

The 12 motors are connected to the same rack through the gearbox (80:1). The rack is welded to the mounting leg. The 12 motors are connected to the same rack through the gearbox (80:1). The rack is welded to the mounting leg. The host controller uses different speeds to lift the mounting leg. Due to the difference between the gearbox and the rack, some motors are connected tightly. Other motors need to run for a certain period of time to reach the rack.

In general speed control mode, the motor output with good contact is in overload state, and the motor with poor contact is in no output state, or its load is pulled in reverse direction. The motor reducer that runs under heavy load for a long time is prone to damage and the AC drive reports faults.

In this case, the output speed accuracy and dynamic response requirements are not high. However, the system must be reliable if the motor or AC drive is damaged. This problem can be solved by using the droop function:

Operation procedure:

1. Enable droop function for all AC drives by settting d3-27 to 1.
2. Set d3-29 to the rated motor slip.

5.3.2 Asynchronous Motor V/f Control

5.3.2.1 Control Mode

Application scenarios

The V/f control mode is applicable to asynchronous motor control applications.

Operation principles

Adjust the set frequency curve through droop control by setting the speed curve. The curve is affected by overcurrent suppression, overvoltage suppression, undervoltage suppression, and slip compensation. The output frequency is obtained through the V/f curve to obtain the set output voltage. The final voltage amplitude is output after energy conservation control and over-excitation control. After the output frequency is suppressed by oscillation, the final set frequency is obtained and the voltage phase angle is obtained by integral means. The final output is delivered to the AC drive.

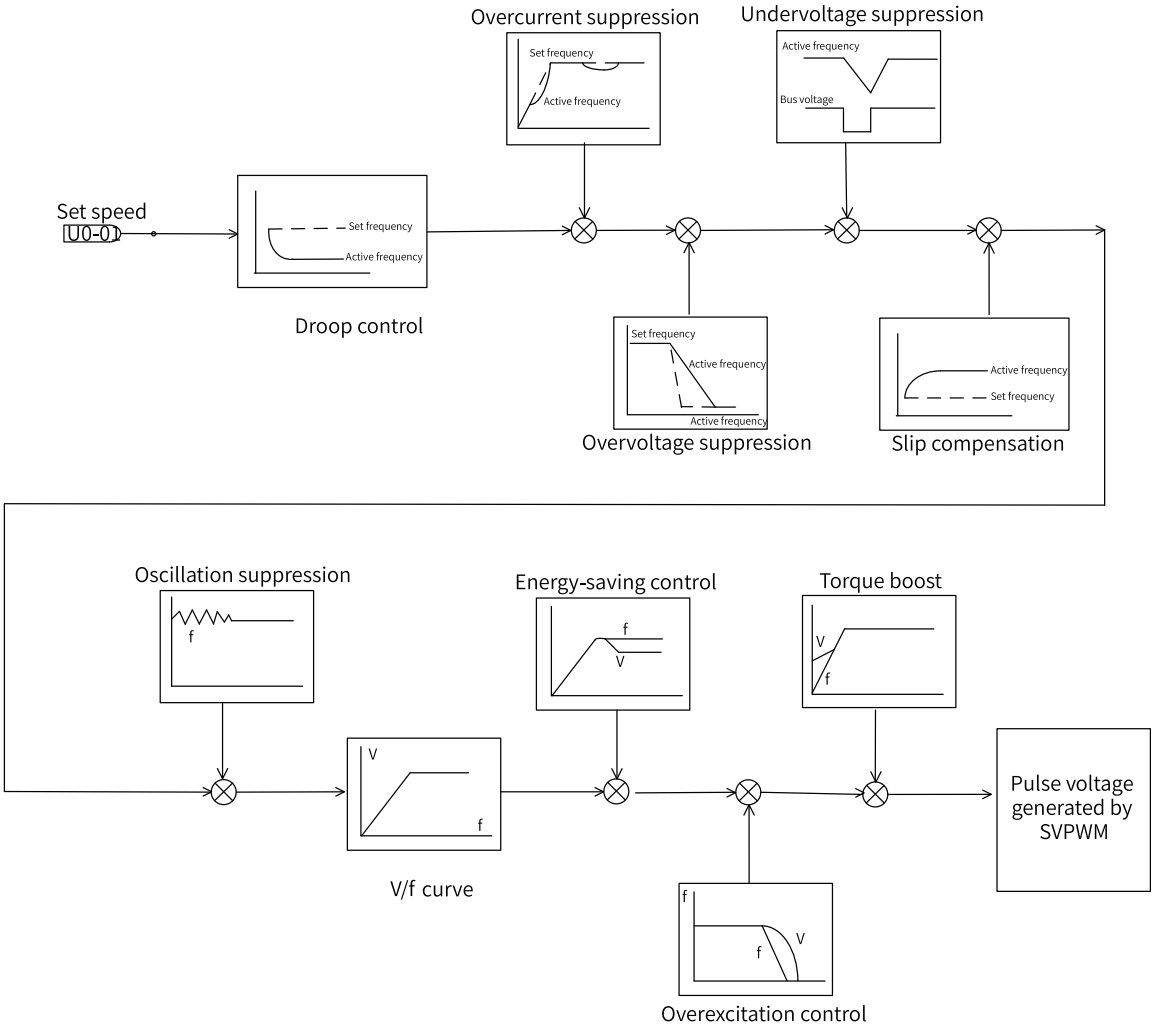


Figure 5-163 Schematic diagram of V/f control mode

5.3.2.2 V/f curve selection

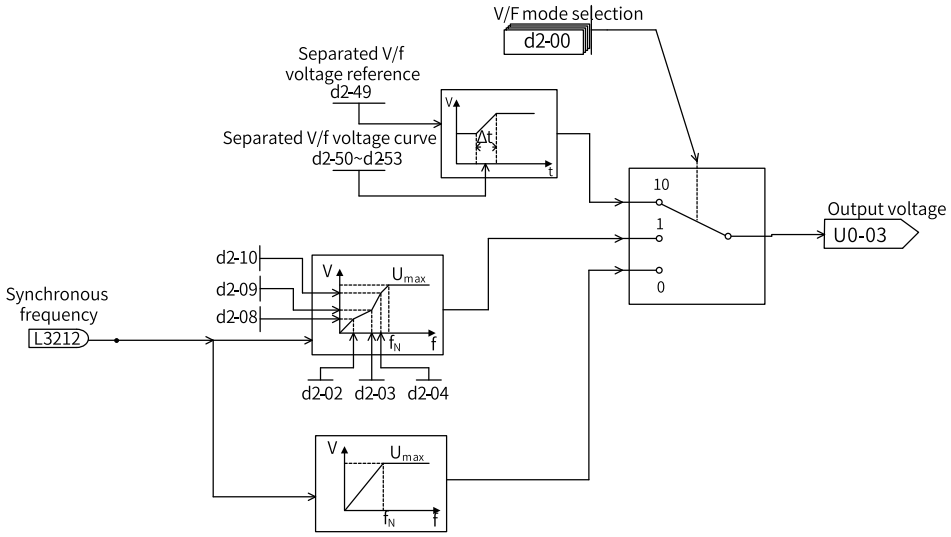
Scenarios

There are three modes for V/f curves:

1. Linear V/F When the motor runs at a rated frequency, a linear relationship is kept between the output voltage and the frequency. It is applicable to common constant-torque load.
2. 1: Multi-point V/f curve It is applicable to special load such as dehydrators and centrifuges. The relationship between the voltage and frequency points can be set according to the motor characteristics.
3. Separated V/f The V/f separation mode is generally used in induction heating, inverter power supply, and torque motor control. In this mode, the output voltage of the AC drive is independent of the frequency. You can set the output frequency and output voltage.

Working Principle

1. Linear V/F When the motor runs at a rated frequency, a linear relationship is kept between the output voltage and the frequency.
2. 1: Multi-point V/f curve Users can set the d2-02 to d2-10 parameters to define the V/f curve frequency and voltage points. Multi-point V/f needs to be set according to the motor characteristics. The voltage and three frequency points should meet the following conditions: V1 ≤ V2 ≤ V3 and f1 < f2 < f3. Different voltage and frequency points are connected by a polyline.
3. Separated V/f The output frequency is determined by the frequency source. The output voltage is set by d2-48 (Voltage source of V/f separation). If the set separation voltage changes, you can set the V/f separation voltage change time through d2/d2 to prevent sudden voltage change. You can select whether the frequency source reaches the set value at one shot or according to the acceleration/deceleration curve by d2-52 (Frequency RFG time of V/f separation).



f_N indicates set frequency
U_{max} indicates maximum output voltage

Figure 5-164 Operating principle of V/f curve

F_N indicates the set frequency, and U_{max} indicates the maximum output voltage

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d2-00	V/f curve type	0: Linear V/f curve 1: Multi-point V/f curve 10: Separated V/f	0	0 to 10
d2-01	Multi-point curve	Used to select the multi-point curve source. 0: Three-point curve - The V/f curve is set by the parameters d2-02 to d2-04 and d2-08 to d2-10.	0	0 to 0
d2-02	Frequency point 1 on a multi-point V/f curve	Defines frequency point 1 of a multi-point V/f curve.	0.0 Hz	0.0 Hz to d2-03
d2-03	Frequency point 2 on a multi-point V/f curve	Defines frequency point 2 of a multi-point V/f curve.	0.0 Hz	d2-02 to d2-04
d2-04	Frequency point 3 on a multi-point V/f curve	Defines frequency point 3 of a multi-point V/f curve.	0.0 Hz	d2-03 to 600.0 Hz
d2-08	Voltage point 1 on a multi-point V/f curve.	Defines voltage point 1 of a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-09	Voltage point 2 on a multi-point V/f curve.	Defines voltage point 2 of a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-10	Voltage point 3 on a multi-point V/f curve.	Defines voltage point 3 of a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-47	Upper limit of V/f separation voltage	Defines the voltage upper limit of separated V/f. This parameter uses the rated motor voltage as the base value in percentage.	100.0%	50.0%-200.0%

Parameter Code	Parameter Name	Description	Default	Value range
d2-48	Voltage source of V/f separation	Defines the target voltage reference source in case of separated V/f. 0: Digital setting The V/f separation voltage is set by d2-49 (voltage digital setting for V/f separation). 2：AI1 - The voltage source is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3：AI2 - The voltage source is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference (DI7) The V/f separation voltage is set through the DI5. The frequency is calculated based on the curve of the relationship between the pulse frequency and running frequency. 6: Multi-reference In multi-reference mode, different combinations of DI terminal states correspond to different reference values. For details, see the multi-reference module. 7: Simple PLC The V/f separation voltage is set by simple PLC. For details, see the function description of simple PLC. 8: PID The V/f separation voltage is set by PID. For details, see the PID function description. 9: Communication The V/f separation voltage is set through communication. The operating frequency is input through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Other: F connector Read the connector value through setting the parameter No. of a float connector. The value being read is used as the V/f separation voltage in speed control. This mode is used for expansion of common sources. (How to set the connector parameters: If the parameter is set to others, the AC drive automatically jumps to the connector selection. Click a connector and the value of the connector will be used as the source for V/f separation voltage)	0	0 to 9
d2-49	Digital setting of V/f separation voltage	Defines the digital setpoint of the voltage in separated V/f. Valid when the voltage source of V/f separation (d2-48) is set to 0.	0V	0–C4-03
d2-50	Voltage acceleration time of V/f separation	Defines the time required for the output voltage to rise from 0 to the rated motor voltage.	0.0s	0.0–1000.0s
d2-51	Voltage deceleration time of V/f separation	This parameter defines the time required for the output voltage to fall from the rated motor voltage to 0.	0.0s	0.0–1000.0s

Parameter Code	Parameter Name	Description	Default	Value range
d2-52	Frequency RFG time of V/f separation	Sets the frequency RFG time of V/f separation. 0: RFG time forced to be 0 The acceleration/deceleration time of frequency reference is set to 0 forcibly. 1: Preset RFG time Acceleration/Deceleration is performed based on the set time.	0	0 to 1
d2-53	Stop mode selection of V/f separation	Sets the stop mode selection of V/f separation. 0: Frequency and voltage declined to 0 independently - The frequency/voltage declined to 0 independently based on respective deceleration time. 1: Frequency declines to 0 after voltage declines to 0 The voltage declines to 0 based on the deceleration time. Then the frequency declines to 0 based on the deceleration time. 2: Coast to stop - The voltage/frequency coasts to stop directly, regardless of the deceleration curve.	0	0 to 2

Precautions

In V/f separation and multi-point V/f control, note that the ratio of V/f cannot be too large. Otherwise, overcurrent may occur; for example, voltage is given without reference to the frequency. If the voltage is directly set without a frequency, overcurrent may occur.

5.3.2.3 V/f Overvoltage Suppression

Scenarios

When the motor is in a deceleration regenerative state, if the power supply is not regeneration-enabled, energy will be fed into the bus, resulting in voltage rise and overvoltage of the bus, which is especially obvious when the motor inertia is large and the deceleration time is short.

If overvoltage exists in the DC bus, enable V/f overvoltage suppression.

Operation principles

After setting F2-39 to enable the V/f overvoltage suppression function, when the bus voltage rises to the setpoint (bus overvoltage threshold defined by F2-40), the AC drive will adjust the output frequency to maintain the bus voltage stability and inhibit the voltage rise.

After the function is enabled, the actual deceleration time will be automatically lengthened. If the actual deceleration time cannot meet the requirements, d0-41 (V/f over-excitation gain) can be appropriately increased.

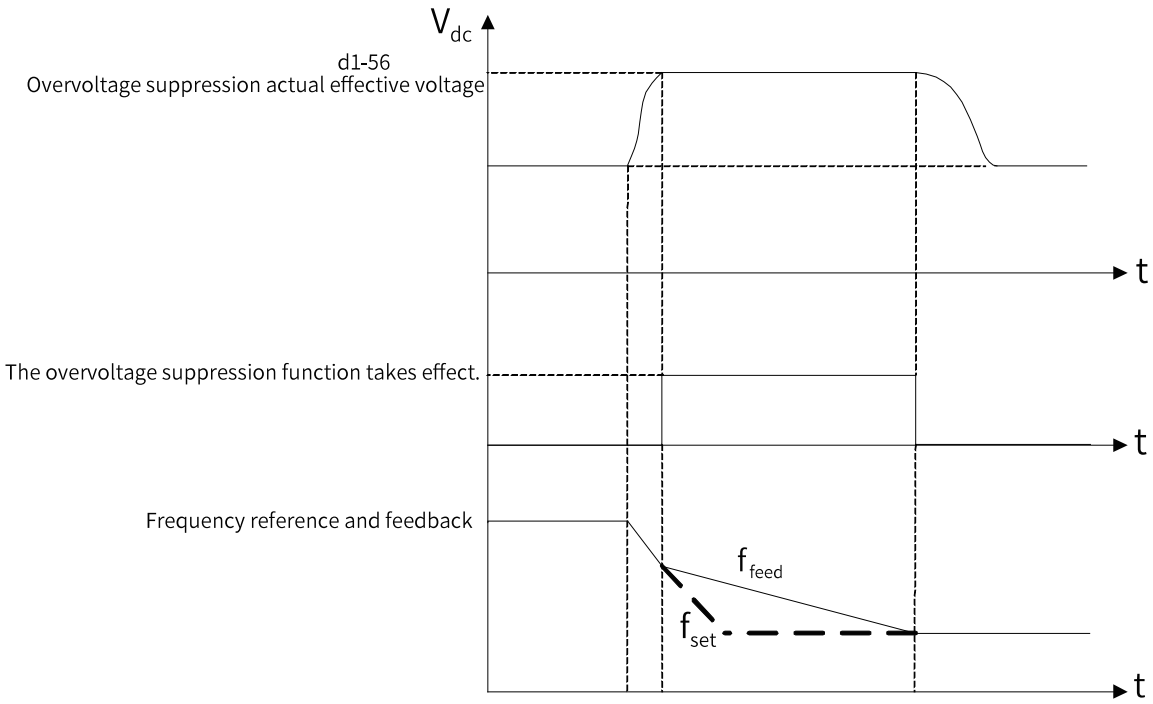


Figure 5-165 V/f Overvoltage Suppression

F_{feed} : feedback frequency, f_{set} : set frequency

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
F2-39 d1-54	Overvoltage suppression	Sets whether overvoltage suppression is enabled. 0: Disable 1: After the overvoltage suppression function is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setting. F2-39 is the same parameter as d1-54. After F2-39 is modified, d1-54 is updated synchronously.	1	0 to 1
F2-40 d1-55	Overvoltage suppression action voltage	Defines the bus voltage threshold for overvoltage suppression. The effective value is displayed in d1-56. If the mains voltage is too high and the overvoltage suppression action voltage is set to a lower value than the bus voltage after rectification, the motor may accelerate or V/f may be overcurrent at startup. F2-40 is the same parameter as d1-55. After F2-40 is modified, d1-55 is updated synchronously.	770.0V	600.0 V to A3-57
d1-56	Effective voltage threshold for overvoltage suppression	Displays the actual voltage when overvoltage suppression is triggered. When the bus voltage exceeds the value of this parameter, overvoltage suppression applies.	770.0V	600.0 V to A3-57

Parameter Code	Parameter Name	Description	Default	Value range
d1-57	Overvoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage of Kp. Kp is calculated through the loop calculation method. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately. The actual Kp gain is calculated through the loop calculation method, which is the product of Kp and d1-57 [Overvoltage suppression Kp adjustment].	100%	0.0% to 1000%
d1-58	Overvoltage suppression Ki adjustment	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation method. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately. The actual Ki gain is calculated through the loop calculation method, which is the product of Ki and d1-58 [Overvoltage suppression Ki adjustment].	100%	0.0% to 1000%

Precautions

- Use the V/f overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value less than the V/f overvoltage suppression trigger voltage or disable the V/f overvoltage suppression.
- In the case of common bus, enable the V/f overvoltage suppression function on only one drive unit, typically the drive unit with the largest inertia, and disable this function on other drive units.
- Overvoltage suppression cannot be enabled for lifting active loads. When the load drops, the motor is in the power generation state. Overvoltage suppression limits the power generation, which can prevent the motor from carrying the load effectively, leading to continuous acceleration. There is a risk of motor stall.
- If many parallel motors are connected, increase the overvoltage suppression Kp adjustment. If the motor inertia is large, decrease the overvoltage suppression Kp adjustment.

Application Cases

If the braking resistor is not applied, set F2-39/d1-54 to enable the V/f overvoltage suppression. Set F2-40/d1-55 according to the actual bus voltage. The remaining values can keep the default values. The V/f suppression can protect the AC drive and prevent the bus voltage from hitting too high if the decelerating to stop is required. When the customer needs to decelerate to stop, overvoltage suppression can protect the AC drive to prevent the bus voltage from being too high.

5.3.2.4 V/f Undervoltage Suppression

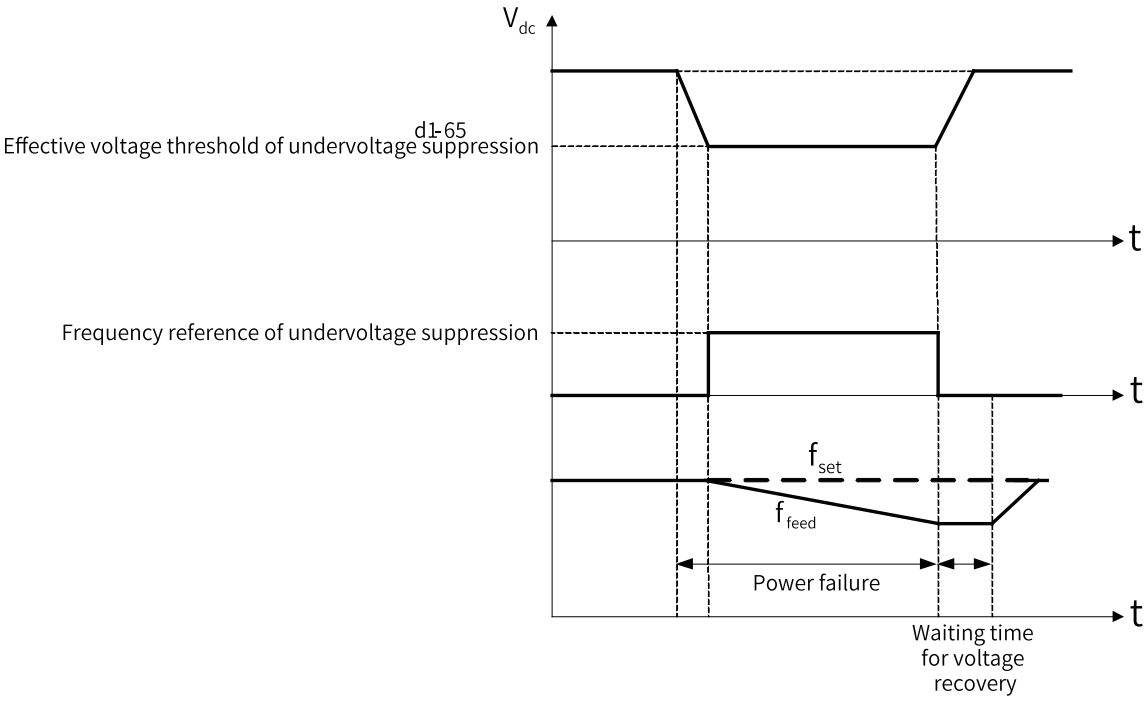
Scenario

This function is mainly applicable to unstable power grid, preventing the AC drive from undervoltage caused by short-term voltage dip and system stop. It can also be used to prevent the power failure of the grid from causing damage to processing materials due to machine coast to stop, such as yarn breaking in the textile industry.

After the bus voltage falls below the allowable value(defined by d165), the V/f undervoltage suppression function makes the motor enter the power generation state to compensate for energy loss and stabilize the voltage in the DC bus. When the power supply or DC bus incurs short-term power-off, undervoltage will occur if the fault is not handled in time, causing coast to stop.

Operation principles

Set d1-63 to a non-zero value to enable the undervoltage suppression function to suppress undervoltage in a short period, preventing stop upon instantaneous power-off. When the power supply or DC bus is powered off for a long time, the AC drive keeps the bus voltage stable and suppresses the voltage by adjusting the output frequency. Enable the undervoltage suppression function to compensate for the power loss on the bus by generating electricity until each motor stops reliably.



Note

F_{feed} : feedback frequency, f_{set} : set frequency

Technical data

Parameter Code	Parameter Name	Description	Default	Value range
d1-63	Undervoltage action	Defines the response when the bus voltage reaches the undervoltage suppression point due to power failure. 0: The DO does not act 1: Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. If the bus voltage is restored during this period, the motor restores to the target speed according to the acceleration time. If the bus voltage is restored during this period, the motor restores to the target speed based on the acceleration time. 2: Decelerate to stop - When the bus voltage drops to the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is restored during this period, the motor still stops. During this time, the bus voltage is restored and the motor remains at stop until the stop is completed.	0	0 to 2
d1-64	Undervoltage suppression action voltage	Defines the voltage threshold for undervoltage suppression. When the bus voltage is lower than the undervoltage suppression threshold due to power failure, the drive acts according to the action set in d1-63.	430.0V	A3-55 to 500.0 V
d1-65	Effective voltage threshold of undervoltage suppression	Displays the actual voltage of the undervoltage suppression threshold The actual action voltage is internally limited when the undervoltage suppression threshold that does not match the model is set.	430.0V	A3-55 to 500.0 V

Parameter Code	Parameter Name	Description	Default	Value range
d1-66	Undervoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage of Kp. Kp is calculated through the loop calculation method. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or even unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through the loop calculation method, which is the product of Kp and d1-66 [Overvoltage suppression Kp adjustment].	100%	0.0% to 1000%
d1-67	Undervoltage suppression Ki adjustment	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation method. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation method, which is the product of Ki and d1-67 [Overvoltage suppression Ki adjustment].	100%	0.0% to 1000%

Application Cases

The textile industry requires high yarn continuity. If the power grid is disconnected, the entire machine coasts to stop. All yarns are disconnected, making it difficult to restart production. Undervoltage suppression prevents the machine from rotating and breaking the yarn after power failure. When power failure occurs for a short time, the machine enters undervoltage suppression state and resumes normal production.

The application configuration is as follows:

1. Connect the bus of the AC drive together and use a large AC drive to power other AC drives.
2. For motors with a large inertia, set d1-63 (undervoltage action) to 1.
3. During power failure, the motor with undervoltage suppression is used as the master. The PLC calculates the matching speed of other motors. The motors decelerate to stop.
4. Bit 4 of L1021 is the flag bit for undervoltage suppression. After undervoltage suppression, the flag position is 1.

5.3.2.5 V/f Overcurrent Suppression

Scenarios

Overcurrent is reported when the current exceeds the limit of the AC drive during rapid acceleration/deceleration or when the load is too heavy. The overcurrent suppression function can suppress current exceeding the overcurrent threshold. The overcurrent suppression function can suppress current exceeding the overcurrent threshold.

Operation principles

After the overcurrent suppression function is enabled, if the output current of the AC drive reaches the motor overcurrent suppression threshold during motor current rising, the output frequency of the AC drive changes to reduce motor slip. This reduces the motor output current. After the current drops below the overcurrent suppression threshold, the frequency starts to restore to the target frequency. The actual acceleration time will be extended automatically during rapid acceleration, and the deceleration time will be prolonged during rapid deceleration. The motor output frequency drops when a sudden heavy load occurs during steady operation.

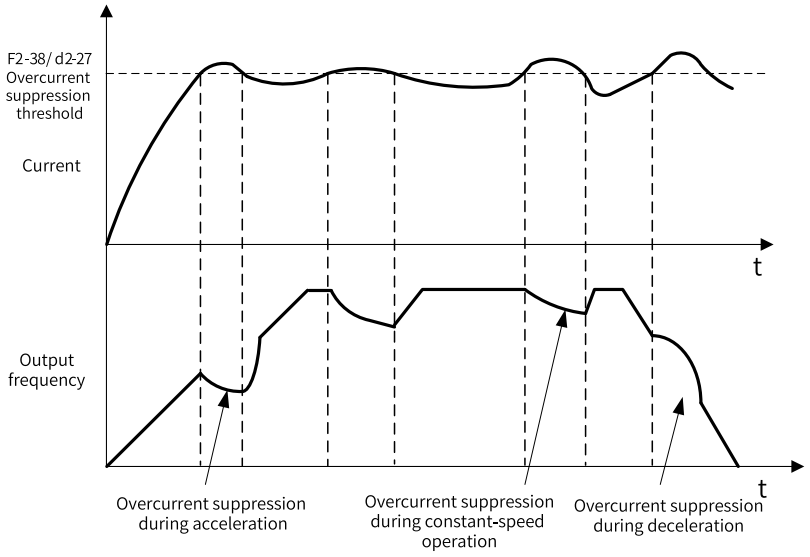


Figure 5-166 Schematic diagram of the overcurrent suppression control function

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
F2-37 d2-26	Overcurrent suppression	Sets whether overcurrent suppression is enabled. 0: Disable When the AC drive output current reaches the threshold set by d2-27, the AC drive slows down the acceleration or reduces the operation frequency to prevent continuous current rising, thus suppressing the overcurrent faults. F2-37 is the same parameter as d2-26. After F2-37 is modified, d2-26 is updated synchronously.	1	0 to 1
F2-38 d2-27	Overcurrent suppression threshold	Defines the current threshold for triggering overcurrent. The actually effective overcurrent suppression threshold is determined by this parameter or A3-05 (AC drive maximum current), whichever is smaller. F2-38 is the same parameter as d2-27. After F2-38 is modified, d2-27 is updated synchronously.	200%	80%-300%
d2-28	Overvoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage of Kp. Kp is calculated through the loop calculation method. A larger value of this parameter means faster frequency adjustment and better acceleration following effect, but also more prone to oscillation. The actual Kp gain is calculated through the loop calculation method, which is the product of Kp and d2-28 [Overvoltage suppression Kp adjustment].	100%	1%-500%
d2-29	Overvoltage suppression Ki adjustment	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation method. A larger value of this parameter means faster frequency adjustment and better acceleration following effect, but also more prone to oscillation. The actual Ki gain is calculated through the loop calculation method, which is the product of Ki and d2-29 [Overvoltage suppression Ki adjustment].	100%	10%-1000%

Precautions

The current of V/f overcurrent suppression is large. When the load is large, the motor decelerates. When the output frequency is lower than 5 Hz, low-frequency derating of the AC drive may occur, causing the AC drive to report overload. If overcurrent suppression is prone to overload at low speed, check whether the load is abnormal. Otherwise, select an AC drive with a higher rated power.

Application Cases

Set F2-37/d2-26 (Overcurrent suppression) to 1 (enable) and set F2-38/d2-27 (Overcurrent suppression threshold) according to the current in the normal operating conditions on the customer

site. Ensure that the current suppression threshold is higher than the current under normal operating conditions. The remaining values are set by default.

5.3.2.6 V/F Oscillation Suppression

Scenarios

During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.

Working Principle

You can set d2-22 (V/f oscillation suppression) to enable oscillation suppression to improve the control effect. d2-23, which is the V/f oscillation suppression gain, should be as small as possible to reduce its influence on normal operation, provided that the oscillation can be effectively suppressed. When the oscillation is obvious, it is necessary to increase the gain. The higher the gain, the better the suppression effect will be.

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d2-22	V/f oscillation suppression	Sets whether V/f oscillation suppression is enabled. 0: Disable 1: During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.	1	0 to 1
d2-23	V/f oscillation suppression gain	Defines the V/f oscillation suppression gain. This parameter adjusts the intensity of V/f oscillation suppression. A larger value of this parameter means greater compensation, but setting it too large may result in overcompensation that can cause oscillation.	100%	0 to 400%

Precautions

When the oscillation suppression function is enabled, the rated current and no-load current of the motor must be as accurate as possible to ensure the V/f oscillation suppression effect.

Application case:

Motor oscillation caused by mechanical structure can be reduced by setting d222 (V/f oscillation suppression) to enable.

5.3.2.7 V/f Torque Boost

Scenarios

When the motor adopts V/f control, the voltage drop on the stator resistor will lead to small motor output torque, and even poor load capacity of the motor at low speed. The torque boost function can be used to compensate the voltage loss on the stator resistor, improving the load capacity of the

motor at a low speed. If the torque boost is not enabled in the V/f heavy-load startup, overload faults may occur.

Operation principles

Setting d2-16 to enable this function and select the torque boost mode.

In the case of customized torque boost, the voltage compensated by torque boost can be set by E3-14. When the load is heavy and the starting torque of the motor is insufficient, the value of d2-14 can be increased. Note that an excessively high setpoint can easily result in motor overtemperature and drive overcurrent. E3-16 sets the cut-off frequency of torque boost, that is, the active frequency of torque boost. If the frequency is lower than this frequency, the boost is active; otherwise, it is inactive.

When automatic torque boost is applied, the AC drive automatically calculates the voltage compensation amount according to the motor parameters, so there is no need to set E3-14 and E3-16. Note that before using this function, be sure to perform motor auto-tuning to ensure the accuracy of motor parameters.

When the automatic and manual torque boost is selected, you can adjust the manual boost amount through d2-14 and d2-15. If the manual boost amount is too small, the automatic torque boost calculates and compensates the voltage.

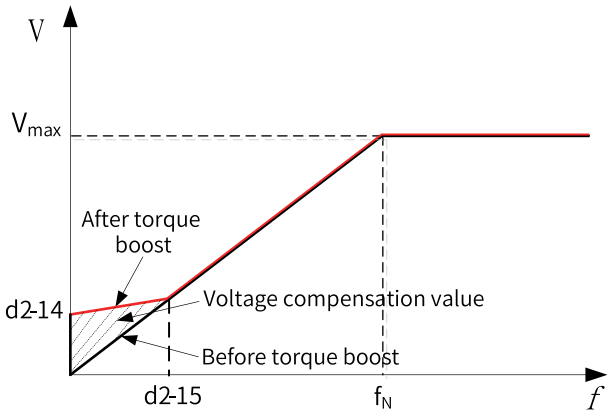


Figure 5-167 V/f Torque Boost

F_N indicates the set frequency, and V_{max} indicates the maximum output voltage

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d2-14	Manual torque boost amount	Sets the manual torque boost amount. This parameter defines the voltage boost amount at zero speed in V/f mode. Increasing this voltage can improve the load capacity at low speed, but setting it too large may easily result in overcurrent, overload, or other problems. After the output frequency is increased to the cut-off frequency of torque boost (d2-15), the boost voltage is linearly reduced to 0.	3.0%	0.0%–100.0%
d2-15	Cut-off frequency of torque boost	Defines the cut-off frequency of torque boost. When the operation frequency exceeds this cut-off frequency, torque boost is disabled.	100.0%	0.0%–400.0%
d2-16	Torque boost mode	Used to select the torque mode. 0: The boost amount at zero speed is defined by d2-14. After the speed increases, the manual boost amount is reduced linearly until the cut-off frequency decreases to 0. 1: The boost voltage is calculated automatically based on motor parameters. In this mode, it is recommended to perform auto-tuning for better effects. 2: The final effective boost amount is the sum of the manual boost amount plus the automatic boost amount.	2	0 to 2

Application Cases

After the motor starts and fails to run normally due to heavy load, increases d2-14 (Manual torque boost amount) when the motor stops. Increase the value until it can be started successfully.

5.3.2.8 V/f Slip Compensation

Scenarios

V/f slip compensation can compensate the decrease of speed of an asynchronous motor when the load increases, so that the motor speed can basically remain unchanged when the load changes. Slip compensation improves V/f control speed accuracy.

Working Principle

Enable d2-41 (Slip compensation mode) to enable slip compensation. Adjust the compensation frequency by setting d2-42. When the coefficient is set to 100%, the compensation slip is the rated slip of the motor when the rated load is applied to the motor. When the compensation coefficient is set to 0, the slip compensation function is disabled. When adjusting the V/f slip compensation gain, confirm that the motor speed under the rated load is the same as the target motor speed. If they are different, slightly adjust the parameter.

d2-43 can set the V/f slip compensation filter time. The smaller the setting, the faster the response speed of slip compensation, but a too small value will also cause oscillation or instability in the dynamic process of the motor.

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d2-41	Slip compensation mode	Sets the slip compensation mode. 0: No slip compensation 1: Enable compensation mode.	0	0 to 1
d2-42	Slip compensation gain	This parameter adjusts the frequency in slip compensation.	100.0%	0.0%–200.0%
d2-43	Slip compensation filter time	Sets the slip compensation filter time. Longer filter time means a slower and smoother dynamic process of slip compensation.	0.5s	0.1s to 10.0s

Precautions

V/f slip compensation improves dynamic accuracy, but brings slower dynamic response. Vector control should be used for high-dynamic response applications.

Application case:

In textile applications, the asynchronous motor runs stably in V/f control mode. The heavier the load, the more the motor's output speed deviates from the set speed, with the actual motor speed lower than the set speed. In the actual process, the speed must be as accurate as possible to match the motor of different mechanisms.

Set d2-41 to 1 (enable) to improve the speed accuracy. The speed accuracy during actual running can meet the process requirements. If the slip compensation process is too fast, increase d2-43 (slip compensation filter time).

5.3.2.9 V/f Energy-Saving Control

Scenarios

Energy-saving control is applicable to applications where the motor load does not change. It can be also used in light-load applications to reduce output current automatically to achieve energy conservation. It can be used in applications where the load changes slowly, such as fans, water pumps, and air compressors.

Working Principle

After the E6-00 parameter is set to enable the function, when the motor runs with low load, the AC drive continuously reduces the output voltage to lower exciting current, reducing energy consumption.

Related parameters

Parameter	Name	Description	Default	Value range
d2-35	Energy-saving in V/f control mode	Used to enable V/f energy-saving control. 0: Disable 1: Energy-saving control can reduce output current and energy consumption of the asynchronous motor when it runs with no load or light load.	0	0 to 1
d2-36	Cut-off frequency of V/f energy-saving control	Defines the cut-off frequency in V/f energy-saving control. Energy-saving control can be enabled only when the operation frequency is greater than this cut-off frequency.	30%	20 to 100%

Application case:

In light-load applications, if you want to reduce the output power, you can enable d2-35 and set the cut-off frequency (defined by d2-36) to the value lower than the normal operating frequency.

5.3.2.10 V/f Droop Control

Scenarios

When multiple motors drive the same load together, a slight deviation occurs between the motors even at the same speed reference due to different mechanical behaviors. In addition, the output torque is much different, and even motors may drive each other.

It is widely used in working conditions such as belt conveyor transmission, roller bed transmission, and continuous casting machines. The application features simple application and no communication between the motor controllers. Multiple motors can drag the same load with rigid or flexible connections. When multiple motors run in redundant mode, it is convenient to stop faulty equipment while keep others running normally.

Working Principle

Droop control is a control method that uses the output torque of the motor to reduce the motor speed reference by negative feedback. Droop control features good stability and simple application though low control accuracy. Droop control can be applied to all motors to enable automatic balanced load distribution between motors, requiring no communication between motors. Motors with higher speed bear higher torque. The negative feedback helps to automatically reduce speed reference and distribute torque to other motors.

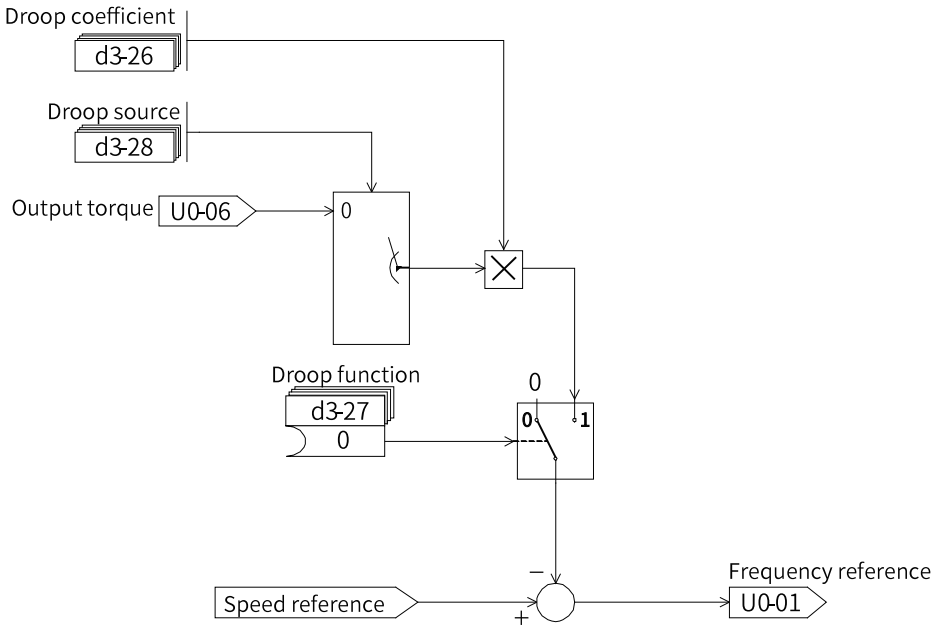


Figure 5-168 V/f droop control diagram

Related parameters

Parameter Code	Parameter Name	Description	Default	Value range
d3-27	Droop function	Set whether the droop function of speed control is enabled. Value description 0: Disable 1: Enable When multiple motors are used to drive the same load, the load distribution between multiple motors can be achieved after this function is enabled. But this will affect the speed accuracy.	0	0 to 1
d3-28	Droop source	Sets the droop source. 0: Select the actual output torque of the motor as the droop source. 1: Select the final torque setpoint of the motor as the droop source. 2: Select the output of the speed loop as the droop source. 3: Select the integral item of the speed loop as the droop source. To set V/f droop control, the value of this parameter shall be set to 0.	1	0 to 3
d3-29	Droop coefficient	Defines the droop coefficient. Large droop coefficient may lead to obvious droop effect, but the speed accuracy will be affected and speed oscillation will occur. Additional information: Droop speed change = d3-28 [Droop source]×d3-29 [Droop coefficient].	0.0%	0.0% to 50.0%

Precautions

- The adjustment range of the speed is generally not greater than the rated motor slip.
- The speed cannot be exactly followed. The actual speed has a static difference with the reference, which is proportional to the load.
- Precise load distribution cannot be ensured during the dynamic process.

Application case:

When multiple motors are connected with a belt, to ensure the load balance of the motor and does not result in the generation of one motor, set the droop coefficient. Adjust the droop speed change to the rated slip.

In this case, the output speed accuracy and dynamic response requirements are not high. However, the system must be reliable if the motor or AC drive is damaged. It is recommended to use the droop

function by setting d3-27 to 1, and d3-29 = [(Rated frequency x 60 ÷ pole pair number) - Rated speed] ÷ Rated speed.

5.3.2.11 Overexcitation

Scenario

During rapid deceleration, the bus voltage increases. When the bus voltage is close to the overvoltage threshold, increase the motor excitation current to increase the loss and reduce the deceleration time.

Operation principles

Set overexcitation gain through d0-41 when the motor is decelerating and the bus voltage is approaching the overvoltage threshold in asynchronous motor V/f control mode. When entering the overexcitation state, the AC drive increases the output voltage to increase the motor exciting current. This aims to intensify the loss and consequently reduce the motor deceleration time. The higher the overexcitation gain, the better the suppression effect will be.

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
F2-36 (d0-41)	Overexcitation gain (V/f)	Defines the over-excitation gain in V/f mode. Increasing the overexcitation will increase the output voltage and decrease the deceleration time of the motor. However, excessive excitation may cause current oscillation. F2-36 is the same parameter as d0-41. After F2-36 is modified, d0-41 is updated synchronously.	90%	0.0% to 200%

Application Cases

In the ceramic industry, a large number of mechanisms on the ceramic tile production line need to start and stop quickly. During deceleration, the general bus voltage will rise, triggering overvoltage suppression and prolonging the deceleration time. Equipment that starts and stops quickly will have a significant impact on the process. Increasing d0-41 (over-excitation gain) properly will result in faster consumption of the bus voltage. It can increase the deceleration time significantly.

5.3.3 Basic Control

5.3.3.1 Random PWM

Scenarios

When driving a motor, the AC drive often generates sharp noise from switching frequencies. In noise-sensitive applications, you can enable the random PWM function to improve the user experience.

Operation principles

After random PWM is enabled, the carrier frequency actually in effect changes randomly near the set carrier frequency, which changes the fixed frequency sharp carrier noise to a relatively soft "sand" sound.

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
A5-11	Random PWM depth	The random PWM can turn the sharp electromagnetic noise of the motor caused by the carrier frequency into a relatively soft "rustling" sound. Setting this parameter to 0 disables this function. A larger value means better noise reducing capacity.	0	0 to 10

Precautions

- Larger random PWM depth brings stronger noise improvement. However, this may impact current harmonics negatively. Therefore, it is recommended to increase the value gradually from the default value during actual commissioning.
- When the carrier ratio (carrier frequency and output frequency ratio) is lower than 10, it is recommended that random PWM cannot be turned on. For carrier ratios below 10 (the ratio of carrier frequency to output frequency), it is recommended to disable the random PWM function. When the carrier frequency is too low and random PWM is activated, the control frequency will be insufficient, leading to fluctuations in motor speed.
- This parameter is effective only for asynchronous motors in V/f mode.

5.3.3.2 Overmodulation

Scenarios

In applications with high demands for the output current and energy efficiency of the AC drive, such as fans and water pumps, increasing the voltage overmodulation coefficient can enhance the output capacity of the voltage and effectively improve the load capacity of the motor in the field weakening region.

Operation principles

Under the same load, increasing the output voltage can reduce the output current, thus reducing the heat generated by motors, cables, and inverters. The output voltage is related to the grid voltage/ capacity, rectifier, and inverter. This can be summarized as follows: The power grid and rectifier determine the output voltage base. Small power grid capacity will result in a large voltage drop after heavy load. The maximum voltage base is determined after the bus voltage is obtained by the power grid through rectifier. In the SVPWM linear modulation area, the relationship between bus voltage and the maximum output voltage of the AC drive is as follows:

$$V_{\text{maximum output voltage}} = \frac{1}{\sqrt{2}} U_{dc}$$

For control stability, reserve a 3% voltage margin (D5-00) to stabilize the output voltage as follows:

$$V_{\text{max output voltage}} = \frac{1-(D5-00)}{\sqrt{2}} U_{dc} = \frac{0.97}{\sqrt{2}} U_{dc}$$

In some sites, the bus voltage is low due to low input voltage. You can increase the output voltage through overmodulation and set A5-06 to adjust the overmodulation coefficient. Take A5-06 = 106% as an example. If the output voltage is not enabled, the output voltage can be increased by 6% (if the harmonics are low during stable operation). With overmodulation enabled, the conversion relationship between the effective value of the maximum output line voltage and the bus voltage of the AC drive is as follows:

$$\text{Umax} = \frac{U_{DC}}{1.414} \times (A5-06) \times \{1-(D5-00)\}$$

Related parameters

Parameter Code	Name	Description	Default Value	Value Range
A5-06	Overmodulation coefficient	Defines the overmodulation coefficient. Increasing the voltage overmodulation coefficient can enhance the voltage output capacity and effectively improve the load carrying capacity of the motor in the flux weakening region. However, this can also increase the output current distortion.	103.0%	0.0% to 110.0%

Precautions

- The larger the overmodulation coefficient, the greater the output voltage distortion and current fluctuation. If the fluctuation is too large, it can easily cause faults such as pulse-by-pulse current limit and overcurrent. Therefore, the negative effect of increased fluctuation must be considered when the overmodulation coefficient is increased.
- The output voltage reverses a voltage margin of 3% to meet the dynamic current response. Therefore, the 103% overmodulation coefficient is equal to 100% of the maximum output voltage, which means there is no overmodulation effect. It is recommended that the overmodulation coefficient not exceed 108%. Generally, the coefficient is within 105%. Otherwise, large harmonic current will be generated, resulting in a decrease in system efficiency.

5.3.3.3 Braking Resistor Control

Scenarios

In applications with energy feedback, particularly during quick deceleration with heavy inertia load or load lifting operations like hoisting, connect the braking unit to manage the excess energy fed back to the bus to avoid overvoltage.

For applications requiring good speed following performance during quick deceleration, installing a braking resistor is highly recommended. If the speed following requirement is not so critical, consider activating the excitation and overvoltage suppression features to protect the bus from overvoltage during deceleration.

Working Principle

When the bus voltage is higher than the active action voltage of the braking unit during AC drive operation, the braking unit works and the energy is dissipated through the braking resistor. When the bus is lower than the braking unit action voltage, the braking unit stops operating.

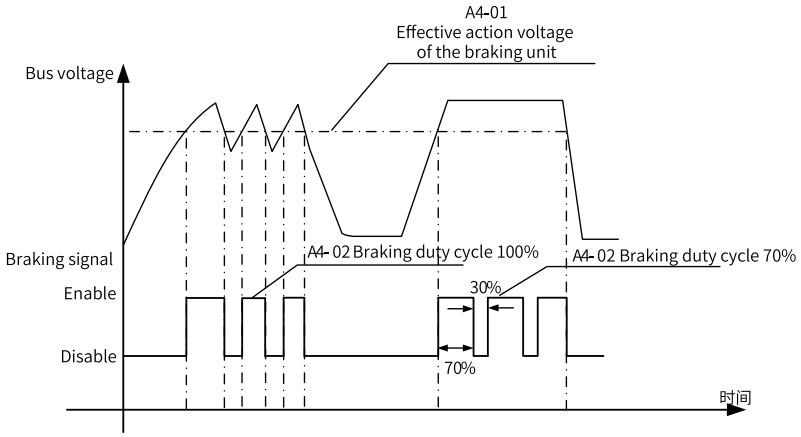


Figure 5-169 Braking resistor control diagram

Related parameters

The starting voltage of the braking unit is set by A4-00 (Braking unit action voltage). The actual effective value is displayed in A4-01. The parameter A4-02 (Braking duty cycle) can be used to adjust the power of the braking unit.

Parameter	Name	Description	Default	Value range
A4-00	Braking unit action voltage	Defines the bus voltage threshold for activating the braking transistor. The actual effective value is displayed in A4-01. When the bus voltage exceeds this threshold, the braking transistor turns on to prevent overvoltage through discharging bus energy via the external braking resistor. The braking transistor will not act when the AC drive is in the stopped state.	760.0V	600.0 to 820.0 V
A4-01	Active braking unit action voltage	Displays the actual effective action voltage of the braking unit, which is set through A4-00.	760.0V	600.0 to 820.0 V
A4-02	Braking duty cycle	Defines the braking duty cycle. Braking duty cycle: 0: No braking; 100%: Normally open This parameter is used to control the braking power. The braking power is calculated as the square of the bus voltage/ braking resistor×braking duty cycle.	100%	0 to 100%

Precautions

- Connect one end of the braking resistor to the BR terminal and the other end to the positive bus (+). Then verify the resistance between the bus terminal and the BR with a multimeter.

- Ensure that the braking resistor terminals are securely connected and with proper power. Failure to comply may result in an increase in the temperature of the terminals, potentially leading to extreme cases such as fire.
- If bus overvoltage occurs during regeneration even with the braking resistor connected, it may indicate that the braking unit does not have sufficient power. In such cases, replace the braking unit with a higher power within the recommended range You can also reduce the action voltage of the braking unit properly, and apply braking in advance to cope with the rapid deceleration. For details of braking unit selection, see *"9.8.7 Braking Resistor" on page 1197*.
- Be mindful of the grid voltage range when setting the braking voltage. High grid voltage can result in high bus voltage. If the braking unit's action voltage is set below the normal bus voltage, the braking unit may operate continuously during AC drive operation, risking damage Therefore, the action voltage of the braking unit should be 20 V higher than the normal bus voltage to ensure safety.
- When the braking unit is connected and the overvoltage suppression function is activated, set the value of A4-00 below the d1-56 parameter (Actual overvoltage suppression action voltage).
- For large inertia loads, if the speed loop integral time is too short during vector control, the bus voltage may fluctuate excessively when load changes, leading to overheating of the braking resistor. To mitigate this, increase the speed loop integral time (F2-03) (such as 2 seconds) to reduce bus voltage fluctuations.

5.3.3.4 Parameter Calculation

Scenarios

The parameter calculation function can be used in situations when auto-tuning cannot be performed or when the requirements on the parameter accuracy is not high, such as V/f control mode. This function calculates and updates some parameters based on the motor nameplate-based parameters and the built-in experience algorithm.

To use the parameter calculation, set the nameplate-based parameters, including C4-00 to C4-09, enable parameter calculation (C2-19 = 1), and then confirm nameplate-based parameter calculation (C2-20 = 1). The parameter calculation is completed.

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
C2-19	Parameter calculation	Enable parameter calculation. Description 0: Inactive 1: 1: Motor nameplate-based parameter calculation	0	0 to 1
C2-20	Parameter calculation confirmation	Check whether the parameter calculation function is active. You must enable this function and confirm that it is active before parameter calculation can be performed. Description 0: Inactive 1: Active	0	0 to 1

The parameters updated by calculation are as follows:

Param.	Parameter Name	Parameters updated by calculation
C4-12	Back EMF of synchronous motor	□
C4-20	Stator resistance	□
C4-22	Asynchronous motor rotor resistance	□
C4-24	Leakage inductance of asynchronous motor stator	□
C4-26	Leakage inductance of asynchronous motor rotor	□
C4-28	Asynchronous motor mutual inductance	□
C4-30	No-load current of asynchronous motor	□
C4-32	d axis inductance of synchronous motor	□
C4-34	q axis inductance of synchronous motor	□

Precautions

The parameter calculation is based on the built-in experience algorithm. It provides a relative parameter as a reference instead of accurate parameters.

The parameters updated are current active motor parameter groups. The current active motor parameter groups are set and viewed through parameters b0-00 and b0-01.

5.3.3.5 Self-test

Scenarios

Self-check is a function that automatically checks the abnormality of the AC drive.

The self-check function includes three items: IGBT shoot through self-check, short circuit to ground self-check, and output phase loss self-check. It is recommended that self-check be performed when the motor and AC drive is used for the first time to check whether internal wiring and external wiring are correct. When the system is short-circuited to ground, inter-phase short-circuited, phase loss, or various hardware faults, the self-check reports the corresponding faults and guides the user to perform specific inspection.

Self-check can be started in three ways: manual self-check, pre-running self-check, and power-on self-check.

- The manual self-check is triggered manually by C2-04.
- The pre-running self-check automatically performs a self-check after each start command is given and then runs again. The power-on self-check automatically performs a self-check after each power-on is completed.
- Y The self-test is performed automatically once after each power-on.

Related parameters:

Table 5–79 Pre-running self-check configuration

Parameter Code	Parameter Name	Description	Default	Value range
C2-03	Pre-running self-check configuration	Defines the self-check configurations before start. Description Bit 0: The AC drive performs the IGBT shoot through self-check before start. Bit1: Enable the self-test for short circuit to ground before starting the AC drive Bit2: Enable the phase loss self-test before starting the AC drive	0x0000	0x0000 to 0xFFFF

Table 5–80 Power-on self-check configuration

Parameter Code	Parameter Name	Description	Default	Value range
C2-06	Self-check upon power-on	This parameter sets the self-check upon power-on. Value description Bit0: IGBT direct-through self-test enabled when the AC drive is powered on Bit1: Enable the self-test for short circuit to ground when the AC drive is powered on Bit2: Enable the output phase loss self-test when the AC drive is powered on	0x0002	0x0000 to 0xFFFF

Table 5–81 Manual self-check configuration

Parameter Code	Parameter Name	Description	Default	Value range
C2-04	Manual self-check	Manual self-check command Description 0: No command 1: Static self-check	0	0 to 1
C2-05	Manual self-check	This parameter sets the self-check items. Description Bit0: IGBT pass-through self-test enabled during manual self-test of the AC drive Bit1: Enable the short circuit to ground self-test during manual self-test of the AC drive Bit2: Output phase loss self-test enabled during manual self-test of the AC drive	0x0007	0x0000 to 0xFFFF

The start of manual self-test is similar to parameter auto-tuning. After selecting self-test, the operating panel displays CHEC flashing. After the self-test is completed within 100 ms, the system enters the power-on blocking state. If no fault is reported, the self-check is normal.

Precautions

During self-check, the AC drive will generate waves. Therefore, ensure that the self-check, especially the power-on self-check, is performed without the risk of electric shock.

The time consumed during the self-check is within 100 ms. For the applications with strict requirements on startup time, perform the self-check carefully. Otherwise, slow start will occur.

Do not start self-check when the motor is rotating. If self-check is started when the motor still has back EMF, a false fault may be reported such as short circuit to ground.

When using the self-check function, ensure that the rated motor current is greater than 0.2 times the rated AC drive current. If the motor power is much lower than the AC drive power, the self-check may fail. In this case, self-check is not recommended.

When the motor cable reaches several hundred meters, a small AC drive (Below 30kW) has a large grounding capacitor. A relatively large leakage current to the ground will occur during self-check compared to the rated current of the AC drive. The self-check may result in false faults. In this case, self-check is not recommended.

When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. The following figure shows the connection of different grid types.

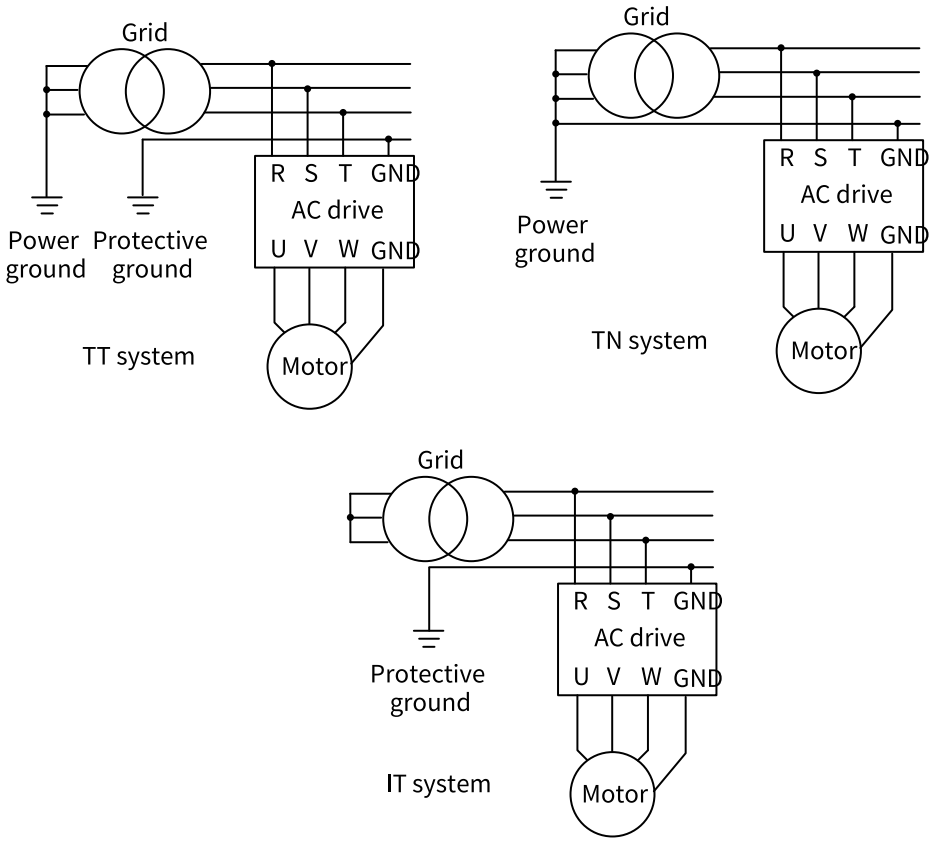


Figure 5-170 Self-test connection of different power grid types

5.3.3.6 Shorting motor stator control

Scenarios

The shorting motor stator is a type of braking control applicable to synchronous motors. It is also known as active short circuit (ASC). For example, when a load with gravitational potential energy is hoisted, a certain braking torque is generated through shorting motor stator to prevent the load from overspeed. In the applications such as fan and water pump, the shorting motor stator function also prevents the motor from rotating due to inertia.

Operation principles

When the motor rotates, the three phases of the winding of the synchronous motor are short-circuited in the shorting motor stator state of the AC drive, inducing a current within the windings. Then the braking torque is generated. Therefore, the higher the motor speed, the higher the sealing torque and the lower the speed. The smaller the shorting torque is.

The process of shorting motor stator is as shown in the following figure.

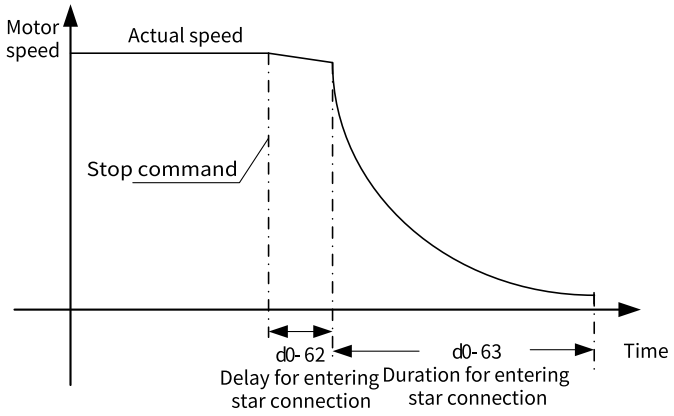


Figure 5-171 Shorting motor stator control

Related parameters:

Parameter Code	Parameter Name	Description	Default	Value range
d0-61	Star connection	0: Disable 1: Enable Other: B connector This function is active in the decelerate-to-stop, stop-at-maximum-capacity, and quick stop modes, but not in the coast-to-stop mode.	0	0 to 1
d0-62	Delay time for starting shorting motor stator	Star connection starts after this delay time elapses upon stop.	0.0 ms	0.0 to 5000.0 ms
d0-63	Holding time of shorting motor stator at stop	The start connection state is canceled after the set hold time elapses. The maximum setpoint indicates the active short circuit control is always active.	10.0s	0.1s to 3600.0s

Precautions

When the motor speed is high, shorting the star will cause the motor kinetic energy to feedback to the bus, causing the bus voltage to rise. When the bus reaches a high value, to prevent overvoltage, the drive stops star sealing, which causes the motor to lose the star sealing braking torque. Therefore, it is recommended to use this type of application together with the braking resistor.

5.3.3.7 Carrier Frequency and Wave Generation

Scenarios

The carrier frequency of the AC drive is set by A5-01 (Set carrier frequency). In addition to being limited by A5-01 (Set carrier frequency) and A5-00 (Maximum carrier frequency), the carrier frequency is controlled by functions such as "Carrier frequency adjustment with synchronous frequency" and "Random PWM". For details, see description of A5-09 to A5-13.

Working Principle

After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08), when the output frequency is lower than the value of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the value of A5-10 plus A5-09, the effective carrier frequency will reach the set carrier frequency. The following figure shows the operating principle of the carrier frequency and step frequency adjustment function.

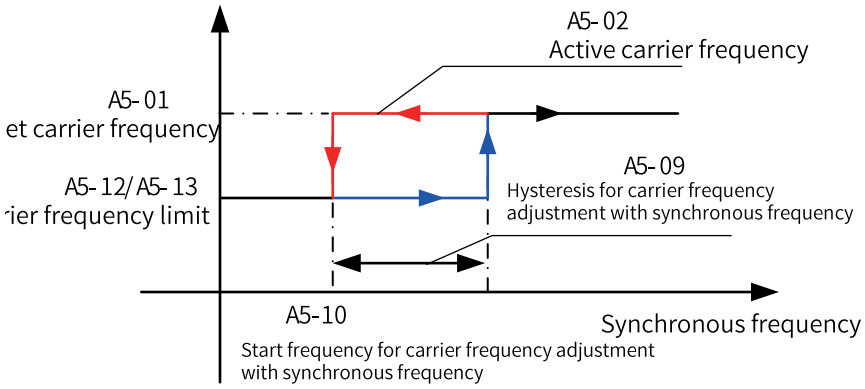


Figure 5-172 Carrier frequency adjustment with synchronous frequency

Related parameters:

Parameter Code	Name	Description	Default	Value range
A5-00	Maximum AC drive carrier frequency	The maximum carrier frequency that can be set by the AC drive is related to the motor type, control mode d0-00, and model hardware and cannot be changed.	16.0 kHz	0.0 kHz to 24.0 kHz
A5-01	Set carrier frequency	Defines the carrier frequency of the drive. It is used to adjust the carrier frequency of the AC drive, helping to reduce the motor noise, avoiding the resonance of the mechanical system, and reducing the leakage current to the earth and interference generated by the AC drive. It helps reduce the motor noise, avoid the resonance of the mechanical system, and reduce the leakage current to the earth and interference generated by the AC drive. Additional information: The higher the setting, the lower the motor noise and the lower the current ripple. However, an excessively high carrier frequency can result in derating of the drive, leading to frequent overload. When the carrier frequency is low, high harmonics of the output current and power loss, as well as temperature rise of the motor increase.	4.0 kHz	0.8 kHz to 20.0 kHz
A5-02	Carrier frequency	Displays the effective carrier frequency of the drive. Additional information: The carrier frequency of the AC drive is also affected by the carrier frequency adjustment with synchronous frequency and random PWM.	4.0 kHz	0.8 kHz to 20.0 kHz

Parameter Code	Name	Description	Default	Value range
A5-09	Hysteresis for adjusting carrier frequency with sync frequency	Defines the hysteresis for adjusting carrier frequency with synchronous frequency.	3.0 Hz	0.0-100.0 Hz
A5-10	Start frequency for adjusting carrier frequency with sync frequency	Defines the starting frequency for adjusting carrier frequency with synchronous frequency.	5.0 Hz	0.0-600.0 Hz
A5-12	Carrier frequency upper limit at low speed (V/f)	Defines the low-speed carrier frequency limit in V/f mode. Additional information: 1 .1. Valid for V/f mode. 2 .After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08), when the output frequency is lower than the value of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the value of A5-10 plus A5-09, the effective carrier frequency will reach the set carrier frequency.	20.0 kHz	0.8 kHz to 20.0 kHz
A5-13	Carrier frequency upper limit at low speed (SVC)	Defines the carrier frequency limit at low speed in the SVC mode. Additional information: 1 .This parameter is effective only in the SVC mode. 2 .After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08), when the output frequency is lower than the value of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the value of A5-10 plus A5-09, the effective carrier frequency will reach the set carrier frequency.	2.0 kHz	0.8 kHz to 20.0 kHz

Precautions

In the SVC control mode, setting A5-13 too large may cause problems such as low motor torque, failure to drive the load, and failure to start. It is recommended that A5-13 not exceed 6.0 kHz.

Increasing the carrier frequency will generally improve the motor control performance, current harmonics, and noise, but it will also have negative effects such as drive temperature rise. The specific effects are as follows:

Items	Impact
Carrier frequency	Low→High
Motor noise	Large→Small
Current harmonics	Poor→Good
Motor temperature rise	High→Low
AC drive temperature rise	Low→High
Leakage current	Small→Large
External radiation interference	Small→Large

The default carrier frequency varies with the AC drive power. You can modify it as needed.

But note that if the set carrier frequency is higher than the default value, it will lead to an increase in temperature rise of the AC drive heatsink. In this case, you need to de-rate the AC drive. Otherwise, the AC drive may overheat.

For the long-wire output, the high carrier frequency of the long-wire can lead to poor motor noise, large current harmonics, and large temperature rise of the motor and reactor due to the reflection of leakage current and voltage on the ground. High carrier frequency may result in a loss of motor life and a sharp increase in interference. When the control frequency is sufficient, the carrier frequency should be reduced as far as possible.

5.3.4 Encoder

5.3.4.1 Encoder Wiring and Basic Settings

Describes the wiring and parameter settings of each encoder.

5.3.4.1.1 Overview of Encoders

The MD630-INT supports multiple types of encoders. Different types of encoders require different types of encoder cards (later known as PG cards) for signal processing. Only one PG card can be inserted at a time.

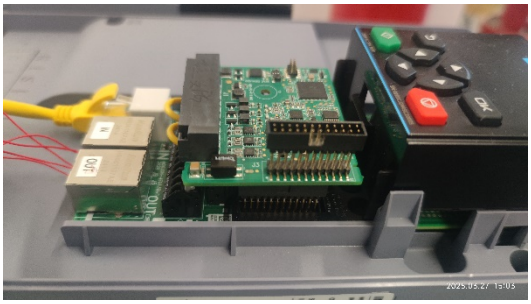
The following table lists the types of encoder signals supported by PG cards:

Encoder model	Supported encoder type	Encoder card specifications
MD-PG-AU1	ABZ incremental encoder	Supports TTL/HTL level, and differential (500 kHz)/push/pull (100 kHz)/OC (50 kHz) signal input
	Inovance communication 23-bit encoder	Resolution: 32-bit (max.); Data refresh rate: 16 kHz; Communication rate: 8 Mbps (max.)
	SSI encoder	Resolution: 32-bit (max.); Communication rate: 2 Mbps (max.)
	EnDat encoder	Resolution: 32-bit (max.); Communication rate: 10 Mbps (max.)
	BISS encoder	Resolution: 32-bit (max.); Communication rate: 10 Mbps (max.)
	Magnetic encoder	Resolution: 32-bit (max.); Data refresh rate: 16 kHz; Communication rate: 2 Mbps (max.)
MD-PG-R1	Resolver	Resolution: 12 bit Excitation frequency: 10 kHz/12 kHz/15 kHz/20 kHz (adjustable through software) Excitation voltage: 7 Vrms Rotation change ratio: 0.5 or 0.286
MD-PG-S1	Sine-cosine encoder	Differential mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V. Common mode voltage: Vcm = 3.0V (max.) Input frequency: f = 100kHz (max.)

Group F3 contains some parameters for quick debugging of the encoder detection signal.

All parameters for encoder detection signal are in group C2 settings. The parameters in group F3 are the mappings of the parameters in group C2. Modification to any parameter in group C2 or F3 will apply to the parameter in the other group.

The MD630-INT encoder card is mounted on the AC drive control board, as shown in the following figure.



5.3.4.1.2 ABZ Encoder

Encoder wiring

The incremental encoder uses the PG card (MD-PG-AU1).

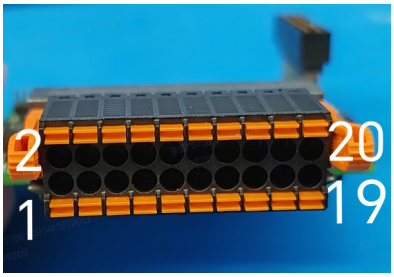
Differential Input: Connect the A+/A-/B+/B-/Z+/Z- of the encoder to the corresponding A+/A-/B+/B-/Z+/Z- of the encoder card. Connect the encoder power supply positive lead to the 5V terminal, and the encoder power supply negative lead to the COM terminal of the encoder card. Connect the encoder shield cable to the PE terminal.

OC input: Connect the A/B/Z of the encoder to the A+/B+/Z+ of the encoder card respectively. Connect the encoder power supply positive lead to the 5V or 15V terminal, and the encoder power supply negative lead to the COM terminal of the encoder card. Connect the encoder cable shield to the PE terminal.

Complementary push-pull input: Connect the encoder A+/A-/B+/B-/Z+/Z- to the corresponding A+/A-/B+/B-/Z+/Z- of the encoder card respectively. Connect the encoder power supply positive lead to the 5V or 15V terminal. For encoders with a power voltage range of 5V (TTL level), connect the power supply to the 5V terminal. For encoders with a power voltage range of 10 V to 30 V (HTL level), connect the power supply to the 15V terminal. Connect the encoder power supply negative lead to the COM terminal of the encoder card. Connect the encoder cable shield to the PE terminal.

Single-ended input: Connect the A/B/Z of the encoder to the A-/B-/Z- of the encoder card respectively. Connect the encoder power supply positive lead to the 5V or 15V terminal, and the encoder power supply negative lead to the COM terminal of the encoder card. Connect the encoder cable shield to the PE terminal.

The encoder input interface terminal pins are defined as shown in the following figure, and the interface is described in the following table. *"5.3.4.1.10 Frequency-division Output" on page 540*

Terminal	Pin No.	Name	Function definition
 A- B- C- 15 V COM OA- OB- OZ- COM PE A+ B+ C+ 5V / OA+ OB+ OZ+ VCC PE	1	A+	ABZ encoder signal A+
	2	A–	ABZ encoder signal A-
	3	B+	ABZ encoder signal B+
	4	B–	ABZ encoder signal B-
	5	Z+	ABZ encoder signal Z+
	6	Z-	ABZ encoder signal Z-
	7	5V	5 V power supply for the encoder
	8	15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground Divided output external input power grounding
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting steps

For ABZ encoder, perform the following steps:

1. Set the encoder type: Set the parameter C0-00 to 1 (ABZ encoder) based on the actual connected PG card.
2. Set the number of lines of the ABZ encoder. The nameplate parameter of the ABZ encoder indicates how many pulses are generated per revolution. Taking the 1024-PPR encoder as an example, set C0-02 to 1024.
3. Set the logic level type of the ABZ encoder. If the set type does not match the actual type of the hardware, it may cause abnormality in pulse detection and fault triggering.
4. Based on actual requirements, set the underlying pulse processing method (parameter C0-19) and the pulse speed measurement mode (parameter C0-20). If no specific performance is needed, use the default configuration.
5. Depending on the actual field usage environment, application requirements and the encoder characteristics used, select the handling of Z signal faults between C0-21 and C0-30, and set the fault detection enabling and fault detection thresholds. If there is no special need, use the default configuration.

Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Rotary encoder 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-02	Encoder PPR	1024	1 to 65535	Set this parameter when an ABZ encoder or sine-cosine encoder is used.

Param.	Name	Default	Value Range	Description
C0-18	ABZ encoder level type	1	1: Derivative output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	-
C0-19	Command word of the ABZ encoder	0x0E60	Bit 0: A/B pulse selection in M/T speed measurement 0: A pulse 1: B pulse Bit 1: Reserved Bit 2: Interchange of input signals A and B 0: Disable 1: Enable Bit 3: Interchange of A and B signals during frequency-division output 0: Disable 1: Enable Bit 4: Z signal inversion during frequency-division output 0: Disable 1: Enable Bit 5: Low bit of filter function selection 0: Disable 1: Enable Bit 6: High bit of filter function selection 0: Disable 1: Enable Bit 7 and Bit 8: Reserved Bit 9: Pulse A disconnection detection 0: Disable 1: Enable Bit 10: Pulse B disconnection detection 0: Disable 1: Enable Bit 11: Z pulse disconnection detection 0: Disable 1: Enable Bit 12 to Bit 15: Reserved	-

Param.	Name	Default	Value Range	Description
C0-20	ABZ speed measurement mode is in quadrature counting	0	0: Quadrupled frequency 1: Quadrupled frequency at low speed, single frequency at high speed 2: Single frequency	-
C0-58	Z signal interference detection enable	1	0: Disable 1: Enable	-
C0-59	Z signal interference fault threshold	0.5	0.5 to 10.0	-
C0-60	Number of allowed Z signal interference	10	5 to 1000	Sets the number of allowed Z signal interference. See C0-59 for usage.
C0-61	Z signal loss detection enable	1	0: Disable 1: Enable	-
C0-62	Number of allowed Z signal loss	10	5 to 100	Sets the Z signal loss fault detection threshold. **Note:** When the synchronous motor is running in FVC mode and equipped with ABZ or sine-cosine encoder, if C0-61 (Z signal loss detection enable) is active and the motor does not receive Z signal during rotation beyond C0-62 (Z signal loss detection threshold), E22-6 (Z signal loss warning) will be reported during running, and E20-8 (Z signal loss fault) will be reported after stop.
C0-63	Orientation deviation detection enable	1: Enable	0: Disable 1: Enable	Sets whether orientation deviation detection is enabled. **Value description:** 0: Disable 1: Enable - When the synchronous motor is running in FVC, if the correction angle of the Z signal exceeds 45°, E22-5 (Orientation deviation fault) will be reported.

Note

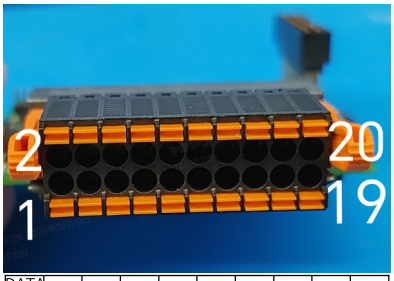
- For synchronous motors, the encoder Z signal must be connected. For details, see
- For asynchronous motors, the motor can be used without Z signal.

5.3.4.1.3 23-bit Encoder

Wiring of the Encoder

The 23-bit encoder uses the PG card [MD-PG-AU1].

The encoder input terminal pins are defined in the following figure. The terminals are described in the following table (*"5.3.4.1.10 Frequency-division Output" on page 540*).

Terminal	Pin No.	Interface Name	Function
 DATA- / / 15V COM OA- OB- OZ- COM PE DATA+ / / 5 V / OA+ OB+ OZ+ VCC PE	1	DATA+	DATA signal of the 23-bit encoder (+)
	2	DATA-	DATA signal of the 23-bit encoder (-)
	7	5V	5 V power supply for the encoder
	8	15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground External input power ground of frequency-division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic settings

For 23-bit encoder setting, follow these steps:

1. Set the encoder type: Set the value of parameter C0-00 (Encoder type) to 2 [23-bit encoder].
2. Set the communication frequency of the 23-bit encoder: Set the communication frequency according to the nameplate or manual of the 23-bit encoder. For example, if the communication frequency is 2M, set the parameter C0-23 to 1.

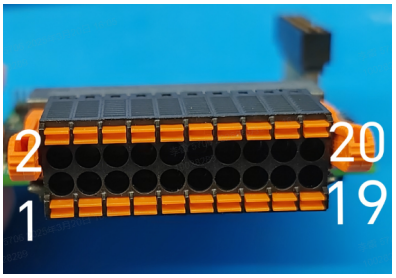
Param.	Name	Default Value	Value Range	Descriptions
C0-00	Encoder type	0: No encoder	0: No encoder 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-23	23-bit encoder communication frequency selection	1	1: 2M 3: 4M 4: 8M	-

5.3.4.1.4 SSI Encoder

Encoder wiring

The SSI encoder adopts a PG card (MD-PG-AU1).

The following figure shows the pin definitions of the encoder input interface terminals. For details, see *"5.3.4.1.10 Frequency-division Output" on page 540*.

Terminal	Pin No.	Interface Name	Function
 CLK- DATA- / 15V COM OA OB- OZ- COM PE CLK+ DATA+ / 5V / OA+ OB+ OZ+ VCC PE	1	CLK+	Clock signal of the SSI encoder (+)
	2	CLK-	Clock signal of the SSI encoder (-)
	3	DATA+	Data signal of the SSI encoder (+)
	4	DATA-	Data signal of the SSI encoder (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply common ground External input power ground for frequency-divided output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

Configure the SSI encoder as follows:

1. Set the encoder type: Based on the actually connected PG card, set the parameter C0-00 (encoder type) to 4 (SSI Encoder).
2. Set the SSI encoder communication baud rate: The appropriate communication baud rate is set based on the actual supported baud rate of the encoder and the length of the encoder cable.
3. Set the data format of the SSI encoder: Set the encoder parameters based on the actual data format of the encoder, including C0-32 (SSI encoder check selection), C0-33 (SSI encoder data format), C0-34 (number of SSI encoder state bits), C0-51 (number of single-turn bits of communication-type encoder), and C0-52 (number of multi-turn bits of communication-type encoder).
   For example, to configure the SSI encoder with odd parity check, gray code, 2-bit state bit, 13-bit single-turn precision, and 12-bit multi-turn precision, do as follows:

   Set C0-32 (SSI encoder check selection) to 1, C0-33 (SSI encoder data format) to 1, C0-34 (number of SSI encoder status bits) to 2, C0-51 (number of single-turn bits of communication-type encoder) to 13, and C0-52 (number of multi-turn bits of communication-type encoder) to 12.

[Baud rate limit]

The upper baud rate supported by the SSI encoder decreases as the encoder cable length increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the baud rate, a disconnection fault will be reported.

Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-31	SSI communication baud rate	3	0: 2M 1: 1.5M 2: 1M 3: 0.5M 4: 0.4M 5: 0.25M 6: 0.125M	/
C0-32	SSI encoder signal check	0	0: No check 1: Odd check 2: Even check	/
C0-33	SSI encoder data encoding format	0	0: Binary 1: Gray code	/
C0-34	Number of SSI encoder state bits	0	0 to 8	/
C0-51	Number of single-turn bits of communication-type encoder	23	1 to 32	/
C0-52	Number of multi-turn bits of communication-type encoder	0	0 to 32	/

Note

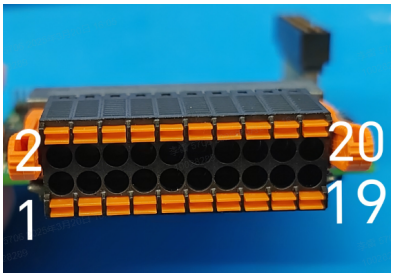
In the SSI data, the sum of the multi-turn bits, the single-turn bits, and the error bits must be less than 36 bits, and the upper limit resolution of the multi-turn bits and single-turn bits must be less than 24 bits.

5.3.4.1.5 EnDat Encoder

Encoder wiring

The EnDat encoder adopts a PG card (MD-PG-AU1).

The following figure shows the pin definitions of the encoder input interface terminals. For details, see *"5.3.4.1.10 Frequency-division Output" on page 540*.

Terminal	Pin	Interface Name	Function
 CLK- DATA- / 15 V COM OA- OB- OZ- COM PE CLK+ DATA+ / 5V / OA+ OB+ OZ+ VCC PE	1	CLK+	Clock signal of the EnDat encoder (+)
	2	CLK-	Clock signal of the EnDat encoder (-)
	3	DATA+	Data signal of the EnDat encoder (+)
	4	DATA-	Data signal of the EnDat encoder (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V common ground
	18	COM	External input power ground for frequency-divided output
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

Configure the EnDat encoder as follows:

1. Set the encoder type: Based on the actually connected PG card, set the parameter C0-00 (encoder type) to 6 (EnDat Encoder).
2. Set the EnDat encoder communication baud rate: The appropriate communication baud rate is set based on the actual supported baud rate of the encoder and the length of the encoder cable.
3. Set the data format of the EnDat encoder: Set the encoder parameters based on the actual data format of the encoder, including C0-51 (number of single-turn bits of communication-type encoder) and C0-52 (number of multi-turn bits of communication-type encoder).
   For example, to configure the EnDat encoder with 13-bit single-turn precision, and 12-bit multi-turn precision, set C0-51 (number of single-turn bits of communication-type encoder) to 13 and C0-52 (number of multi-turn bits of communication-type encoder) to 12.

[Baud rate limit]

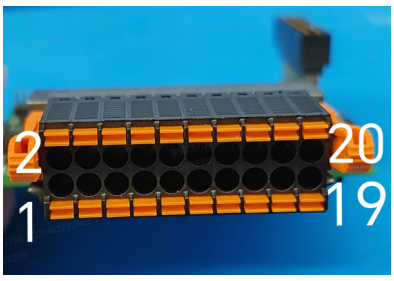
The upper baud rate supported by the EnDat encoder decreases as the encoder cable length increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the baud rate, a disconnection fault will be reported.

Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-29	Resolver encoder gear ratio selection	0	0: 0.5 1: 0.286	/
C0-41	EnDat encoder communication frequency	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	/
C0-51	Number of single-turn bits of communication-type encoder	23	1 to 32	/
C0-52	Number of multi-turn bits of communication-type encoder	0	0 to 32	/

5.3.4.1.6 Magnetic Encoder

Wiring of the encoder

[MD-PG-AU1] The encoder input terminal pins are defined in the following figure. The terminals are described in the following table (*"5.3.4.1.10 Frequency-division Output" on page 540*).



DATA-	/	/	15 V	COM	OA-	OB-	OZ-	COM	PE
DATA+	/	/	5V	/	OA+	OB+	OZ+	VCC	PE

Terminal	Pin	Terminal Name	Function
	1	DATA+	DATA signal of the 23-bit encoder (+)
	2	DATA-	DATA signal of the 23-bit encoder (-)
	7	5V	5 V power supply for the encoder
	8	15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground
	18	COM	External input power ground of frequency-division output
	19	PE	Shield grounding
	20	PE	

Basic settings

For magnetic encoder setting, follow these steps:

1. Set the encoder type: Set the value of parameter C0-00 (Encoder type) to 2 [23-bit encoder].
2. Set the magnetic encoder communication frequency: The magnetic encoder only supports 2M communication frequency, then set the value of C0-23 to 1.

Param.	Name	Default	Value Range	Descriptions
C0-00	Encoder Type	0: No encoder	0: No encoder 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-23	23-bit encoder communication frequency selection	1	1: 2M 3: 4M 4: 8M	-

Note

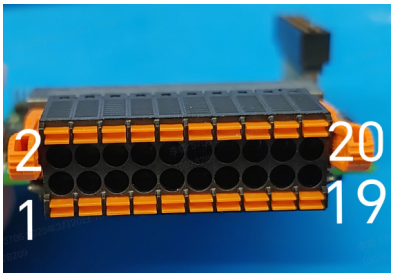
- The magnetic encoder baud rate only supports 2 M, and C0-23 can only be 1.
- The magnetic encoder data refresh rate is 16 kHz.

5.3.4.1.7 BISS Encoder

Encoder wiring

The BISS encoder adopts a PG card (MD-PG-AU1).

The following figure shows the pin definitions of the encoder input interface terminals. For details, see *"5.3.4.1.10 Frequency-division Output" on page 540*.

Port	Pin	Interface Name	Function
 CLK- DATA- / 15V COM OA- OB- OZ- COM PE CLK+ DATA+ / 5V / OA+ OB+ OZ+ VCC PE	1	CLK+	Clock output signal of the BISS encoder (+)
	2	CLK-	Clock output signal of the BISS encoder (-)
	3	DATA+	Data signal of the BISS encoder (+)
	4	DATA-	Data signal of the BISS encoder (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V common ground
	18	COM	External input power ground for frequency-divided output
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

Configure the BISS encoder as follows:

1. Set the encoder type: Based on the actually connected PG card, set the parameter C0-00 (encoder type) to 7 (BISS encoder).
2. Set the BISS encoder communication baud rate: The appropriate communication baud rate is set based on the actual supported baud rate of the encoder and the length of the encoder cable.
3. Set the data format of the BISS encoder: Set the encoder parameters based on the actual data format of the encoder, including C0-46 (BISS encoder check selection), C0-47 (number of BISS encoder state bits), C0-51 (number of single-turn bits of communication-type encoder), and C0-52 (number of multi-turn bits of communication-type encoder).
   For example, to configure the BISS encoder with calculated CRC same as received CRC, 2-bit state bit, 13-bit single-turn precision, and 12-bit multi-turn precision, do as follows:

   Set C0-46 (BISS encoder check selection) to 1, C0-47 (number of BISS encoder status bits) to 2, C0-51 (number of single-turn bits of communication-type encoder) to 13, and C0-52 (number of multi-turn bits of communication-type encoder) to 12.

[**Baud rate limit**]

The upper baud rate supported by the BISS encoder decreases as the encoder cable length increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the baud rate, a disconnection fault will be reported.

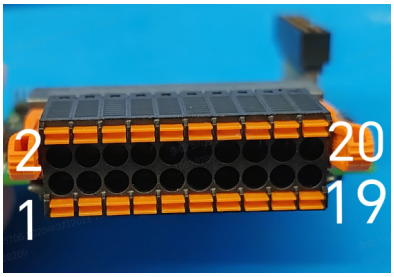
Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-45	Communication frequency of BISS encoder	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	/
C0-46	BISS encoder signal check	0	0: Calculated CRC opposite to the received CRC 1: Calculated CRC same as received CRC	/
C0-47	Number of BISS encoder state bits	0	0 to 8	/
C0-51	Number of single-turn bits of communication-type encoder	23	1 to 32	/
C0-52	Number of multi-turn bits of communication-type encoder	0	0 to 32	/

5.3.4.1.8 Resolver

Encoder wiring

Resolvers adopt PG cards (MD-PG-R1).

The following figure shows the pin definitions of the encoder input interface terminals. For details, see *"5.3.4.1.10 Frequency-division Output" on page 540*.

Terminal	Pin	Interface Name	Function
	1	SIN+	Resolver feedback SIN (+)
	2	SIN-	Resolver feedback SIN (-)
	3	COS+	Resolver feedback COS positive
	4	COS-	Resolver feedback COS positive
	5	EXC+	Resolver excitation (+)
	6	EXC-	Resolver excitation (-)
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

Configure the resolver as follows:

1. Set the encoder type: Based on the actually connected PG card, set the parameter C0-00 (encoder type) to 3 (resolver).
2. Set the number of pole pairs of the resolver: Set C0-13 (number of pole pairs) according to the nameplate or manual.

Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sin-cos encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-13	Number of resolver pole pairs	1	1 to 65535	/

Note

For synchronous motors running with a resolver, ensure that the following two conditions are met:

1. Number of motor pole pairs ≥ number of rotor pole pairs.
2. The motor pole pairs/resolver pairs can be divided.

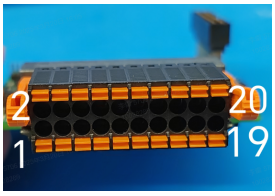
The asynchronous motor does not have this limit.

5.3.4.1.9 Sine-cosine Encoder

Encoder wiring

The sine-cosine encoder can use the PG card [MD-PG-S1].

The encoder input interface terminal pins are defined as shown in the following figure, and the interface is described in the following table. *"5.3.4.1.10 Frequency-division Output" on page 540*

Terminal	Pin No.	Interface name	Function definition
 SIN - / SIN + / COS - / COS + / Z- / Z+ / COM / 5V / / / OA- / OA+ / OB- / OB+ / OZ- / OZ+ / COM / VCC / PE / PE	1	SIN+	Sine-cosine encoder feedback SIN+
	2	SIN-	Sine-cosine encoder feedback SIN-
	3	COS+	Sine-cosine encoder feedback COS+
	4	COS-	Sine-cosine encoder feedback COS-
	5	Z+	Sine-cosine encoder Z signal +
	6	Z-	Sine-cosine encoder Z signal -
	7	C5V	5 V power supply for the encoder
	8	COM	C5V power supply reference ground Divided output external input power grounding
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting steps

For sine-cosine encoders, perform the following steps:

1. Set the encoder type: Set the parameter C0-00 to 5 (sine-cosine encoder) based on the actual connected PG card.
2. Set the resolution (number of lines) of the incremental encoder. The nameplate parameter of the incremental encoder indicates how many pulses are generated per revolution. Taking the 1024-PPR encoder as an example, set C0-02 to 1024.
3. Depending on the actual field usage environment, application requirements and the encoder characteristics used, select the handling of Z signal faults between C0-21 and C0-30, and set the fault detection enabling and fault detection thresholds. If there is no special need, use the default configuration.

Param.	Name	Default	Value Range	Description
C0-00	Encoder type	0: /	0: / 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BISS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.
C0-02	Encoder PPR	1024	1 to 65535	Set this parameter when an ABZ encoder or sine-cosine encoder is used.
C0-21	Z signal loss detection enable	1: Enable	0: Disable 1: Enable	-

Param.	Name	Default	Value Range	Description
C0-22	Z signal interference detection enable	1: Enable	0: Disable 1: Enable	-
C0-24	Z signal interference fault threshold	0.5%	0.5% to 10.0%	-
C0-25	Orientation deviation detection enable	1: Enable	0: Disable 1: Enable	-
C0-26	Number of allowed Z signal interference	10	5 to 1000	-
C0-30	Number of allowed Z signal loss	10	5 to 100	-

Note

For synchronous motors, the encoder Z signal (R signal) must be connected. The MD630-INT does not support correction of sine-cosine encoders through C/D.

For asynchronous motors, you can use them without a Z signal.

5.3.4.1.10 Frequency-division Output

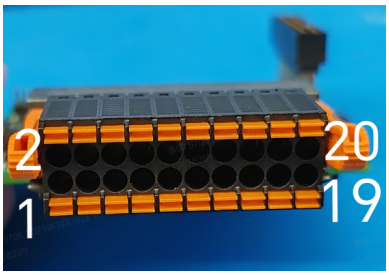
Frequency-division output wiring

The wiring steps for the frequency-division output are as follows:

1. The complementary push-pull frequency-division output cables connect to OA+/OA-, OB+/OB-, OZ+/OZ- of terminal J3 of PG card. The reference ground of frequency-division output connects to COM.

2. The single-ended push-pull frequency-division output cables connect to the OA+, OB+, and OZ+ of terminal J3 of PG card, and the reference ground of the frequency-division output connects to COM.

The encoder input terminal pins are defined in the following figure. The terminals are described in the following table.

Terminal	Pin No.	Name of Complementary Push-pull Interface	Functions of Complementary Push-pull	Name of Single-ended Push-pull Interface	Function of Single-ended Push-pull Interface
 / / / / / OA OB- OZ- COM PE / / / / / OA+ OB+ OZ+ VCC PE	11	OA+	A+	OA+	A+
	12	OA-	A-	-	-
	13	OB+	B+	OB+	B+
	14	OB-	B-	-	-
	15	OZ+	Z+	OZ+	Z+
	16	OZ-	Z-	-	-
	17	VCC	External input power for split-frequency output (5 V output from the board by default, or 5 to 30 V input from the external power supply)	VCC	External input power for split-frequency output (5 V output from the board by default, or 5 to 30 V input from the external power supply)
	18	COM	External input power ground of frequency-division output	COM	External input power of frequency-division output If the twisted pair single-ended push-pull cable is used, the negative ends of the twisted pair shall be grounded.
	19	PE	Shield grounding	PE	Shield grounding
	20	PE		PE	

Basic settings

For frequency-division output, follow these steps:

1. Set the number of frequency-division pulses: The number of pulses is set according to the actual requirements.
2. If the input is an ABZ encoder, you can set the ABZ encoder frequency division coefficient. The frequency-division output of ABZ encoder = the input ABZ encoder frequency/C0-16 (ABZ encoder frequency division coefficient).
3. Based on the required A/B phase sequence and external demand for the Z signal level, set C0-17 (Frequency-division output configuration command word). The bit 1 (Frequency-division output AB signal phase) can adjust the AB phase sequence, and the bit 2 (Frequency-division output Z signal) can modify whether the Z signal is in low or high level when it arrives.

Param.	Name	Default Value	Value Range	Descriptions
C0-15	Number of frequency-division output pulses	4096	4 to 65532	Set the number of AB pulses (quadrupled frequency) output by the PG card to an integer multiple of 4. Otherwise, the output pulses are inaccurate.
C0-16	ABZ encoder frequency-division coefficient	1	1 to 64	Only used in ABZ encoder frequency-division output. ABZ encoder frequency/C0-16 = Frequency-division output of ABZ encoder.

Param.	Name	Default Value	Value Range	Descriptions
C0-17	Frequency-division output configuration command word	0x0004	Bit 0: Frequency-division signal source selection 0: Channel 1 1: Channel 2 Bit 1: Frequency-division output AB signal phase 0: Phase A leads phase B 1: Phase B leads phase A Bit 2: Frequency-division output Z signal level 0: Z signal is in low level 1: Z signal is in high level Bit 3 to Bit 15: Reserved	-

Param.	Name	Default Value	Value Range	Descriptions
C0-19	Command word of the ABZ encoder	0x0E60	Bit 0: M/T speed A, B pulse selection 0: A pulse 1: B pulse Bit 1: reserved Bit 2: input A, B signal exchange 0: No exchange 1: Exchange Bit 3: A and B signals exchange during frequency-division output 0: No exchange 1: Exchange Bit 4: Z signal flipping during frequency-division output 0: Non-flipping 1: Flip Bit 5: Filter function selection (low level) 0: Disable 1: Enable Bit 6: Filter function selection (high level) 0: Disable 1: Enable Bit 7 to Bit 8: Reserved Bit 9: A pulse disconnection detection 0: Disable 1: Enable Bit 10: B pulse disconnection detection 0: Disable 1: Enable Bit 11: Z pulse disconnection detection 00: Disable 1: Enable Bit 12 to Bit 15: Reserved	-

5.3.4.1.11 Common Fault Triggered by Abnormalities

Description

For the three PG cards (MD-PG-AU1, MD-PG-R1, and MD-PG-S1) of MD630-INT, you can determine whether the PG card is online through hardware circuit connection or handshake messages.

Different faults or warnings are reported for different parameter settings and control modes.

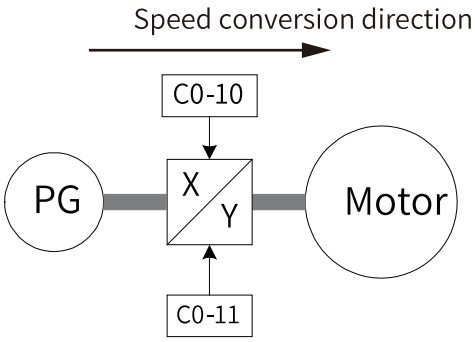
Control mode	Scenario	Setting	Fault code	Fault description
SVC, V/f	Any encoder abnormality	/	No	/
FVC	The PG card is not connected.	/	E22.7: Encoder card communication abnormal	The communication between the encoder card and the main controller is abnormal.
	The PG card is connected, but handshake messages between the encoder card and main controller fail.	Start the motor.		Handshake messages between the encoder card and main controller fail.
	The PG card is connected, but the encoder type is set incorrectly. The actual encoder type is not the same as the encoder type set.	Enable hardware disconnection (bit 3 of C0-01, encoder control word) or set FVC switch to SVC to the passive switch mode (d7-02/dF-02/y7-02/yF-02=2).	E20.01: Encoder disconnected E22.8: Encoder communication abnormal	Communication between the encoder and encoder card is abnormal, and the verification error occurs.
	The PG card is connected, but encoder hardware is disconnected.		E20.01: Encoder cable disconnected	Encoder disconnection (hardware detection)
	The PG card is connected, but communication between the encoder and PG card is abnormal.		E22.08: Encoder communication abnormal	Communication between the encoder and encoder card is abnormal and position is not obtained.

For detailed fault causes and solutions, see *"7.7 Common Fault Troubleshooting" on page 1035*.

5.3.4.2 Encoder Function

5.3.4.2.1 Transmission Ratio

The MD630-INT supports a transmission mechanism between the motor and the encoder. When the encoder and the motor are not installed on the shaft, the speed conversion relationship is shown in the following figure.



C0-10 and C0-11 set the transmission ratio between the motor and the corresponding encoder. The speed ratio is as follows:

$$\frac{\text{Motor speed}}{\text{Encoder speed}} = \frac{\text{C0-10}}{\text{C0-11}}$$

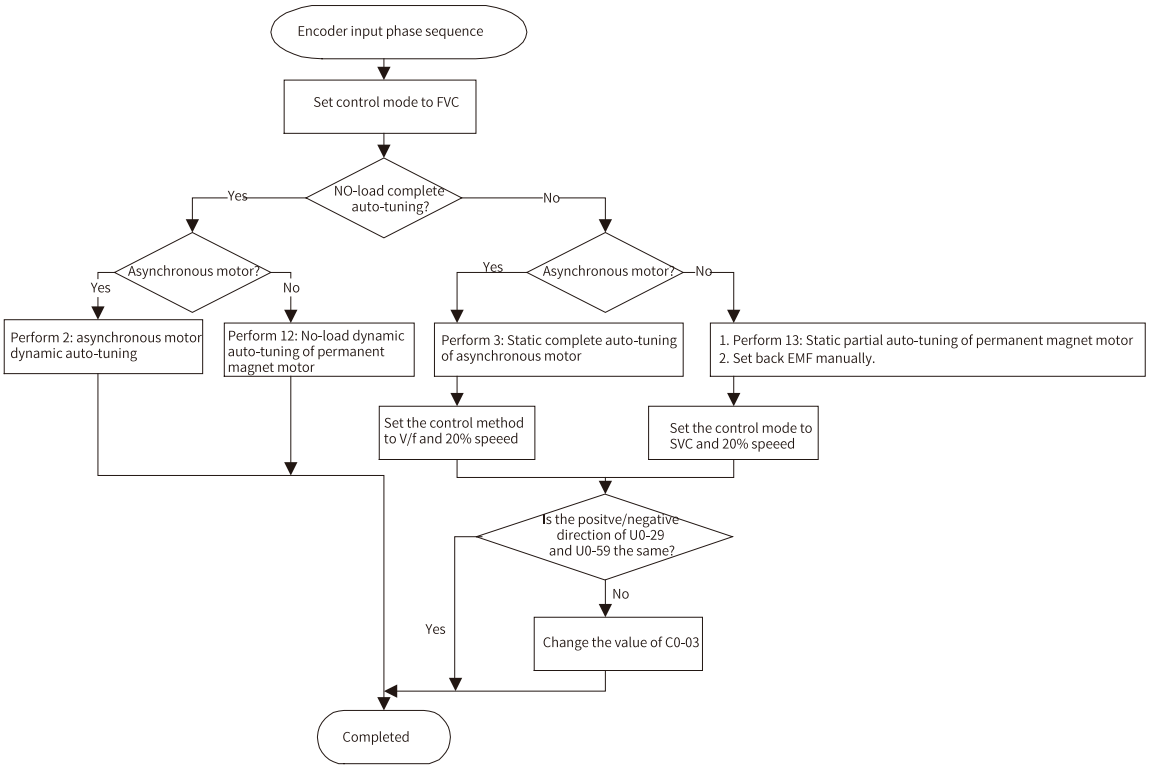
Param.	Name	Value Range	Default Value	Descriptions
C0-10	Encoder gear ratio numerator	1 to 65535	1	When the encoder and motor are not coaxially mounted, the control motor needs to set the gear ratio, which forms the gear ratio together with C0-11. If the motor to load deceleration ratio is 2.5 (2.5 revolutions of motor = 1 revolution of load), and the encoder is installed on the load, the numerator should be set to 5 and the denominator should be set to 2. **Note:** The product of the transmission ratio numerator and the number of motor pole pairs cannot exceed 65535.
C0-11	Encoder gear ratio denominator	1 to 65535	1	When the encoder and motor are not coaxially mounted, the control motor needs to set the gear ratio, which forms the gear ratio together with C0-11. If the motor to load deceleration ratio is 2.5 (2.5 revolutions of motor = 1 revolution of load), and the encoder is installed on the load, the numerator should be set to 5 and the denominator should be set to 2. **Note:** The product of the transmission ratio numerator and the number of motor pole pairs cannot exceed 65535.

5.3.4.2.2 Input Phase Sequence of Encoder

The parameter C0-03 (Phase sequence of encoder) indicates whether direction of the encoder speed and motor speed is consistent. If the parameter is set incorrectly, the motor will rotate in the forward direction while the encoder speed will be negative.

[**Input phase sequence setting process**]

For encoder direction setting, refer to the following flow chart.



[**Auto-tuning of the direction**]

If the motor can be unloaded and can rotate freely, it is recommended to set F1-69 to 2 (Dynamic auto-tuning of asynchronous motor) and 12 (No-load dynamic auto-tuning of permanent magnet motors) to automatically identify the encoder direction.

Note that before auto-tuning, set the control mode to FVC and the correct encoder type.

[**Manually set the direction**]

For asynchronous motors, obtain the correct encoder direction by setting F1-69 to 3 (Static complete auto-tuning of asynchronous motor) and Vf operation mode.

1. Set F1-69 to 3 (Static complete auto-tuning of asynchronous motor).

2. Set the control mode to Vf and 20% speed to observe whether the direction of encoder feedback speed (U0-29) and frequency reference (percentage) (U0-59) are consistent through the background oscilloscope.

If U0-29 and U0-59 speeds are in the same direction, the encoder is in the correct direction.

If U0-29 and U0-59 speeds are reversed, the encoder is reversed and set C0-03 to the other value.

If it was 0-forward, set the value to 1-reverse.

If it was 1-reverse, set the value to 0-forward.

For synchronous motors, obtain the correct encoder direction by setting F1-69 to1 static auto-tuning and SVC mode.

1. Set F1-69 to1 static auto-tuning.

2. Consult the manufacturer about the back EMF to set the back EMF of the motor manually.

3. Set the control mode to SVC and 20% speed to observe the actual motor speed (U9-00) and the encoder feedback speed (U9-20) through the background oscilloscope.

If U9-00 and U9-20 speeds are in the same direction, the encoder is in the correct direction.

If U9-00 and U9-20 speeds are reversed, the encoder is reversed and set C0-03 to the other value.

If it was 0-forward, set the value to 1-reverse.

If it was 1-reverse, set the value to 0-forward.

Note:

For synchronous motors, if FVC control is used, in addition to obtaining the direction of the encoder, an accurate encoder mounting position angle must be obtained. Otherwise, device runaway may occur. For details, see *"5.3.4.2.3 Synchronous Motor Angle Correction" on page 548*.

Asynchronous motors do not have the above restrictions. After the encoder phase sequence is obtained, FVC control can be used.

The settings mentioned in the above process must be performed after the C0-00 encoder type is set accurately.

Param.	Name	Value Range	Default Value	Description
C0-03	Phase sequence of encoder	0: Forward 1: Reverse	0: Forward	Changes encoder speed measurement phase sequence.

5.3.4.2.3 Synchronous Motor Angle Correction

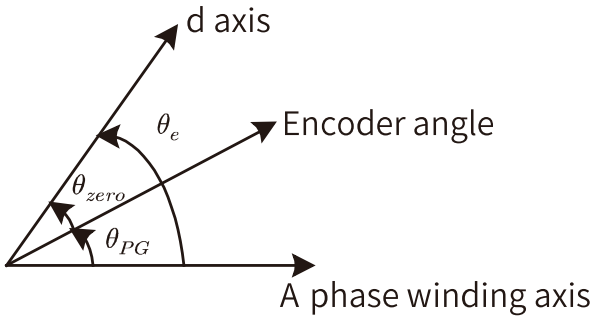
Encoder mounting angle description

When the synchronous motor adopts vector control with encoder (FVC), it depends on the correct permanent magnet angle (d-axis). Therefore, the deviation between the encoder angle and the permanent magnet angle must be known. The deviation is C0-04 (Encoder mounting angle).

For incremental encoders, the mounting angle of the encoder represents the clip angle of the Z signal and the axis of the phase A winding.

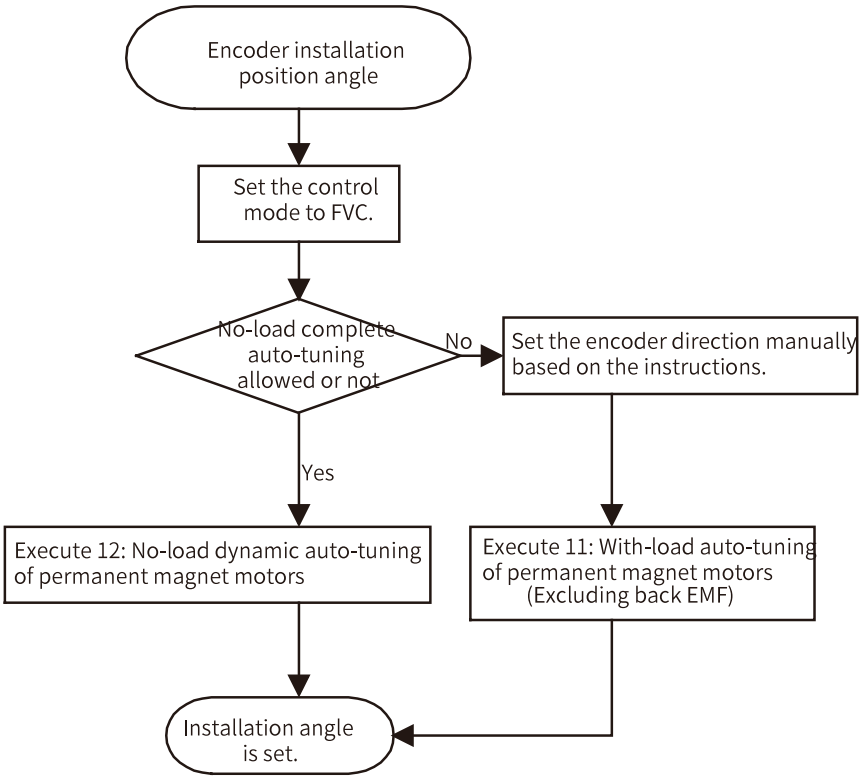
For absolute encoders, the encoder mounting angle represents the angle between the 0° of the encoder and the axis of the motor phase A winding.

Encoder angle (θ_{PG}), d-axis angle (θ_e), The relationship between the encoder mounting position angle (θ zero) and the motor phase A winding axis is shown in the following figure.



Encoder mounting position angle acquisition method

You can obtain C0-04 (encoder mounting angle) automatically through auto-tuning.



For motors that can rotate freely, 12 (no-load dynamic auto-tuning of permanent magnet motors) is recommended. This auto-tuning automatically learns the phase sequence of the encoder input signal and the mounting position angle of the encoder. The auto-tuning accuracy of the mounting position angle is the highest.

If no-load complete auto-tuning cannot be performed, you can manually set the encoder direction +11 - Permanent magnet motor with-load auto-tuning (no back potential) to learn the encoder installation position angle. The steps are as follows:

1. Obtain the correct phase sequence of the C0-03 encoder as described in *"5.3.4.2.2 Input Phase Sequence of Encoder" on page 546*.

2. After manually identifying the encoder phase sequence, you can obtain the mounting position angle of the encoder by performing 11 (Permanent magnet motor with-load auto-tuning (no back EMF)).

Note:

1. 11 (Permanent magnet motor with-load auto-tuning (no back EMF)) cannot automatically identify the encoder input phase sequence. If the encoder phase sequence is incorrect, perform 11 and the wrong encoder installation position angle will be obtained.

2. The synchronous motor must obtain an accurate encoder mounting position angle under FVC control. Otherwise, runaway fault can occur.

3. When the synchronous motor is controlled by FVC, if an incremental encoder, ABZ, or SinCos is used, Z signal must be provided to prevent operation. Otherwise, runaway fault can occur.

Parameter	Name	Value Range	Default Value	Description
C0-04	Encoder installation angle	0.0 to 359.9	0.0	-

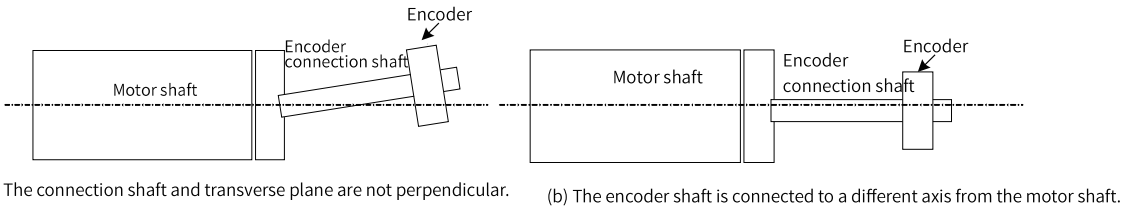
5.3.4.2.4 Speed Fluctuation Caused by Encoder Installation

In some high-performance applications (such as test benches), the speed fluctuation that the drive controls the motor must be minimized. In this case, the encoder must be installed properly. If the encoder is not installed properly, it may cause system performance degradation or even failure. The most common encoder installation problem is the encoder run-out, which can be divided into the following three situations:

The connection shaft and surface are not vertical. During installation, if the connection shaft is not vertical to the surface of the encoder, the encoder shaft will tilt.

The encoder connection shaft and motor shaft are misaligned. This results in radial run-out during operation.

Motor manufacturing problems occur, such as bearing damage or severe unbalance of the motor (relatively rare).



(a) The connection shaft and transverse plane are not perpendicular.

(b) The encoder shaft is connected to a different axis from the motor shaft.

Figure 5-173 Installation problem diagram

Problems caused by encoder radial run-out

Radial run-out of the encoder has the following effect on system operation:

Feedback speed fluctuation: This will cause torque fluctuation and shock. The machine may produce abnormal noise. The problem is more obvious when the machine runs at a high speed, reducing mechanical service life.

Abnormal control: Under high-speed operation and high value of the speed loop gain, overcurrent and overvoltage may occur.

Mechanical fatigue: Radial run-out of the encoder increases fatigue stress in the connection area, resulting in broken spring of the encoder base or broken encoder coupling.

Troubleshooting

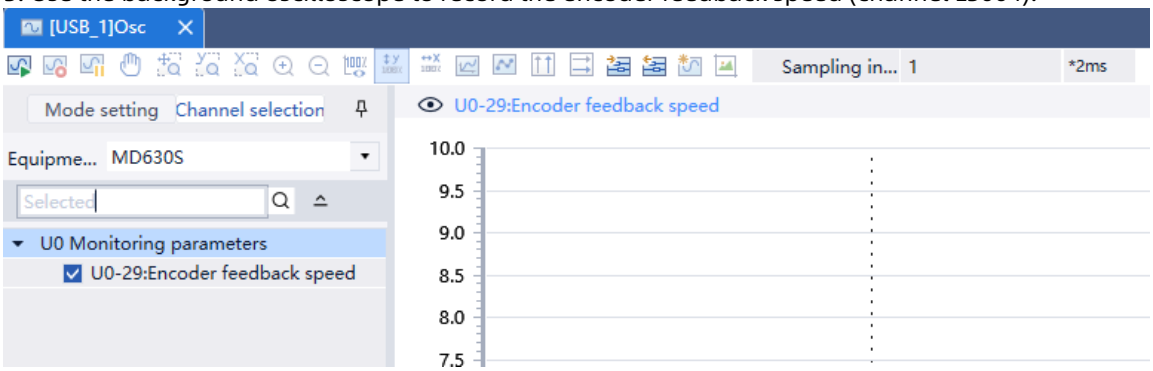
Radial run-out of the encoder shaft will cause the encoder feedback speed to fluctuate with the mechanical frequency. You can use the following two methods to determine whether there is an abnormality.

Method 1: Cost to stop

1. Select any control mode (such as V/f, SVC, or FVC) to set the stop mode to "coast to stop".

2. Start the motor and make it run to a certain speed (for example, 50% of the rated speed).

3. Use the background oscilloscope to record the encoder feedback speed (channel L3004).



4. Observe the waveform. After the motor coasts to stop, the encoder feedback speed is subject to mechanical frequency jitter. For example, if the motor runs at the frequency of 62.99 Hz and the number of pole pairs is 2, the mechanical frequency is 31.75 Hz. If the waveform indicates that the mechanical frequency fluctuation (such as 31.25 Hz) exists in the encoder feedback speed, there is a problem with the encoder radial run-out.

Method 2: Motor speed and encoder speed comparison in the SVC mode

1. Set the control mode to SVC.

2. Observe the actual motor speed (L3000) and the encoder feedback speed (L3004) in the background oscilloscope.

3. If the actual motor speed (L3000) is stable and does not fluctuate, and the encoder feedback speed (L3004) has mechanical frequency fluctuation, there is a problem with encoder installation.

Encoder concentricity determination

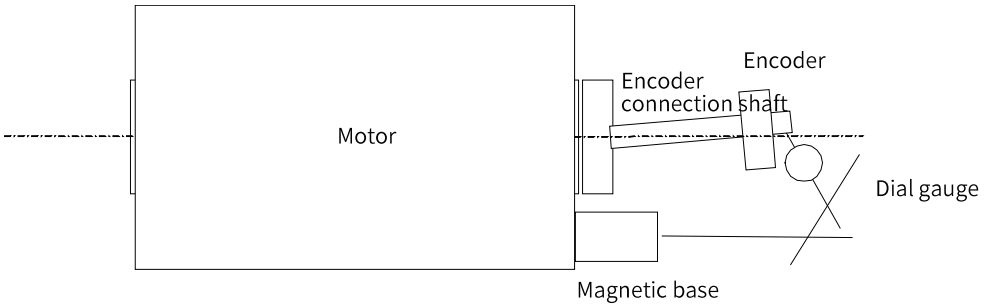
If the encoder installation is defective, you can calibrate the stand with a dial gauge and measure the radial run-out value of the encoder. The procedure is as follows:

1. Fix the dial gauge to the magnetic base, and align the dial gauge head with the encoder shaft.

2. After zero calibration, slowly rotate the motor shaft and read the encoder radial run-out value.

3. Acceptance criterion: The radial run-out range of the encoder should be less than 0.03 mm. During operation in the SVC mode, the encoder feedback speed fluctuation should be controlled within 0.2%.

For projects where there are high requirements on speed fluctuation, the encoder installation should meet the above requirements. For field debugging, the radial run-out value of the encoder needs to be measured to ensure installation quality.



Stand installation recommendation

During encoder installation, the following measures are recommended to ensure system stability and reliability:

1. Coupling selection: Avoid rigid couplings. Rigid couplings may cause additional stress on encoder bearings during operation, which increases the risk of damage. It is recommended to select a flexible coupling to reduce vibration and shock.

2. Reinforcement of the fixing screw: The encoder fixing screw should be fitted with spring washers. Spring washers can be used to prevent the screw from loosening due to vibration during operation, thus preventing the encoder from shaking and ensuring a stable installation.

3. Avoid the use of long shafts: Avoid using long shafts in the shaft system of the stand. The torsional rigidity of the long shaft decreases and the system's deflection and vibration will be increased. The shaft will shake when the motor runs with the load, therefore affecting the overall control performance.

Through the above measures, the encoder installation quality can be effectively improved, the system failure caused by improper installation can be reduced, and the equipment can be stable for a long time.

5.3.4.2.5 Encoder

If the coupling between the motor and the encoder is not connected tightly, relative slip may occur between the encoder and the motor.

For asynchronous motors, the motor can operate normally without serious slip.

For synchronous motors, the mounting position angle of the encoder changes due to code slip. In this case, the carrying capacity of the motor will be reduced, and in severe cases, the motor may fly.

When you suspect that the encoder slips, you can verify whether the encoder slips by using the following two methods:

Method 1: Software method

You can confirm whether the encoder slips by adjusting the encoder mounting position angle again. This method is applicable to any working condition.

Operation procedure:

A) Record the current C0-04 (Encoder mounting angle) first.

B) Perform 12 [no-load dynamic auto-tuning of the permanent magnet machine] when the motor is idle and can rotate freely, or 11 [no-load auto-tuning of the permanent magnet machine] when the motor is loaded. The encoder mounting position angle can be read again.

C) Compare the previously recorded encoder installation position angle with the re-identified encoder installation position angle. The deviation between the two must not exceed 20°. If the deviation exceeds 20°, the encoder slips.

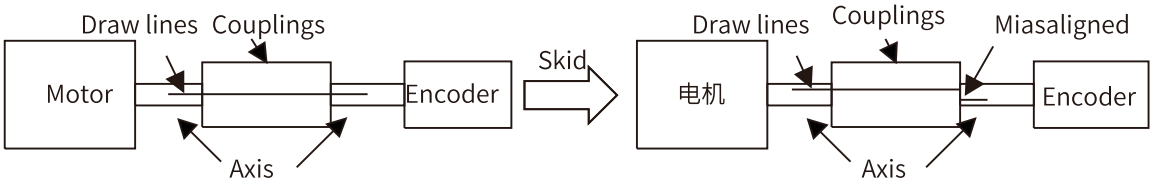
Method 2: Physical method

This method is applicable to the connection between the encoder and the motor through a coupling and is exposed. It is not applicable to the structure of the encoder that is built into the motor housing.

A) Draw a straight line through the marking stroke between the encoder-coupling-motor axis.

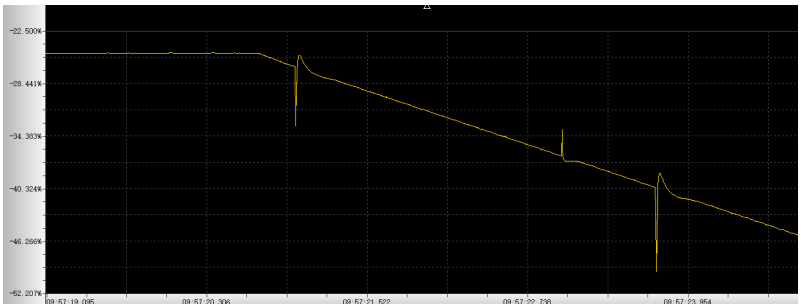
B) Switch the control mode to SVC, start the motor, set a low speed of 30%, and run for a period of time.

C) Stop the motor and observe whether the lines drawn earlier are misaligned. If the line is misaligned, the encoder slips and the encoder needs to be tightened again. The following figure shows the details.



5.3.4.2.6 Encoder Interference

During the operation of the motor, there will be relatively large electromagnetic interference. If the encoder signal is interfered, it will result in an angle or speed burr. The following figure shows the waveform of the interfered encoder feedback speed (L3004).



Interference source analysis

Common interference types and sources are as follows:

Electrostatic interference: Electrostatic discharge or high-impedance circuit from the surface of the device

Magnetic field interference: Electromagnetic field from the motor, drive or power cable

High-frequency interference: Radiation from external electromagnetic waves or reflection of signal cables

Low-frequency interference: Inductive coupling or power noise from the signal cable

Anti-interference measures

1. **Signal cable selection and wiring**

Twisted-pair cable: Twisted pair cables are recommended. Signal cables are routed in pair for transmission (A+/A-, B+/B-, power supply+/power supply-, Data+/Data-) to reduce interference.

Shield: Use a metal mesh shield with excellent shading performance to avoid poor shading performance of the single-layer aluminum foil.

Cable thickness: Because of the skin effect, the high frequency signal cable is routed on the conductor surface. Therefore, the signal cable should not be too thick. The thicker the power supply 0V wire in the cable, the better. The thick 0V wire can form a large inter-wire capacitance with the shield, and absorbs and routes the high-frequency interference signal. Wires that are not used in the cable can be combined into 0V wire. The recommended thickness ratio of the signal cable and power supply cable is 1:3.5. The cross sectional area of the signal cable is 0.14^2 and the 0V wire is 0.5^2.

Avoid wrapping: The signal cable should be kept as straight as possible to avoid distortion caused by inductance.

Avoid re-connection of cables: Use one cable from the encoder to the receiver as far as possible with the minimum connections. More connections indicate more reflective surfaces and emitters, resulting in more burrs and signal distortion.

Avoid parallel routing of encoder and power cables: Route long encoder cables through special metal pipes to avoid sharing the pipes with the power cables, and prevent the encoder signal from being interfered by the power cables.

2. **Grounding and shielding**

Correct grounding and shielding is the key to reduce interference. It is necessary to form a closed loop from the source to the encoder signal line feedback ground.

AC drive grounding: The AC drive needs to be connected to the power supply ground through the PE terminal to ensure that the AC drive is grounded.

Motor grounding: The motor enclosure is connected to the PE terminal of the drive through the grounding cable to ensure that the motor is grounded.

Ground of the encoder signal cable shield: The shield ground is divided into single-ended ground and double-ended ground.

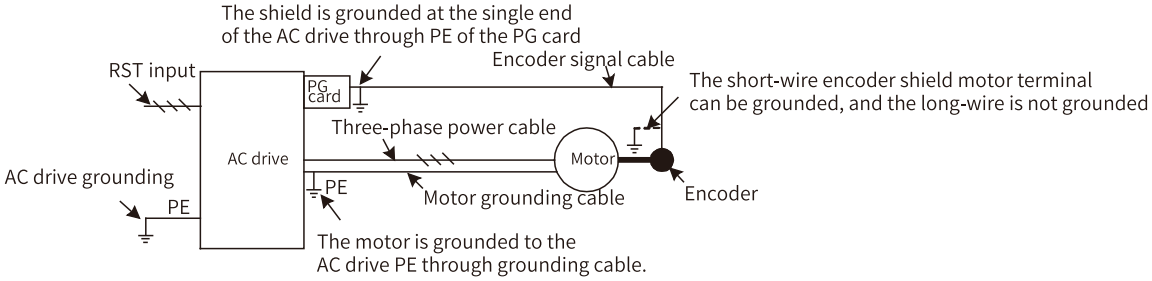
Single-ended ground: When the shield is connected to the PG card of the drive for grounding, it is called as single-ended ground. It is recommended when the encoder cable is long (50 m). To implement single-ended ground, connect the encoder signal cable shield to the PE interface on the PG card.

Double-ended grounding: When both the AC drive and encoder are connected to ground, it is called double-ended grounding. When the encoder cable is short, you can use double-ended grounding.

Power supply 0V to PE connection: Normally, PE is not connected to power supply 0V unless the PE signal is not interfered. After PE and 0V are connected, the short-circuit high frequency signal of the

filter can be absorbed by PE, therefore reducing the encoder signal interference. Determine whether to connect PE and 0V through test in the field.

Insulated sheath: The encoder with the insulated shaft or mount the rubber sheath to the encoder shaft can prevent shaft voltage interference.



Parameter filter

If there is always unsolvable interference in the encoder feedback speed, and if requirements on the motor control performance are not high, the filter time of the encoder feedback speed can be increased appropriately.

Parameter code	Parameter name	Value range	Default value	Description
C0-05	Filter time of encoder speed test	0.0000s to 6.0000s	0.0040s	By adjusting the encoder speed measurement filter time constant, the filtering effect on the encoder signal can be changed. The higher the filter time, the smoother the encoder feedback speed, but the greater the feedback speed delay; the lower the filter time, the greater the encoder feedback speed fluctuation, but the smaller the feedback speed delay; under the FVC control mode, the filter time constant cannot be too low when the resolver and other encoder signal quality is not good.

Note

Increasing the filter will seriously reduce the control performance of the AC drive. If the filter time is set too large, oscillation may occur.

5.3.4.2.7 Encoder Open Circuit Detection and SVC

Switchover

Encoder open circuit juged by hardware

Hardware open circuit detection refers to the open circuit detection through the encoder card. All types of encoders support hardware open circuit detection.

When the hardware disconnection signal is detected and bit03 (Hardware open circuit detection) of C0-01 is enabled, the fault (E20.01-Encoder disconnection) is reported if the signal persists after the time defined by C0-07 elapses.

Param.	Name	Value range	Default	Description
C0-01	Encoder control word	bit0: Reserved bit1: Software open circuit detection 0: Disable 1: Enable bit2: Deburring 0: Disable 1: Enable bit3: Hardware open circuit detection 0: Disable 1: Enable bit4: Moving average filter 0: Disable 1: Enable bit5: Position-based deburring function 0: Default 1: Disable bit6 to bit15: Reserved	0x0008	bit0: Speed measurement enable When the FVC control mode is selected, speed measurement is enabled automatically. When other control mode is selected, speed measurement is required, you can turn on or off the encoder speed measurement function as needed. bit1: Software open circuit detection The software open circuit detection serves to detect the open circuit function of the encoder during operation. The encoder open circuit cannot be detected at stop. After software open circuit detection is enabled, the deburring function is enabled automatically. When the number of speed measurement errors exceeds C0-09, encoder software open circuit fault can be reported. bit2: Deburring The deburring function serves to remove occasional speed measurement burrs, and the size of the burrs removed is controlled by B5-07. bit3: Hardware open circuit detection The hardware open circuit detection determines whether open circuit occurs based on the hardware open circuit signal. When the hardware open circuit signal is active for a period longer than the time set by C0-07, the hardware open circuit fault is reported. bit4: Filter mode selection The low-pass filter mode is used by default. bit7 to bit8: ABZ speed measurement mode selection in quadrature counting [code updated] 0: Quadruple x 4 speed measurement mode is used throughout the process. 1: The quadruple x 4 speed measurement mode is used during operation at low speed. In high-speed operation, the single-pulse speed measurement mode is used. The threshold for switching speed measurement modes is configured automatically based on the number of pulses per revolution. 2: Quadruple x 1 speed measurement mode is used during the whole process. bit9: ABZ pulse reference mode 0: ABZ quadrature-based angle/speed measurement 1: Pulse (A) direction (B)-based angle/speed measurement (Continued)

Param.	Name	Value range	Default	Description
C0-01	Encoder control word	bit0: Reserved bit1: Software open circuit detection 0: Disable 1: Enable bit2: Deburring 0: Disable 1: Enable bit3: Hardware open circuit detection 0: Disable 1: Enable bit4: Moving average filter 0: Disable 1: Enable bit5: Position-based deburring function 0: Default 1: Disable bit6 to bit15: Reserved	0x0008	(Continued) 0: Counting at falling edge of A 1: Counting at rising edge of A bit11: Pulse (A) direction (B) function selection 2, determined by chip pin signals 0: High level increment counting/Low level decrement counting of B 0: High level decrement counting/Low level increment counting of B
C0-07	Speed feedback PG open circuit detection time	0.1s to 10.0s	0.5s	Used to set the encoder open circuit detection time. If encoder hardware open circuit detection is enabled (bit3 of C0-01 set to 1), the drive reports ERR20 when it detects an open circuit fault and the fault lasts for a period longer than the defined by C0-07.

Encoder error judged by software

Only the ABZ encoder can determine whether the encoder feedback is normal through the software. This function is not supported by other types of encoders. By default, software open circuit detection is not enabled. You can enable it through the bit1 (Software open circuit detection) of the encoder control word C0-01.

If software open circuit detection is enabled, there is a detection threshold in the software, which can be adjusted through C0-08 (Software detection coefficient for encoder open circuit). When the error detected by the software exceeds the number of cycles defined by C0-09, the fault [E20.05 - Encoder software open circuit] can be reported.

Param.	Name	Value range	Default	Description
C0-01	Encoder control word	bit0: Reserved bit1: Software open circuit detection 0: Disable 1: Enable bit2: Deburring 0: Disable 1: Enable bit3: Hardware open circuit detection 0: Disable 1: Enable bit4: Moving average filter 0: Disable 1: Enable bit5: Position-based deburring function 0: Default 1: Disable bit6 to bit15: Reserved	0x0008	bit0: Speed measurement enable When the FVC control mode is selected, speed measurement is enabled automatically. When other control mode is selected, speed measurement is required, you can turn on or off the encoder speed measurement function as needed. bit1: Software open circuit detection The software open circuit detection serves to detect the open circuit function of the encoder during operation. The encoder open circuit cannot be detected at stop. After software open circuit detection is enabled, the deburring function is enabled automatically. When the number of speed measurement errors exceeds C0-09, encoder software open circuit fault can be reported. bit2: Deburring The deburring function serves to remove occasional speed measurement burrs, and the size of the burrs removed is controlled by B5-07. bit3: Hardware open circuit detection The hardware open circuit detection determines whether open circuit occurs based on the hardware open circuit signal. When the hardware open circuit signal is active for a period longer than the time set by C0-07, the hardware open circuit fault is reported. bit4: Filter mode selection The low-pass filter mode is used by default. bit7 to bit8: ABZ speed measurement mode selection in quadrature counting [code updated] 0: Quadruple x 4 speed measurement mode is used throughout the process. 1: The quadruple x 4 speed measurement mode is used during operation at low speed. In high-speed operation, the single-pulse speed measurement mode is used. The threshold for switching speed measurement modes is configured automatically based on the number of pulses per revolution. 2: Quadruple x 1 speed measurement mode is used during the whole process. bit9: ABZ pulse reference mode 0: ABZ quadrature-based angle/speed measurement 1: Pulse (A) direction (B)-based angle/speed measurement (Continued)

Param.	Name	Value range	Default	Description
C0-01	Encoder control word	bit0: Reserved bit1: Software open circuit detection 0: Disable 1: Enable bit2: Deburring 0: Disable 1: Enable bit3: Hardware open circuit detection 0: Disable 1: Enable bit4: Moving average filter 0: Disable 1: Enable bit5: Position-based deburring function 0: Default 1: Disable bit6 to bit15: Reserved	0x0008	(Continued) bit10: Pulse (A) direction (B) function selection 1, determined by chip pin signals 0: Counting at falling edge of A 1: Counting at rising edge of A bit11: Pulse (A) direction (B) function selection 2, determined by chip pin signals 0: High level increment counting/Low level decrement counting of B 0: High level decrement counting/Low level increment counting of B
C0-08	Encoder open circuit software detection coefficient	0.0% to 800.0%	100.0%	Used to set the magnitude of speed burs upon speed error. The default value (100%) needs no adjustment generally.
C0-09	Threshold of speed error events	1 to 100	10	When encoder software open circuit detection is enabled, the encoder software open circuit fault is reported when the number of speed measurement errors detected exceeds C0-09.

Troubleshooting to open circuit

You can set how the drive acts when different groups of motors are running upon encoder open circuit through d7-02 to d7-04/dF-02 to dF-04/y7-02 to y7-04/yF-02 to yF-04.

[**Open circuit judgment**]

The encoder open circuit fault is processed based on the setting of d7-02/dF-02/y7-02/yF-02 (Switchover between FVC and SVC modes).

When "0: Not switched" is selected, the corresponding fault is reported and the drive coasts to stop when hardware/software open circuit detection (C0-01) is enabled. If not enabled, overcurrent, overload, bus overvoltage may occur due to angle update error.

When "2: Switched passively" is selected, the encoder hardware and software open circuit detection is performed automatically.

[**Switch to SVC upon encoder open circuit**]

When d7-02/dF-02/y7-02/yF-02 is set to 2 (Switched passively), the control mode switches from FVC to SVC automatically without interrupting operation upon encoder hardware/software open circuit, until a stop command is sent by the user or the operating speed is lower than the threshold (actual speed) defined by d0-09/d8-09/y0-09/y8-09. In this case, a fault can be reported.

The default value of d0-09/d8-09/y0-09/y8-09 (actual speed) is 2%, which means the minimum operating speed after switching to SVC mode upon encoder open circuit is 2% of the default value. A fault can be reported when the synchronous frequency is lower than 2% of the default value. When set to 0%, the operation is not limited after switching to SVC until a stop command is sent by the user, after which the fault is reported.

Note: Setting d0-09/d8-09/y0-09/y8-09 of active load to 0% may result in operational divergence.

Param.	Name	Value range	Default	Description
d7-02/dF-02/y7-02/yF-02	FVC switched to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit and revert to FVC after the encoder is recovered upon stop).	0	-
d7-03/dF-03/y7-03/yF-03	Frequency for switching from FVC to SVC	10% to 500%	50%	-
d7-04/dF-04/y7-04/yF-04	Hysteresis loop for switching from FVC to SVC	10% to 100%	10%	-

5.3.4.2.8 FVC-to-SVC Operation Switchover

If the encoder signal quality is long and the interference is large during high-speed operation and cannot be resolved, you can use the FVC-to-SVC switchover function. Switch the control mode from FVC to SVC at high speed, and then switch back to FVC automatically at low speed to prevent low-speed SVC from being dispersed.

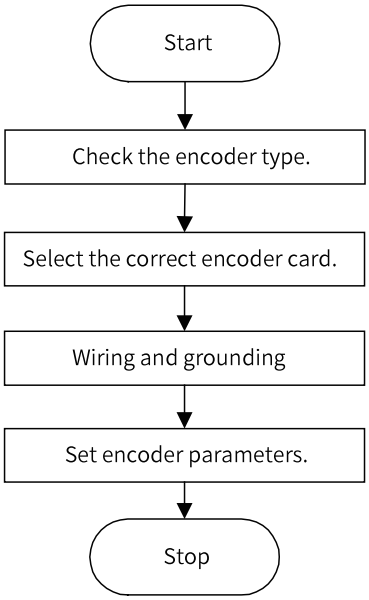
By default, this function is disabled. You can enable this function by using the function code d7-02/dF-02/y7-02/yF-02. You can adjust the speed at which FVC switches to SVC by setting d7-03/dF-03/y7-03/yF-03 and d7-04/dF-04/y7-04/yF-04.

Specification	Name	Value Range	Default value	Parameter Code
d7-02 dF-02 y7-02 yF-02	FVC-to-SVC mode switchover	0: Disable 1: Active switchover 2: Passive switchover. Switch to SVC mode when encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be recovered after stop.	0	-
d7-03 dF-03 y7-03 yF-03	FVC-to-SVC frequency switchover	10% to 500%	50%	-
d7-04 dF-04 y7-04 yF-04	FVC-to-SVC hysteresis switchover	10% to 100%	10%	-

5.3.4.3 Encoder Parameter Configuration

Setting the Encoder

The MD630-INT supports ABZ encoders, 23-bit encoders, resolvers, SSI encoder, sin-cos encoders, EnDat encoders, and BiSS encoders. The commissioning procedure for the encoder is as follows.



The specifications of the encoder card and the supported encoder types are as follows.

Encoder Card	Supported Encoder Type	PG Card Specifications	**Terminal Assignment**
MD-PG-AU1	ABZ incremental encoder	TTL/HTL level supported; differential (500 kHz)/push-pull (100 kHz)/OC (50 kHz) signal input supported; hardware open circuit detection (differential/push-pull) supported	<table><tr><td>A-</td><td>B-</td><td>C-</td><td>15V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>A+</td><td>B+</td><td>C+</td><td>5 V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.
	23-bit encoder	Resolution: 32 bit (Max.) Data refresh rate: 16 kHz Communication rate: 8 Mbps (Max.)	<table><tr><td>DATA-</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA+</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.
	SSI encoder	Resolution: 32 bit (Max.) Communication rate: 2 Mbps (Max.)	<table><tr><td>CLK-</td><td>DATA-</td><td>/</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>CLK+</td><td>DATA+</td><td>/</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.
	EnDat encoder	Resolution: 32 bit (Max.) Communication rate: 10 Mbps (Max.)	
	BISS encoder	Resolution: 32 bit (Max.) Communication rate: 10 Mbps (Max.)	
	Magnetic encoder	Resolution: 32 bit (Max.) Data refresh rate: 16 kHz Communication rate: 2 Mbps (Max.)	<table><tr><td>DATA-</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA+</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.
MD-PG-R1	Resolver	Resolver signal: SIN/COS/EXC signal Excitation output: Vpp = 18.8 V to 19.8 V to 21.1 V Excitation frequency: 10 kHz/12 kHz/15 kHz/20 kHz (adjustable) Feedback transformation ratio: 0.5/0.286	<table><tr><td>SIN-</td><td>COS-</td><td>EXC-</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN+</td><td>COS+</td><td>EXC+</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.
MD-PG-S1	Sin-cos encoder	Differential mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V Common mode voltage: 3.0 V (Max.) Input frequency: F = 100 kHz (Max.)	<table><tr><td>SIN-</td><td>COS-</td><td>Z-</td><td>15V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN+</td><td>COS+</td><td>Z+</td><td>5 V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> See the following table for details.

Table 5–82 Layout of encoder terminals

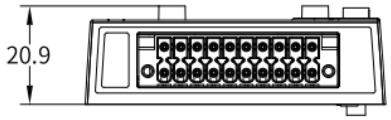
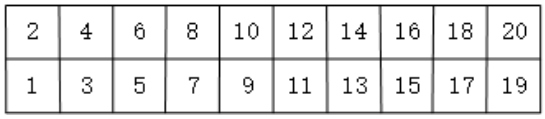
Terminals	
Pin No.	

Table 5–83 Pin assignment of different encoders

Pin No.	ABZ Encoder	23-bit Encoder	Resolver	Sin-cos Encoder
1	A signal (+)	DATA+, data signal (+)	SIN signal (+)	SIN signal (+)
2	A signal (-)	DATA-, data signal (-)	SIN signal (-)	SIN signal (-)
3	B signal (+)	-	COS signal (+)	COS signal (+)
4	B signal (-)	-	COS signal (-)	COS signal (-)
5	Z signal (+)	-	EXC+, excitation (+)	Z signal (+)
6	Z signal (-)	-	EXC-, excitation (-)	Z signal (-)
7	5 V power supply	5 V power supply	5 V power supply	5 V power supply
8	15 V power supply	15 V power supply	15 V power supply	15 V power supply
9	-	-	-	-
10	COM power supply reference ground	COM power supply reference ground	COM power supply reference ground	COM power supply reference ground
19	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)
20	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)	PE (shield grounding)

Table 5–84 Pin assignment of different encoders

Pin No.	EnDat Encoder	SSI Encoder	BISS Encoder	Magnetic Encoder
1	CLK+, clock signal (+)			DATA+, data signal (+)
2	CLK-, clock signal (-)			DATA-, data signal (-)
3	DATA+, data signal (+)			-
4	DATA-, data signal (-)			-
5	-			-
6	-			-
7	5 V power supply			5 V power supply
8	15 V power supply			15 V power supply
9	-			-
10	COM power supply reference ground			COM power supply reference ground
19	PE (shield grounding)			PE (shield grounding)
20	PE (shield grounding)			PE (shield grounding)

Wiring precautions:

● Since the output voltage of the drive is pulse voltage and there is a common mode voltage to the ground, it is necessary to connect the PE terminals of the motor and the drive n addition to connecting the U/V/W power cables. Ensure that the ground busbar of the electrical cabinet is

grounded; otherwise, common mode voltage and leakage current interference may flow back through the encoder cable, causing interference to the encoder signal.

● Encoder cables have high requirements for anti-interference capability. It is necessary to select a shield with a dense metal web, and connect the shield to the PE port of the terminal. Use twisted pair cables and connect them in pairs. For example, use a pair of twisted pair cables for A+ and A- to reduce common mode interference.

● Minimize the usage of encoder cable connectors to reduce radiation interference.

● Avoid parallel proximity between the encoder cable and the motor power cable to prevent the power cable from disturbing the encoder signal.

● Short encoder cables (within 10 m) can be grounded on both ends. Long cables are recommended to be grounded on the encoder card end.

Setting the ABZ encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-02	Encoder PPR	Set this parameter when an ABZ encoder or sin-cos encoder is used.	Yes
C0-18	ABZ encoder level type	-	Yes

Setting the 23-bit encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-23	23-bit encoder communication frequency selection	-	Yes

Setting the resolver

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-13	Number of resolver pole pairs	-	Yes

Setting the SSI encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-31	SSI communication baud rate	-	Yes
C0-32	SSI encoder signal check -	-	Yes
C0-33	SSI encoder data encoding format	-	Yes
C0-34	Number of SSI encoder state bits	-	Yes
C0-51	Number of single-turn bits of communication-type encoder	-	Yes
C0-52	Number of multi-turn bits of communication-type encoder	-	Yes

Setting the sin-cos encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-02	Encoder PPR	Set this parameter when an ABZ encoder or sin-cos encoder is used.	Yes

Setting the EnDat encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-41	Communication baud rate	-	Yes
C0-51	Number of single-turn bits of communication-type encoder	-	Yes
C0-52	Number of multi-turn bits of communication-type encoder	-	Yes

Setting the BISS encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-45	Communication frequency of BISS encoder	-	Yes
C0-46	BISS encoder signal check -	-	-

Param.	Name	Specification	Mandatory
C0-47	Number of BISS encoder state bits	-	-
C0-51	Number of single-turn bits of communication-type encoder	-	-
C0-52	Number of multi-turn bits of communication-type encoder	-	-

Setting the magnetic encoder

Param.	Name	Specification	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	Yes
C0-23	23-bit encoder communication frequency selection	-	Yes

Note

1. The encoder type of the magnetic encoder needs to be 23-bit.
2. The magnetic encoder only supports the baud rate of 2 M, and C0-23 can only be set to 1.

5.4 Advanced Functions

5.4.1 Frequency Detection

5.4.1.1 Frequency Detection (FDT)

Description

This function sets the detection value of the output frequency as well as the hysteresis value upon output cancellation. The hysteresis value is valid only during deceleration. Hysteresis does not occur in detection during acceleration.

Operation principles

When the running frequency is higher than the frequency detection value, the DO output function selection (E1-04) is assigned with function 3 (frequency detection FDT1 output) or function 25 (frequency detection FDT2 output), and the DO outputs the ON signal. When the running frequency is lower than the detection hysteresis value, the DO ON signal output is canceled. The frequency detection function is shown in the following figure. The frequency level detection FDT1 is used as an example.

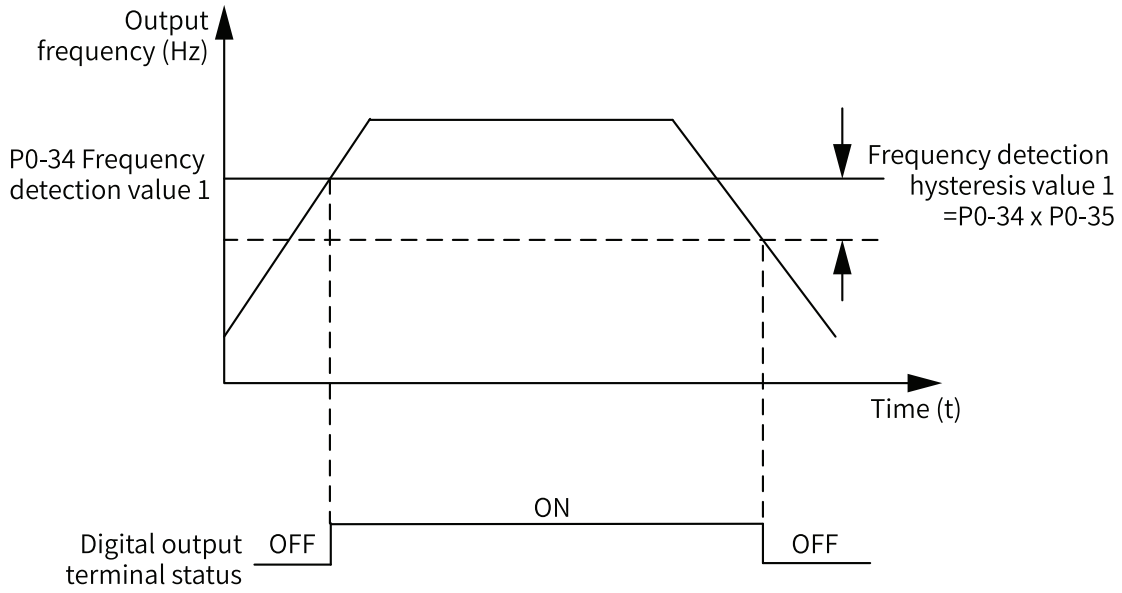


Figure 5-174 Frequency detection diagram

Related parameters

Table 5–85 Parameters related to frequency detection

Parameter	Name	Default Value	Value Range	Description
P0-34	Frequency detection value (FDT1)	50.00 Hz	0.00 Hz to A2-17	Sets the running frequency detection value 1 of the AC drive. Additional information: 1 .DO function is set to 3 (frequency level detection FDT1 output). 2 .When the running frequency of the AC drive is higher than the frequency detection value, the DO outputs an active signal. 3 .When the operating frequency is lower than a specific value (P0-34 - P0-34 × P0-35), the DO outputs an inactive signal.
P0-35	Frequency detection hysteresis value (FDT1)	5.0%	0.0% to 100.0%	Sets the running frequency detection hysteresis coefficient of the AC drive, which is the percentage of the frequency detection value (FDT1). Additional information: Same as P0-34.

Parameter	Name	Default Value	Value Range	Description
P0-36	Frequency detection value (FDT2)	50.00 Hz	0.00 Hz to A2-17	Sets the running frequency detection value 2 of the AC drive. Remarks 1 .The digital output function is set to 25 (frequency level detection FDT2 output). 2 .When the running frequency of the AC drive is higher than or equal to the frequency detection value (FDT2), the DO outputs an active signal 3 .When the operating frequency is lower than a specific value (P0-36 - P0-36 × P0-37), the DO outputs an inactive signal.
P0-37	Frequency detection hysteresis value (FDT2)	5.0%	0.0% to 100.0%	Sets the running frequency detection hysteresis coefficient of the AC drive, which is the percentage of the frequency detection value (FDT2). Additional information: Same as P0-36.

Application examples

Take the frequency detection (FDT) as an example:

1. Set E1-00 (RO output function selection) to 3 (frequency level detection FDT1 output).
2. Set P0-34 (frequency detection value (FDT1)) and P0-35 (frequency detection hysteresis value (FDT1)).
3. Set the target frequency of the AC drive to be greater than or equal to the frequency detection value (FDT1).
4. When the running frequency of the AC drive is higher than or equal to P0-34, the RO outputs an active signal.
5. When the running frequency reaches below P0-34 - P0-34 × P0-35 during AC drive deceleration, the RO stops outputting an active signal.

5.4.1.2 Detection Frequency Amplitude Value

Function description

It is used to detect the running frequency of the AC drive, which is within a certain range of the target set frequency.

Operation principles

The detection range of this function is set by P0-38 (Frequency reach detection width). When the running frequency of the AC drive is within the range of "Frequency reached ± A2-04 × P0-38", and E1-04 (DO output function selection) is set to "4: Frequency reached", the detection amplitude time sequence diagram is shown in the figure below.

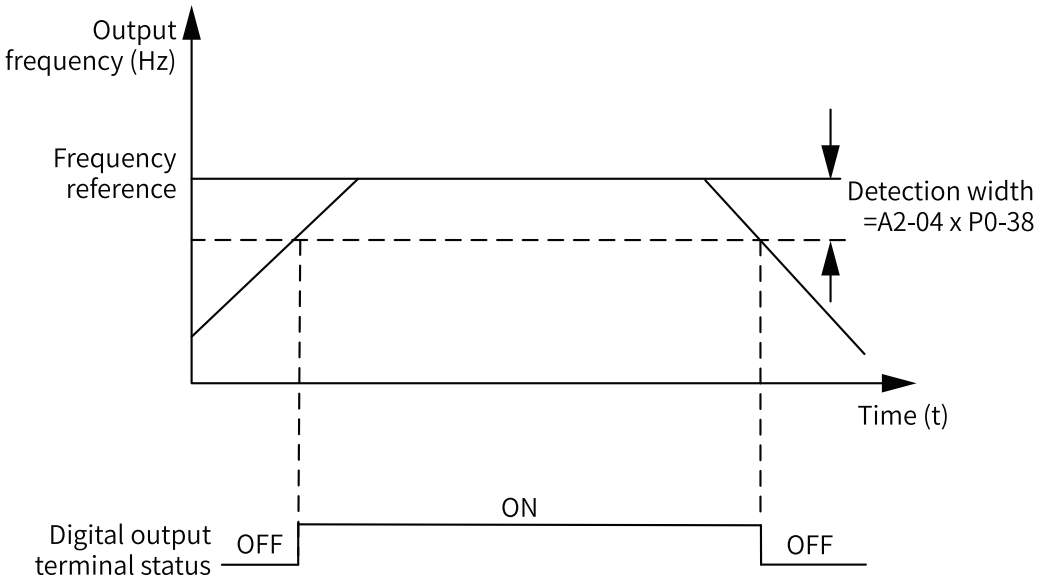


Figure 5-175 Time sequence diagram of the frequency detection amplitude

Related parameter

Table 5–86 Parameters related to detection frequency amplitude

Parameter	Name	Default Value	Value Range	Description
P0-38	Detection frequency amplitude	0.0%	0.0% to 100.0%	Defines the percentage of A2-04 when the running frequency of the drive reaches the detection width. Additional information: 1 .The digital output function is set to "4: Frequency reach". 2 .When the operating frequency of the drive is within the range of "Target frequency ± A2-04 × P0-38", the DO terminal outputs an active signal.

Application examples

Take the RO output function as an example.

1. E1-00 (RO output function selection) is "4: Frequency reach".
2. Set the frequency of the AC drive.
3. When the running frequency of the drive reaches the "set frequency - A2-04 × P0-38 (Frequency reach detection width)" during acceleration, the RO terminal outputs an active signal.
4. When the running frequency reaches below "Set frequency - A2-04 × P0-38 (Frequency reach detection width)" during deceleration, the RO terminal stops outputting an active signal.

5.4.1.3 Frequency Detection Value

Description

It is used to detect the running frequency of the AC drive, which is within any frequency range.

Operation principles

The MD310 provides two groups of frequency detection parameters, including frequency detection value and detection range, as shown in the following figure. When the running frequency of the AC drive is within the range (frequency detection value ± frequency detection amplitude), the DO is assigned with function 26/26: frequency 1/2 reached and outputs an active signal.

The following figure shows the frequency reach function. The frequency 1 reach is used as an example.

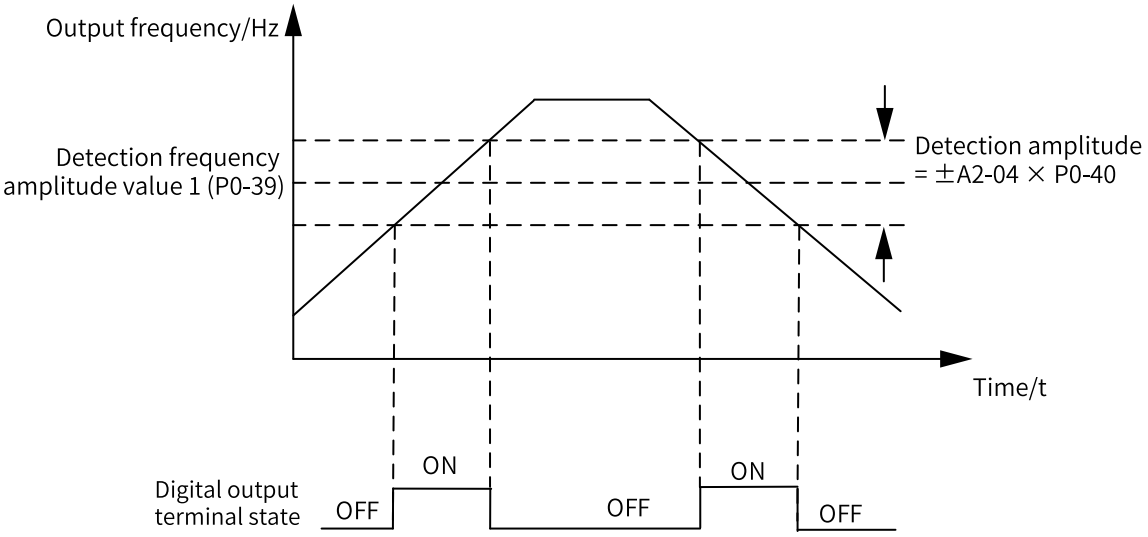


Figure 5-176 Frequency detection value

Related parameters:

Table 5–87 Frequency Detection Value

Item	Name	Default	Value Range	Descriptions
P0-39	Frequency detection value 1	50.00 Hz	0.00% to A2-17	Set the frequency detection value 1 of the running frequency of the AC drive. Additional information: 1 .The digital output function is set to 26: Frequency 1 reach output. 2 .When the running frequency of the AC drive is in the range of target frequency ± per-unit frequency x 04xP0, the DO outputs an active signal.
P0-40	Frequency detection amplitude 1	0.1%	0.1% to 100.0%	This parameter sets the detection frequency amplitude 1, which is a percentage of A2-04. Additional information: Same as P0-39.

Item	Name	Default	Value Range	Descriptions
P0-41	Detection value 2 of frequency	50.00 Hz	0.00% to A2-17	This parameter sets the detection frequency 2 of the AC drive. Additional information: 1 .The digital output function is set to 27: Frequency 2 reach output. 2 .When the running frequency of the AC drive is in the range of target frequency ± per-unit frequency x 04xP0, the DO outputs an active signal.
P0-42	Frequency detection amplitude 2	0.1%	0.1% to 100.0%	Defines the detection frequency amplitude 2, which is a percentage to A2-04. Additional information: Same as P0-41.

Instances

Take the RO output frequency reaching detection value 1 as an example.

1. E1-00 (RO output function selection) is "26: Frequency 1 reach output".
2. Set P0-39 (Frequency reach detection value 1) and P0-40 (Frequency reach detection amplitude 1).
3. Set the target frequency of the AC drive to be greater than or equal to P0-39 [Frequency reach detection value 1].
4. When the AC drive is running, the RO terminal outputs an active signal when the running frequency reaches "P0-39 [Frequency reach detection value 1] ± A2-04 × P0-40 [Frequency reach detection amplitude 1]" during acceleration or deceleration.

5.4.1.4 Frequency Upper Limit Reached

Description

It is used to detect that the running frequency of the AC drive reaches the upper limit and output the corresponding signal. Limit the maximum output frequency of the AC drive by setting the frequency upper limit.

Working Principle

The frequency upper limit in the running direction is divided into the frequency upper limit in the forward direction and the frequency upper limit in the reverse direction.

The active forward frequency upper limit is limited by the combination of three parameters: C4-10 (Maximum motor frequency), d1-03 (Digital setting of the forward frequency upper limit), and d1-05 (Source of forward frequency upper limit). The minimum value of the three parameters is used as the forward frequency upper limit of the set frequency.

The active forward frequency upper limit is limited by the combination of three parameters: C4-10 (Maximum motor frequency), d1-04 (Digital setting of the forward frequency upper limit), and d1-06 (Source of forward frequency upper limit). The minimum value of the three parameters is used as the forward frequency upper limit of the set frequency.

When the frequency upper limit is reached, select "17: Frequency upper limit reached" in E1-04. When the operating frequency of the AC drive reaches the frequency upper limit, the digital output terminal outputs an active signal. The following figure shows the frequency detection function.

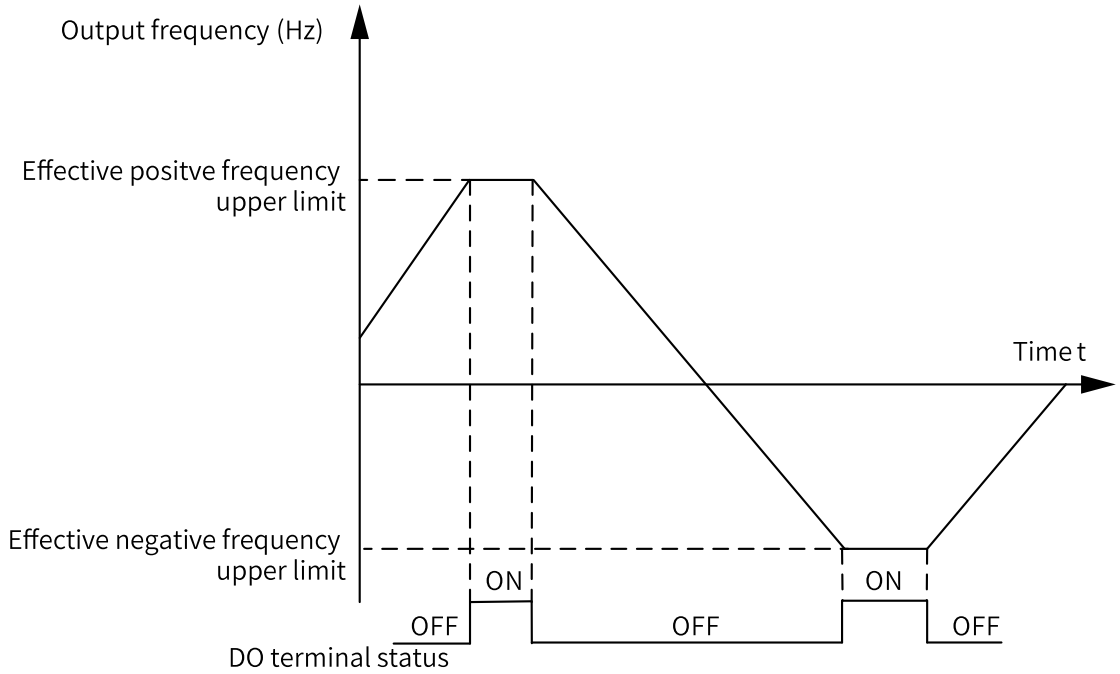


Figure 5-177 Frequency upper limit reach

Related parameters:

Table 5–88 Frequency upper limit reach

Item	Name	Default	Value Range	Descriptions
d1-03	Digital setting of positive frequency upper limit 1	800.0%	d1-07 to 800.0%	This parameter limits the forward maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Additional information: The positive frequency upper limit is the lower one between d1-03 and d1-05.
d1-04	Digital setting of reverse frequency upper limit 1	800.0%	-800.0% to d1-08	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Additional information: The negative frequency upper limit is the lower one between d1-04 and d1-06.

Item	Name	Default	Value Range	Descriptions
d1-05	Source of forward frequency upper limit 2	0	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the maximum operating frequency in the forward direction, which is the percentage of the rated motor frequency. Description 0: 800% - Set the forward frequency upper limit to 800%. 2: AI1 The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The forward frequency upper limit is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse - The positive frequency upper limit is set through the pulse frequency of the DI. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. MD630S 6: Multi-reference. - When multi-reference is used as the forward frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID The forward frequency upper limit is set through PID. 9: Communication The forward frequency upper limit is set through communication. The forward frequency upper limit can be input through remote communication. Others: F connector- The positive frequency upper limit depends on the value of the F connector. Additional information: The effective frequency upper limit in the forward direction is the smaller value between d1-03 and d1-05.

Item	Name	Default	Value Range	Descriptions
d1-06	Source of reverse frequency upper limit 2	1	0: -800% 1: Opposite to the forward frequency upper limit 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Value description 0: -800% - Set the negative frequency upper limit to -800%. 1: Opposite to forward frequency upper limit 2 Set the reverse frequency upper limit to the value opposite to d1-05. 2: AI1 The reverse frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2. - The negative frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The negative frequency upper limit is set through the pulse frequency of the DI and calculated based on the curve of the relationship between the pulse frequency and the set frequency. MD630S 6: Multi-reference When multi-reference is used as the reverse frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the negative frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID The reverse frequency upper limit is set through PID. 9: Communication The reverse frequency upper limit is set through communication. The reverse frequency upper limit can be input through remote communication. Others: F connector. - The reverse frequency upper limit is set through the F connector. Additional information: The negative frequency upper limit is the lower one between d1-04 and d1-06.
C4-10	Maximum motor frequency	50.00 Hz	C4-06 to 599.00	It is used to set the allowed maximum frequency of the motor in the unit of Hz.

Instances

Here, take the RO output frequency upper limit as an example:

1. Set E1-00 (RO output function selection) to 17 (module over-temperature).

2. Set C4-10 (Maximum motor frequency), d1-03 (Digital setting of forward frequency upper limit 1), d1-04 (Digital setting of reverse frequency upper limit 1), d1-05 (Forward frequency upper limit 2 selection), and d1-06 (Reverse frequency upper limit 2 selection).
3. The DO outputs an active signal when the running frequency reaches the upper limit.

5.4.1.5 Frequency lower limit reached

Function description

It is used to detect that the frequency set by the AC drive reaches the lower limit and output the corresponding signal. Set the lower frequency limit to limit the minimum frequency set by the AC drive.

Operation principles

The frequency limit is divided into the frequency limit in the running direction and the frequency limit in the direction of running.

The effective forward/down limit frequency is limited by the combination of the three function codes, C4-11 (Motor minimum frequency) and d1-07 (Motor frequency forward/down limit), taking the maximum values of the two function codes. The set frequency is used as the final effective frequency.

The upper limit of the frequency in reverse direction is limited by the combined limit of two function codes, C4-11 (Motor minimum frequency) and d1-08 (Reverse frequency limit). The absolute maximum of the two function codes is taken and reversed. The set frequency is used as the final effective frequency. For details, see *"5.2.2.5 Frequency Reference Limits" on page 217*.

When the lower limit frequency is reached, select "18: The lower limit frequency is reached (no output at stop)" in E1-04 (DO output function selection). That is, when the set frequency of the AC drive reaches the lower limit frequency valid and is in the running state, E1-04 (DO function selection) Select "37: Frequency lower limit reached (output at stop)". That is, regardless of whether the AC drive is in stop or running state, the digital output terminal outputs an active signal when the set frequency reaches the lower limit of the active frequency.

The following figure shows the frequency reach function.

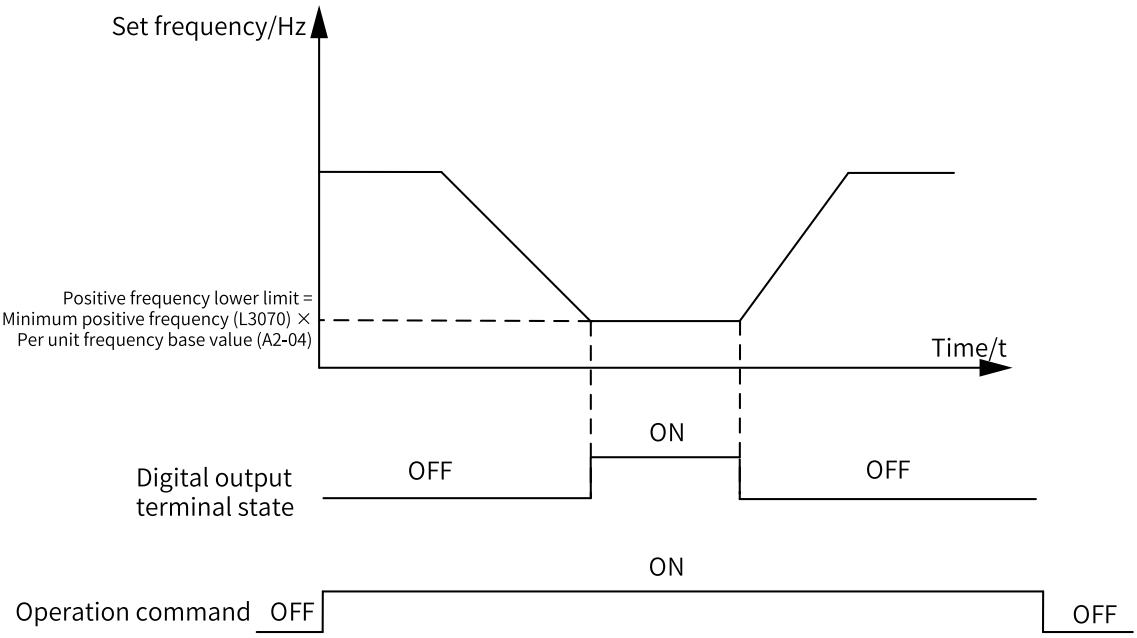


Figure 5-178 18: Frequency lower limit reached (no output at stop)

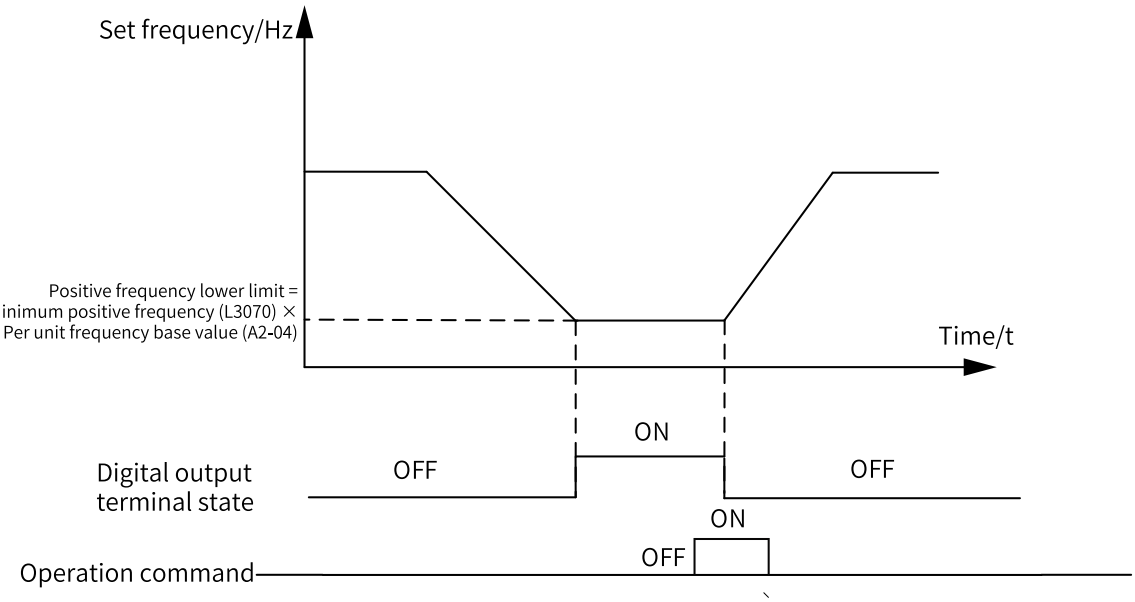


Figure 5-179 37: Frequency lower limit reached (output at stop)

Related parameters

Table 5–89 Parameters related to frequency lower limit reached

Parameter	Name	Default Value	Value Range	Description
d1-07	Positive frequency lower limit	0.0%	0.0% to d1-03	Define the frequency limit positive and negative, which is the percentage of the rated motor frequency.
d1-08	Negative frequency lower limit	0.0%	d1-04 to 0.0%	Set the frequency limit negative to the lower limit, which is the percentage of the rated motor frequency.
C4-11	Minimum motor frequency	0.00	0.00 to C4-10	Define the allowable minimum frequency of the motor in unit of Hz.

Application examples

Here, take the low limit frequency of the RO output as an example.

1. Set E1-00 (RO output function selection) to "18: Frequency lower limit reached" (no output at stop).
2. Set C4-11 (Minimum motor frequency), d1-07 (Digital setting of forward/downward frequency limit 1), and d1-08 (Digital setting of reverse/downward frequency limit 1).
3. When the AC drive is running, the RO terminal outputs an active signal when the set frequency reaches the lower limit of the active frequency.

5.4.1.6 Target speed reached

Description

It is used to detect that the actual motor speed is within the target speed, and the RO terminal outputs an active signal after the target speed is detected and maintained for a certain time.

Operation principles

Set the target speed to reach the detection width through parameter P0-51. The actual motor speed detected by the AC drive is within the target speed ± width range (P0-51) for the duration of reaching the set time. Select "Other: Connector B" in the drop-down menu of E1-04 (DO output function selection) and select "L0110 target speed reached". The DO outputs an active signal, as shown in the following figure.

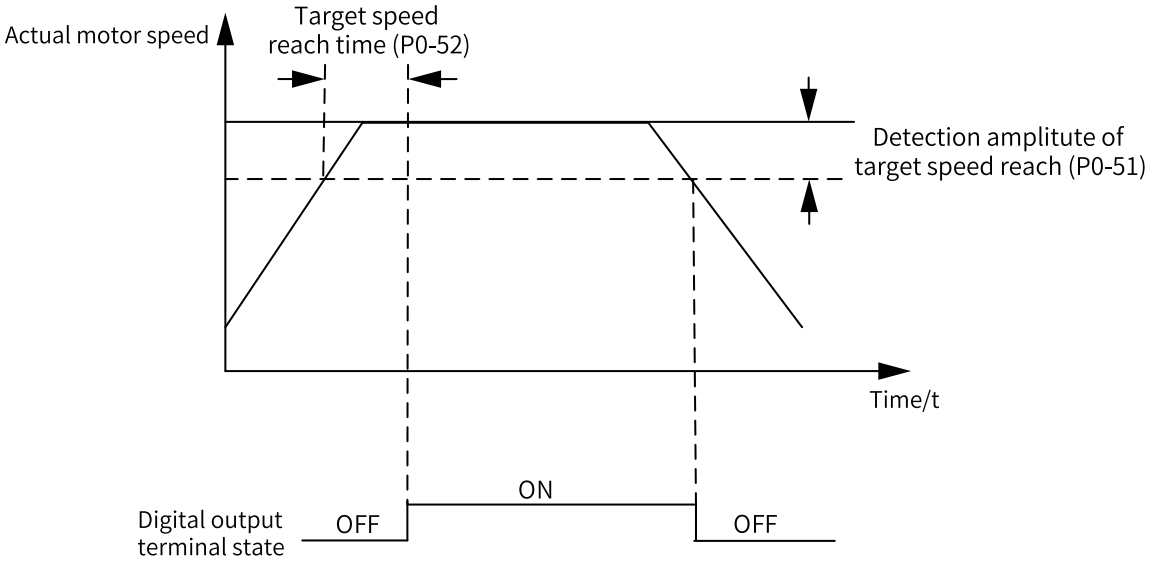


Figure 5-180 Target speed reached

Related parameters:

Table 5–90 Speed Parameters

Item	Name	Default	Value Range	Descriptions
P0-51	Target speed amplitude	3.0%	0.0%–600.0%	Defines the operating frequency of the drive and the amplitude for detecting whether the actual motor speed reaches the target reference speed (frequency). Additional information: 1 .1. When both the running speed and the detected motor actual speed are in the range of target speed ± target speed amplitude for the specified time, an active signal is output. 2 .2: If this parameter is set to 0, the target speed reach function is invalid.
P0-52	Detection time when target speed is reached	3.00s	0.00s to 100.00s	This parameter sets the time for the running frequency and the actual motor speed to reach the target speed (frequency). Additional information: Same as P0-51.

Instances

Here, take the low limit frequency of the RO output as an example.

1. Set E1-00 (RO output function selection) to "L0110 target speed reached" in "Other: Connector B".
2. Set P0-51 (Target speed reach detection width) and P0-52 (Target speed reach time).
3. 1. When both the running speed and the detected motor actual speed are in the range of target speed ± target speed amplitude for the specified time, an active signal is output.

5.4.1.7 Speed Comparison Reach

Function description

When the actual speed of the motor is detected to be within the speed comparison threshold and remains for a certain time, the DO outputs an active signal.

Operation principles

(1) Speed comparison reach 1

When the motor running speed (absolute value) is greater than P0-53 (speed comparison reach threshold 1), the maintenance time reaches P0-55 (speed comparison reach time 1), and the DO terminal is set to "L0270 speed comparison reached 1" in "Others: Connector B", the DO outputs an active signal.

(2) Speed comparison reached 2

When the motor running speed (absolute value) is greater than P0-56 (speed comparison reach threshold 2), the maintenance time reaches P0-56 (speed comparison reach time 2), and the DO terminal is set to "L0271 speed comparison reached 2" in "Others: Connector B", the DO outputs an active signal.

The speed comparison reach function is shown in the following figure. Here, the speed comparison reach 1 is taken as an example.

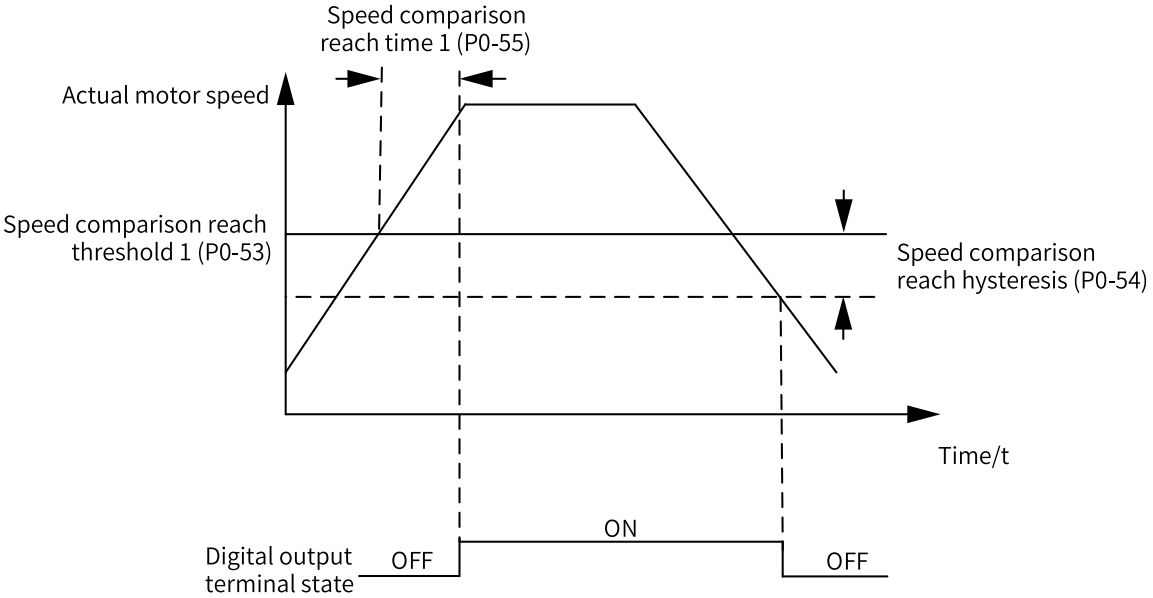


Figure 5-181 Speed comparison reach diagram

Related parameters

Table 5–91 Parameters related to frequency upper limit reach

Specification	Name	Default Value	Value Range	Description
P0-53	Speed comparison threshold 1	100.0%	0.0% to 600.0%	This parameter sets the speed comparison reach threshold 1 of the motor running speed (absolute value). Additional information: 1. When the motor speed (absolute value) during normal operation exceeds P0-53 and lasts for P0-55, the multi-function digital DO outputs “speed comparison reach 1” ON signal. 2. When any of the following conditions are met, the multi-function digital DO outputs the "speed comparison reach" OFF signal: (1) P0-53 (speed comparison threshold 1) is 0. (2) The motor speed is 0. (3) The running direction is opposite to the original. (4) P0-53 is greater than P0-54 and the motor running speed (absolute value) is smaller than |P0-53 - P0-54|.
P0-54	Hysteresis 1 of speed comparison reach	3.0%	0.0% to 600.0%	This parameter sets the speed comparison reach hysteresis 1 of the motor running speed (absolute value). Additional information: See P0-53.
P0-55	Speed comparison reach time 1	3.00 s	3.00 s to 100.00 s	This parameter sets the speed comparison reach time of the motor running speed (absolute value). Additional information: See P0-53.
P0-56	Speed comparison threshold 2	100.0%	0.0% to 600.0%	This parameter sets the speed comparison reach threshold 2 of the motor running speed (absolute value). Additional information: When the motor speed (absolute value) during normal operation exceeds P0-56 (which is not 0) and such status lasts for the time defined by P0-58, the multi-function DO outputs “speed comparison reach 1” ON signal. When any of the following conditions are met, the multi-function digital DO outputs the "speed comparison reached" OFF signal: (1) P0-56 (speed comparison threshold 2) is 0. (2) The motor speed is 0. (3) The running direction is opposite to the original. (4) P0-53 is greater than P0-54 and the motor running speed (absolute value) is smaller than |P0-53 - P0-54|.

Specification	Name	Default Value	Value Range	Description
P0-57	Hysteresis 2 of speed comparison reach	3.0%	0.0% to 600.0%	This parameter sets the speed comparison reach hysteresis 2 of the motor running speed (absolute value). Additional information: See P0-56.
P0-58	Speed comparison reach time 2	3.00 s	3.00 s to 100.00 s	This parameter sets the speed comparison reach time 2 of the motor running speed (absolute value). Additional information: See P0-56.

Application examples

Take the speed comparison reach 1 as an example:

1. Set E1-00 (RO output function selection) to "L0270 speed comparison reached 1" in "Other: B connector".
2. Set P0-53 (speed comparison reach threshold 1), P0-54 (speed comparison reach hysteresis 1), and P0-55 (speed comparison reach time 1).
3. When the actual motor speed detected by the AC drive during acceleration exceeds P0-53 and lasts for P0-55, the RO outputs an active signal.
4. When the actual motor speed detected by the AC drive during deceleration is lower than P0-53 - P0-54, \the RO stops outputingt an active signal.

5.4.1.8 Jump Frequency

Description

The AC drive can avoid the mechanical resonance point of the load through the jump frequency.

Operation principles

- The AC drive supports four jump frequencies. If the four frequencies are set to 0, the frequency jump function is disabled.
- When the target frequency is within the range of the jump frequency, the AC drive jumps the target frequency to the set jump frequency boundary "jump frequency ± P0-10 (jump frequency range)".
- 1. If the running frequency jumps over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency plus the jump frequency amplitude (upper limit of the range).
- 2. If the running frequency does not jump over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency minus the jump frequency amplitude (lower limit of the range).
- If it is set to 0, the frequency jump function is disabled. See the following table for the details.

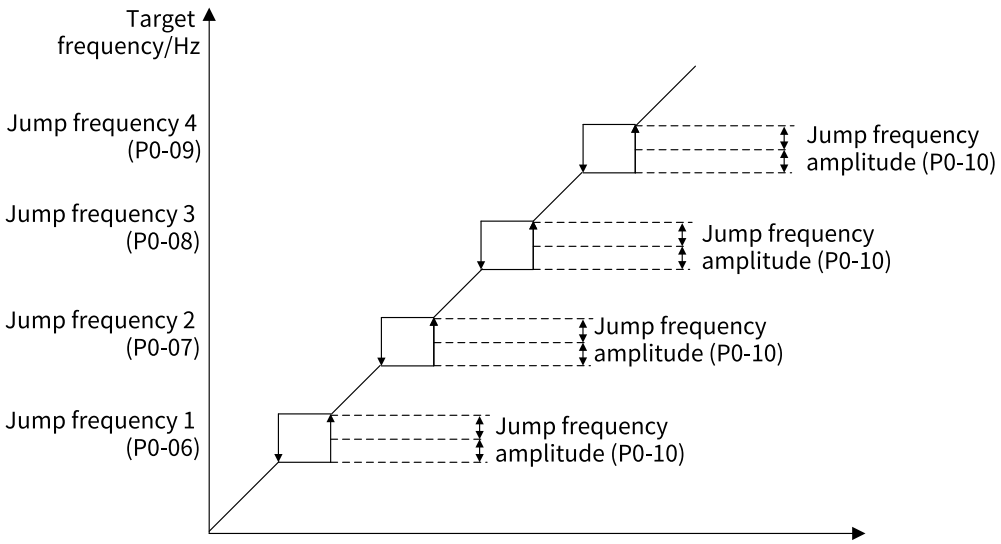


Figure 5-182 Block diagram of HMI functions

Technical data

Table 5–92 Parameters related to jump frequency

Specification	Name	Default Value	Value Range	Description
P0-10	Jump frequency amplitude	0.0 Hz	0.0 Hz to 800.0 Hz	The jump frequency amplitude is set to determine the effective range of the jump frequency . Additional information: 1 .If the running frequency jumps over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency plus the jump frequency amplitude (upper limit of the range). 2 .If the running frequency does not jump over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency minus the jump frequency amplitude (lower limit of the range).
P0-06	Jump frequency 1	0.0 Hz	0.0 Hz to 800.0 Hz	Set the first jump frequency to be used with P0-10. Additional information: 1 .When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2 .If this parameter is set to 0, the first jump frequency is disabled. 3 .During acceleration/deceleration, the actual running frequency normally passes the jump frequency range, and no jump occurs.

Specification	Name	Default Value	Value Range	Description
P0-07	Jump frequency 2	0.0 Hz	0.0 Hz to 800.0 Hz	Set the second jump frequency to be used with P0-10. Additional information: Same as P0-06.
P0-08	Jump frequency 3	0.0 Hz	0.0 Hz to 800.0 Hz	Set the third jump frequency to be used with P0-10. Additional information: Same as P0-06.
P0-09	Jump frequency 4	0.0 Hz	0.0 Hz to 800.0 Hz	Set the fourth jump frequency to be used with P0-10. Additional information: Same as P0-06.

Application examples

Take the frequency jumping point 1 as an example.

1. Set P0-10 (jump frequency amplitude) and P0-06 (jump frequency 1).
2. If the frequency set by the AC drive is within the range of P0-06 ± P0-10, the frequency of the jump frequency boundary is P0-06 ± P0-10.

5.4.2 Current Detection

5.4.2.1 Zero Current Detection

Description

When the output current of the AC drive is lower than or equal to the zero current detection level for a period longer than the value of P0-48 (Zero current detection delay), the DO outputs an active signal.

Working Principle

The DO is assigned with function 34 (Zero current status) and outputs an active signal when the output current of the AC drive remains at or below the zero current detection level (P0-47) for a period greater than the value of P0-48 (zero current detection delay time). You can also check whether the AC drive enters the zero current state by checking L0260 (zero current state) or L1005 (system status word 4) bit10.

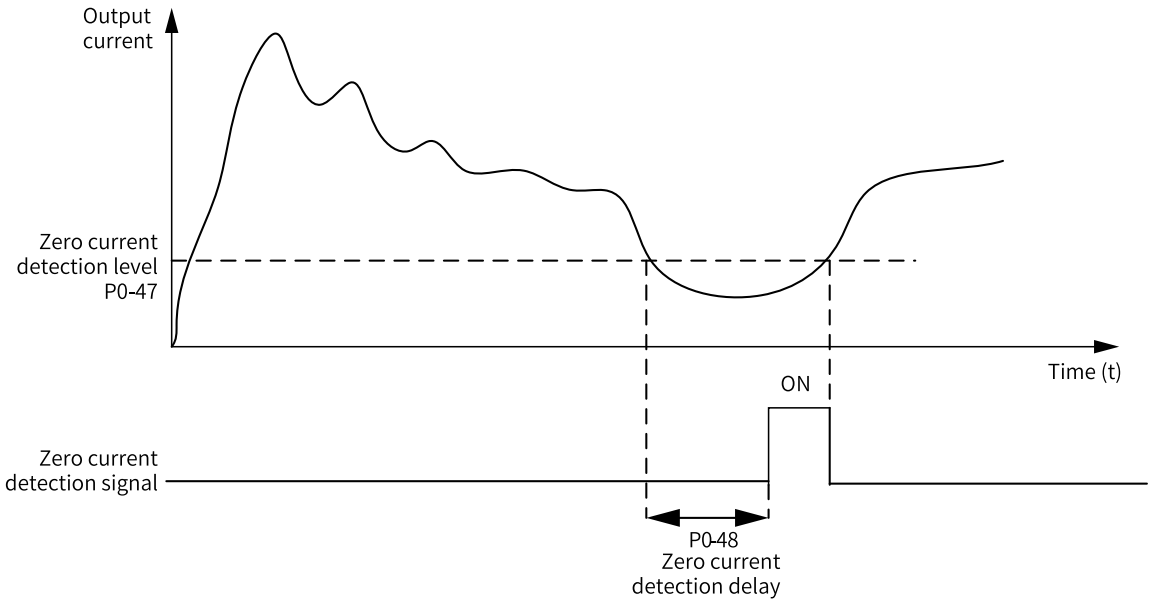


Figure 5-183 Zero current detection

Related parameters

Table 5–93 Parameters about zero current detection

Parameter	Parameter Name	Default	Value Range	Descriptions
P0-47	Zero current detection level	5.0%	0.0% to 300.0% (reference current)	Set the zero current detection value of the output current of the AC drive to the percentage of the rated motor current.
P0-48	Zero current detection delay	0.10s	0.01s to 600.00s	Defines the delay time for zero current detection of the output current of the AC drive.

5.4.2.2 Output Overcurrent Threshold

Description

When the output current of the AC drive is higher than the threshold for a period, the DO outputs an active signal.

Working Principle

When the output current of the AC drive remains above the output current overlimit threshold (P0-49) for a period longer than the value of P0-50 (output current overlimit detection delay), the DO assigned with function 36 (output current overlimit) outputs an active signal. You can also check whether the AC drive output current is higher than the limit by checking L0261 (Output current overlimit) or L1005 (system status word 4) bit11.

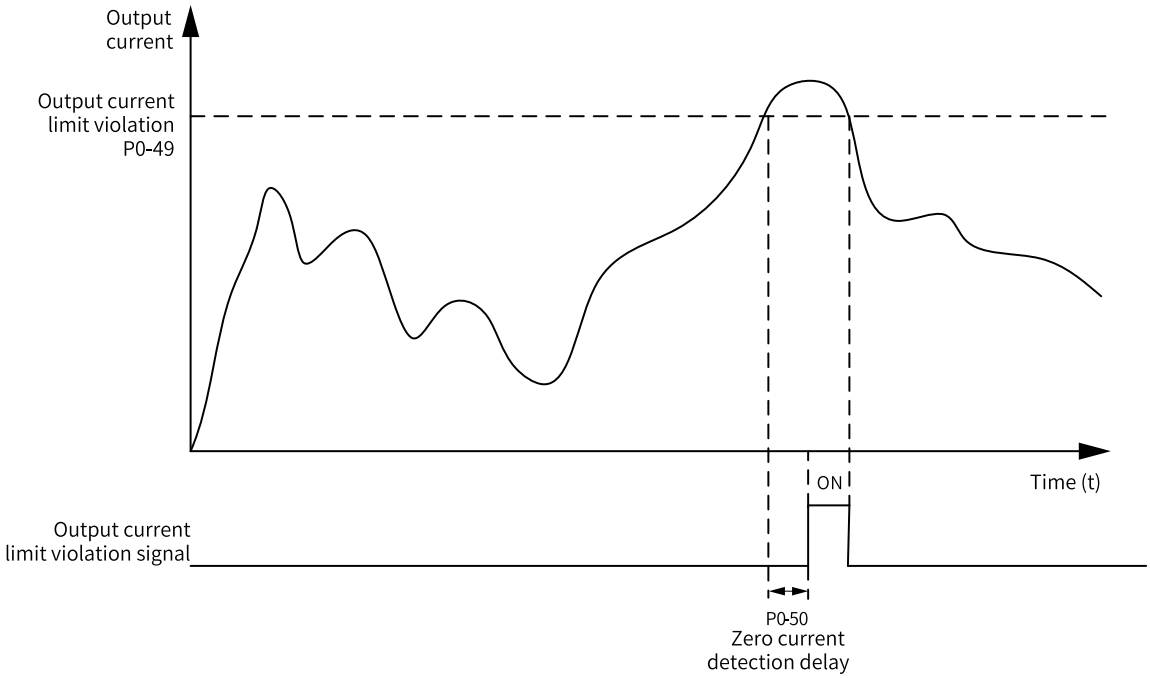


Figure 5-184 Output current overlimit detection

Related parameters

Table 5–94 Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
P0-49	Output overcurrent threshold	200.0%	0.0% to 300.0% (reference current)	Defines the output current overlimit threshold of the AC drive, which is the percentage of the rated motor current.
P0-50	Delay of output current limit violation detection	0.00s	0.00s to 600.00s	Sets the output current overlimit detection delay time.

5.4.2.3 Current 2 reach

Description

It is used to detect that the DO terminal outputs an active signal when the output current of the AC drive reaches any set range.

Operation principles

The DO terminal is assigned with function 28/29: current 1/2 reached and outputs the active signal when the output current of the AC drive is within the range of "current detection value 1 ± current detection width 1 x reference current". The AC drive provides two groups of current detection value and current detection widths, as shown below.

You can also check whether the AC drive reaches the corresponding state by setting bit8 and bit9 of L0258 (current 1 reached), L0259 (current 2 reached), or L1005 (system status word 4).

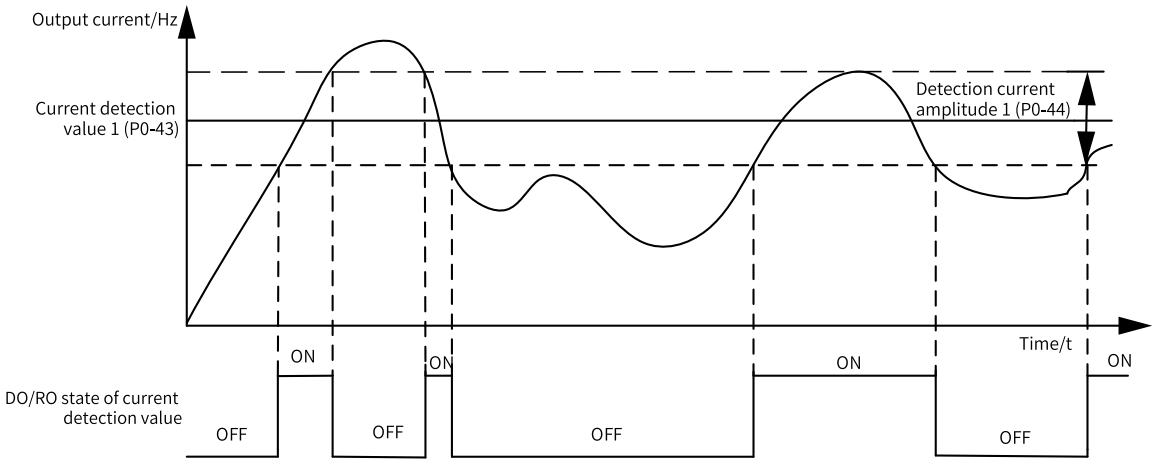


Figure 5-185 Detection current time sequence

Related parameters:

Table 5–95 Current Detection Value

Item	Name	Default	Value Range	Descriptions
P0-43	Detection level of current 1	100.0%	0.0% to 300.0% (reference current)	Defines current detection value 1 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is in the range of detection current 1 ± detection current amplitude 1, the DO outputs an active signal.
P0-44	Detection width of current 1	0.0%	0.0% to 300.0% (reference current)	Defines current detection width 1 of the output current of the AC drive: the percentage of the rated motor current.
P0-45	Detection level of current 2	100.0%	0.0% to 300.0% (reference current)	Defines current detection value 2 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is in the range of detection current 2 ± detection current amplitude 2, the DO outputs an active signal.
P0-46	Detection width of current 2	0.00%	0.0% to 300.0% (reference current)	Defines the detection current amplitude 2, which is a percentage to the rated motor current.

5.4.3 Fan Control

Scenarios

The fan control is used to control the running mode of the cooling fan, or to switch the forward and reverse running of the fan.

Users can set different control modes for the fan according to actual requirements. Especially in the textile industry, the forward and reverse running mode of the fan is important to the blow-off of the lint.

Working principle

Six fan control modes are available. Switch the control modes through A4-11 (Fan control mode).

Here is the six values of A4-11, that, is the six control modes.

- 0: Working (forward running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running
  When A4-11 is set to 0, except for undervoltage state, the fan works when the AC drive is running. When the AC drive stops, the fan works when the heatsink temperature higher than 42℃ and stops when the heatsink temperature lower than 40℃.
- 1: Working continuously (forward running)
  When this parameter is set to 1, the fan keeps operating in the non-undervoltage state.
- 2: Working (forward/reverse running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running
  When A4-11 is set to 2, except for undervoltage state, the fan works when the AC drive is running. When the AC drive stops, the fan works when the heatsink temperature higher than 42℃ and stops when the heatsink temperature lower than 40℃. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously.
- 3: Working continuously (forward and reverse)
  When this parameter is set to 3, the fan keeps operating in the non-undervoltage state. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously.
- 4: Manufacturer-defined mode 1
  4: Manufacturer-defined mode 1. It is not recommended to set this mode.
- 5: Manufacturer-defined mode 2
  4: Manufacturer-defined mode 1. It is not recommended to set this mode.

Note

If the heatsink temperature is higher than a certain value after the fan is turned, The fan automatically switches the speed to high speed. When the heatsink temperature drops to a certain value, the fan switches back to low speed. See the following figure. The heat sink temperature can be viewed by U0-82 (Module temperature).

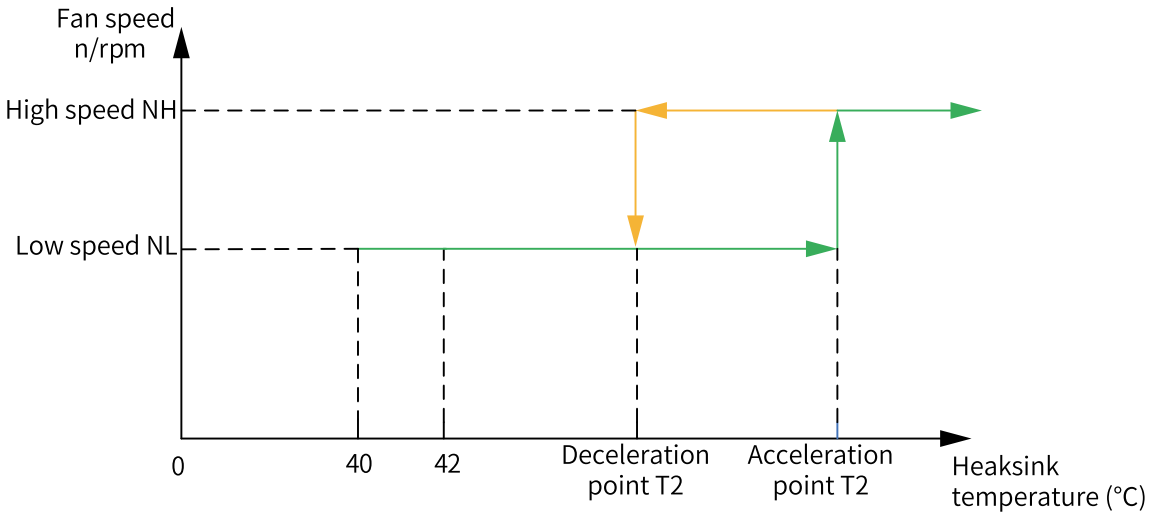


Figure 5-186 Fan speed curve

Related parameters

Table 5–96 Fan control parameters

Param.	Name	Default Value	Value Range	Descriptions
A4-11	General mode of fan control	0	0 to 5	Defines the fan control mode. Value description 0: Working (forward running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running 1: Working continuously (forward running) 2: Working (forward/reverse running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running 3: Working continuously (forward and reverse) 4: Manufacturer-defined mode 1 5: Manufacturer-defined mode 2
A4-12	Digital setting of fan speed	1500rpm	1500rpm to 14000rpm	Defines the operating speed of the fan. This value is active when A4-11 is set to 4.
A4-13	Effective value of digital setting of fan speed	1500rpm	1500rpm to 14000rpm	Displays the set speed of the active fan.
A4-14	Forward operating time of the fan during forward/ reverse operation	60s	60s to 65535s	Sets the forward running time during forward and reverse running. This value is active when A4-11 is set to 2 or 3.

Param.	Name	Default Value	Value Range	Descriptions
A4-15	Reverse operating time of the fan during forward/ reverse operation	60s	60s to 65535s	Sets the reverse running time during forward and reverse running. This value is active when A4-11 is set to 2 or 3.
U0-49	Set fan speed	0rpm	0 rpm to 65535 rpm	Displays the set speed of the fan when it is running. The unit is rpm.
U0-50	Actual fan speed	0rpm	-32768rpm to 32767rpm	Displays the real-time speed of the fan. The unit is rpm.

5.4.4 Setting Time Reached

5.4.4.1 Cumulative Power-on Time Reached

Scenarios

When the DO (RO) terminal is assigned with 24 (Accumulative power-on time reached), the AC drive cumulative power-on time exceeds the user-set cumulative power-on time, and the DO (RO) terminal for this function outputs an active signal, indicating that the power-on time has reached the set target.

Description

Setting the cumulative power-on time reached function is divided into two steps:

1. Set the DO (RO) terminal function to 24 (Cumulative power-on time reached).
2. Set cumulative power-on time threshold by P0-16 (Cumulative power-on hours reached) and P0-17 (Cumulative power-on seconds reached). The time reached is calculated by adding the time set by the two parameters. Note that if P0-16 and P0-17 are set to 0, the cumulative power-on time reached function is inactive and the DO (RO) terminal outputs an inactive signal.

When the cumulative power-on time threshold of the AC drive is set to a valid value, and if the result of Ad-02 x 3600+Ad-03 exceeds the result of P0-16 x 3600+P0-17, the DO (RO) terminal outputs an active signal.

Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
Ad-02	Cumulative power-on time (h)	/	/	Displays the cumulative power-on time in hours.
Ad-03	Cumulative power-on time (s)	/	/	Displays the cumulative power-on time in seconds.

Param.	Parameter Name	Default	Value Range	Descriptions
P0-16	Cumulative power-on hours reached	0	0-65535h	Defines the power-on time threshold in hours. Additional information: 1 .1. The power-on time threshold is determined by combination of P0-16 and P0-17. After the cumulative power-on time is reached, the multi-function digital DO terminal can be configured to output the ON signal. 2 .2. Set P0-16 and P0-17 to 0 to disable the related function.
P0-17	Cumulative power-on seconds reached	0	0-3599s	Defines the operating time threshold in seconds. Additional information: 1 .1. The power-on time threshold is determined by combination of P0-16 and P0-17. After the cumulative power-on time is reached, the multi-function digital DO terminal can be configured to output the ON signal. 2 .2. Set P0-16 and P0-17 to 0 to disable the related function.

Notes

The cumulative power-on time is not cleared automatically. When A0-00 (Parameter initialization) is set to 2 (Clear record information), the count values of Ad-02 (Cumulative power-on time (h)) and Ad-03 (Cumulative power-on time (s)) are cleared and the cumulative power-on timer is restarted.

5.4.4.2 Accumulative Running Time Reached

Scenarios

When the DO (RO) terminal is assigned with 12 (Accumulative running time reached), the AC drive cumulative running time exceeds the user-set cumulative running time, and the DO (RO) terminal for this function outputs an active signal, indicating that the running time has reached the set target.

Description

Setting the cumulative running time reached function is divided into two steps:

1. Set the DO (RO) terminal function to 12 (Cumulative running time reached).
2. Set cumulative running time threshold by P0-18 (Cumulative running hours reached) and P0-19 (Cumulative running seconds reached). The time reached is calculated by adding the time set by the two parameters. Note that if P0-18 and P0-19 are set to 0, the cumulative power-on time reached function is inactive and the DO (RO) terminal outputs an inactive signal.

When the cumulative running time threshold of the AC drive is set to a valid value, and if the result of Ad-00 x 3600+Ad-01 exceeds the result of P0-18 x 3600+P0-19, the DO (RO) terminal outputs an active signal.

Related parameters:

Parameter Code	Name	Default	Value Range	Descriptions
Ad-00	Cumulative running time (h)	/	/	Displays the cumulative operating time in hours.
Ad-01	Cumulative running time (s)	/	/	Displays the cumulative operating time in seconds.
P0-18	Cumulative running hours reached	0	0–65535h	This parameter sets the running time threshold in seconds. Additional information: 1 .1. The running time is determined by combination of P0-18 and P0-19. After the cumulative running time is reached, the multi-function digital DO terminal can be configured to output the ON signal. 2 .1. Set P0-19 to 0. Function OFF
P0-19	Running time threshold (second)	0	0–3599s	Defines the cumulative operating time threshold in seconds. Additional information: 1 .1. The running time is determined by combination of P0-18 and P0-19. After the cumulative running time is reached, the multi-function digital DO terminal can be configured to output the ON signal. 2 .1. Set P0-19 to 0. Function OFF

Notes

The cumulative running time is not cleared automatically. When A0-00 (Parameter initialization) is set to 2 (Clear record information), the count values of Ad-00 (Cumulative running time (h)) and Ad-01 (Cumulative running time (s)) are cleared and the cumulative running timer is restarted.

5.4.4.3 Current Running Time Reached

Scenarios

When the DO (RO) terminal is assigned with 40 (Current running time reached), the AC drive current running time exceeds the user-set current running time, and the DO (RO) terminal for this function outputs an active signal, indicating that the current running time has reached the set target.

Description

Setting the current running time reached function is divided into two steps:

1. Set the DO (RO) terminal function to 40 (Current running time reached).
2. Set current running time reached through P0-20. Note that if P0-20 is set to 0, the current running time reached function is inactive and the DO (RO) outputs an inactive signal.

When current running time threshold is active and when the value of U0-26 (Current running time) exceeds P0-20 (Current running time threshold), the DO （ DO outputs an active signal.

Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
P0-20	Current running time threshold	0.0 min	0.0 min to 6500.0 min	Defines current operating time threshold of the drive. Additional information: 1 .1. If the current running time reaches the value set in this parameter, the corresponding DO becomes ON, indicating that the current running time is reached. 2 .2. Set to 0 to disable the function.
U0-26	Current operating time	/	/	This parameter indicates the current running time in the unit of minute. The maximum value is 6553.5 minutes. If the maximum value is reached, timing stops.

5.4.5 Load Monitoring

Scenarios

The load monitoring function monitors input signals (such as output current, output torque, and output power) related to the AC drive output speed.

This function includes load loss monitoring and overload monitoring.

- Load loss monitoring is used to detect whether a load is lost, such as belt breakage or mechanical shaft breakage.
- Overload monitoring is used to detect whether the load is blocked, such as motor stall.

Function description

After the actual motor speed enters the monitoring range set by the user, the AC drive collects the current motor speed and monitoring signal. It then uses a multi-point curve to determine the upper and lower limit areas of the monitoring signal that correspond to the current motor speed.

- If the current monitoring signal exceeds the upper limit, the load is overlimit.
- If the current monitoring signal exceeds the lower limit, the load is lost.
- If the monitoring signal is between the upper and lower limits, the load is in normal range.

The monitoring signal is generally related to the motor speed. You can select the output current, output torque, or output power used as a monitoring signal through P0-66 (Load monitoring signal selection). You can also select the desired signal from "Others: F connector". For details, see *“ Parameter interconnection” on page 769*.

The status of the selected monitoring signal is checked by P0-67 (Load monitoring signal state).

You can set the allowable overload/load loss time by P0-85 (Allowed overload time) and P0-86 (Allowed load loss time) according to your requirements. If the system detects overload/load loss time longer than the set time, the overload/load loss action will be triggered. You can select the

corresponding overload/load loss action by P0-68 (Action for load loss in monitored state)/P0-69 (Action for overload in monitored state).

Working principle

The following diagram shows the load monitoring function. The lower limit curve is formed by the x-coordinates (Motor speed P0-70 to P0-74) and the y-coordinates (Monitoring signal P0-80 to P0-84). The upper limit curve is formed by the x-coordinates (Motor speed P0-70 to P0-74) and y-coordinates (Monitoring signal P0-75 to P0-79).

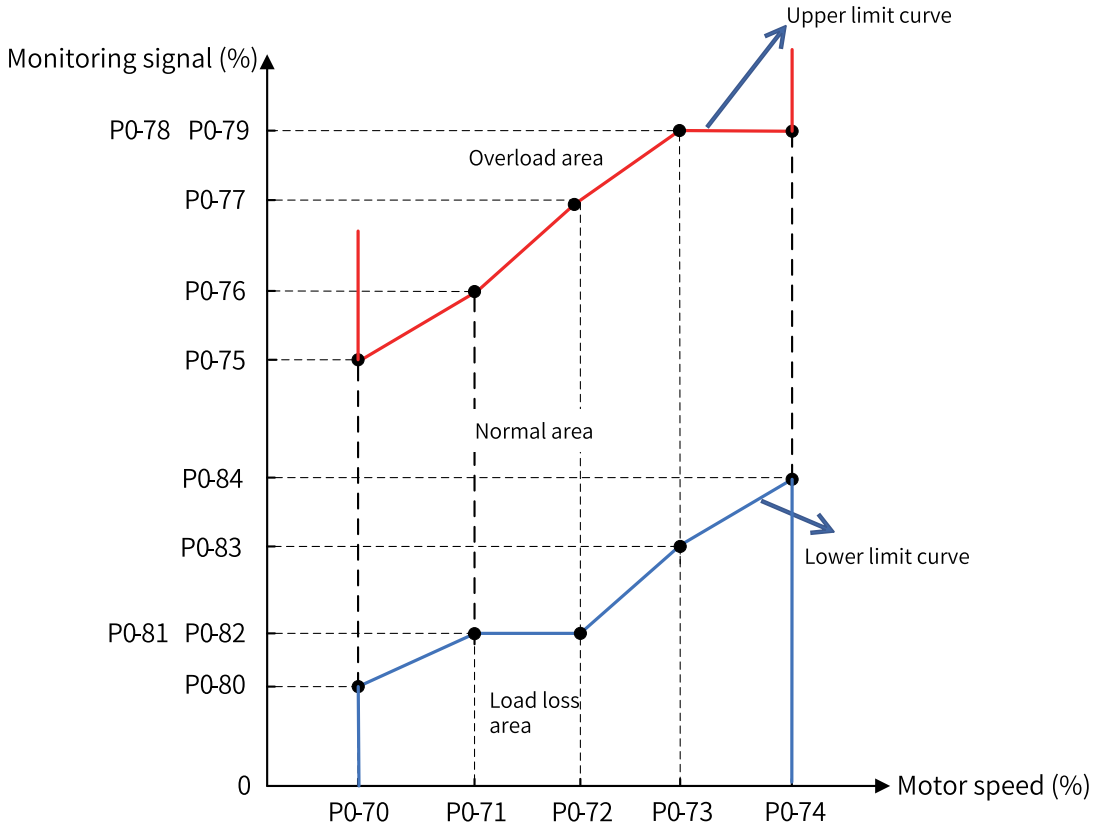


Figure 5-187 Load monitoring signal multi-point curve

Load monitoring starts when the actual motor speed falls into the user-defined x-coordinate area (P0-70 to P0-74). The system calculates upper and lower limits of the monitoring signals (output current, output torque, output power, etc.) on the limit curve according to the current motor speed signal. Them compare the limits with the current monitoring signal collected by the system.

- If the current monitoring signal collected by the system exceeds the upper limit, it indicates overload.
- If the current monitoring signal collected by the system exceeds the lower limit, it indicates load loss.
- If the current monitoring signal collected by the system is between the upper and lower boundary, it indicates normal load.

Related parameters

Param.	Name	Default Value	Value Range	Descriptions
P0-66	Load monitoring signal selection	0	0: Monitoring not enabled 1: Monitor output current 2: Monitor output torque 3: Monitor output power Others: F connector	Set the monitoring signal, including output current, torque, or power, or selecting from the connector. Value description 0: Monitoring not enabled 1: Monitor output current (L3234) 2: Monitor output torque (L3260) 3: Monitor output power (L3266) Others: F connector
P0-67	Load monitoring signal state	0	0 to 65535	Indicates the monitoring signal state. Value description 0: The monitoring signal is within the normal area. 1: The monitoring signal is below the normal area (load loss). 4: The monitoring signal is above the normal area (overload).
P0-85	Allowed overload time	20.0s	0.0s to 6553.5s	This parameter specifies the delay for response action set by P0-68 after the AC drive is monitored to be overload.
P0-86	Allowed load lost time	20.0s	0.0s to 6553.5s	This parameter specifies the delay for response action set by P0-69 after the AC drive is monitored to be load loss.
P0-68	Load monitoring overload action	0	0: No alarm/no fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the AC drive when overload is monitored. [No warning/no fault]. Ignore since no warning/ fault is reported. [Warning]. Overload warning A046.2 is reported when the monitoring signal is higher than the set overload curve for a period longer than the time set by P0-85 (Allowed overload time). [Fault]. Overload fault E046.1 is reported when the monitoring signal is higher than the set overload curve for a period longer than the time set by P0-85 (Allowed overload time). [Warning/fault]. Overload warning A046.2 is reported when the monitoring signal is higher than the set overload curve for a period longer than half of the time set by P0-85 (Allowed overload time). Overload fault E046.1 is reported when the monitoring signal is higher than the set overload curve for a period equal to or longer than the time set by P0-85 (Allowed overload time).

Param.	Name	Default Value	Value Range	Descriptions
P0-69	Action for load loss in monitored state	0	0: No alarm/no fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the AC drive when load loss is monitored. [No warning/no fault]. Ignore since no warning/ fault is reported. [Warning]. Overload warning A046.4 is reported when the monitoring signal is lower than the set overload curve for a period longer than the time set by P0-86 (Allowed load loss time). [Fault]. Overload fault E046.3 is reported when the monitoring signal is lower than the set overload curve for a period longer than the time set by P0-86 (Allowed load loss time). [Warning/fault]. Overload warning A046.4 is reported when the monitoring signal is lower than the set overload curve for a period longer than half of the time set by P0-86 (Allowed load loss time). Overload fault E046.3 is reported when the monitoring signal is lower than the set overload curve for a period equal to or longer than the time set by P0-86 (Allowed load loss time).
P0-70	X-coordinate point 1 in load monitoring state	0.0%	0.0%–600.0%	Set the first speed point of the X axis for load monitoring. Note: When the motor speed is negative, the absolute value is used as the x-coordinate to determine the range of the monitoring signal.
P0-71	X-coordinate point 2 in load monitoring state	0.0%	0.0%–600.0%	Set the second speed point of the X axis for load monitoring. Note: When the motor speed is negative, the absolute value is used as the x-coordinate to determine the range of the monitoring signal.
P0-72	X-coordinate point 3 in load monitoring state	0.0%	0.0%–600.0%	Set the third speed point of the X axis for load monitoring. Note: When the motor speed is negative, the absolute value is used as the x-coordinate to determine the range of the monitoring signal.
P0-73	X-coordinate point 4 in load monitoring state	0.0%	0.0%–600.0%	Set the fourth speed point of the X axis for load monitoring. Note: When the motor speed is negative, the absolute value is used as the x-coordinate to determine the range of the monitoring signal.

Param.	Name	Default Value	Value Range	Descriptions
P0-74	X-coordinate point 5 in load monitoring state	0.0%	0.0%-600.0%	Set the fifth speed point of the X axis for load monitoring. Note: When the motor speed is negative, the absolute value is used as the x-coordinate to determine the range of the monitoring signal.
P0-75	Upper limit 1 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the first overload point on the load curve.
P0-76	Upper limit 2 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the second overload point on the load curve.
P0-77	Upper limit 3 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the third overload point on the load curve.
P0-78	Upper limit 4 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the fourth overload point on the load curve.
P0-79	Upper limit 5 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the fifth overload point on the load curve.
P0-80	Lower limit 1 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the first load loss point on the load curve.
P0-81	Lower limit 2 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the second load loss point on the load curve.
P0-82	Lower limit 3 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the third load loss point on the load curve.
P0-83	Lower limit 4 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the fourth load loss point on the load curve.
P0-84	Lower limit 5 on load monitoring curve	0.0%	0.0%-400.0%	This parameter sets the fifth load loss point on the load curve.

Precautions

The conditions for activating the load monitoring module include:

- P0-66 is not set to 0.

- Speeds on the load monitoring curve are incremental (that is, P0-70< P0-71< P0-72< P0-73< P0-74).
- The actual motor speed is within the range of P0-70 to P0-74.
- Under the same speed point of the load monitoring curve, the overload threshold is greater than the load loss threshold.

Instances

The following example takes output current as the monitoring signal.

1. Set P0-66 (Load monitoring signal selection) to 1 (Monitor output current).
2. Set P0-69 (Action for load loss in monitored state) to 1 (Warning) and P0-68 (Action for overload in monitored state) to 1 (Warning).
3. Set P0-85 (Allowed overload time) and P0-86 (Allowed load loss time).
4. Set P0-70 and P0-74.
5. Set P0-80 to P0-84 and P0-75 to P0-79.
6. After the AC drive starts running, take the following curve as an example. After the motor speed signal enters the monitoring range (greater than P0-70), if the monitored current signal is lower than the lower limit, P0-67 outputs 1, indicating load loss. If the duration exceeds P0-86, the warning message is output. When the motor speed signal is between P0-72 and P0-73 and if the monitored current signal is higher than the upper limit, P0-67 outputs 4, indicating overload. If the duration exceeds P0-85, the warning message is output.

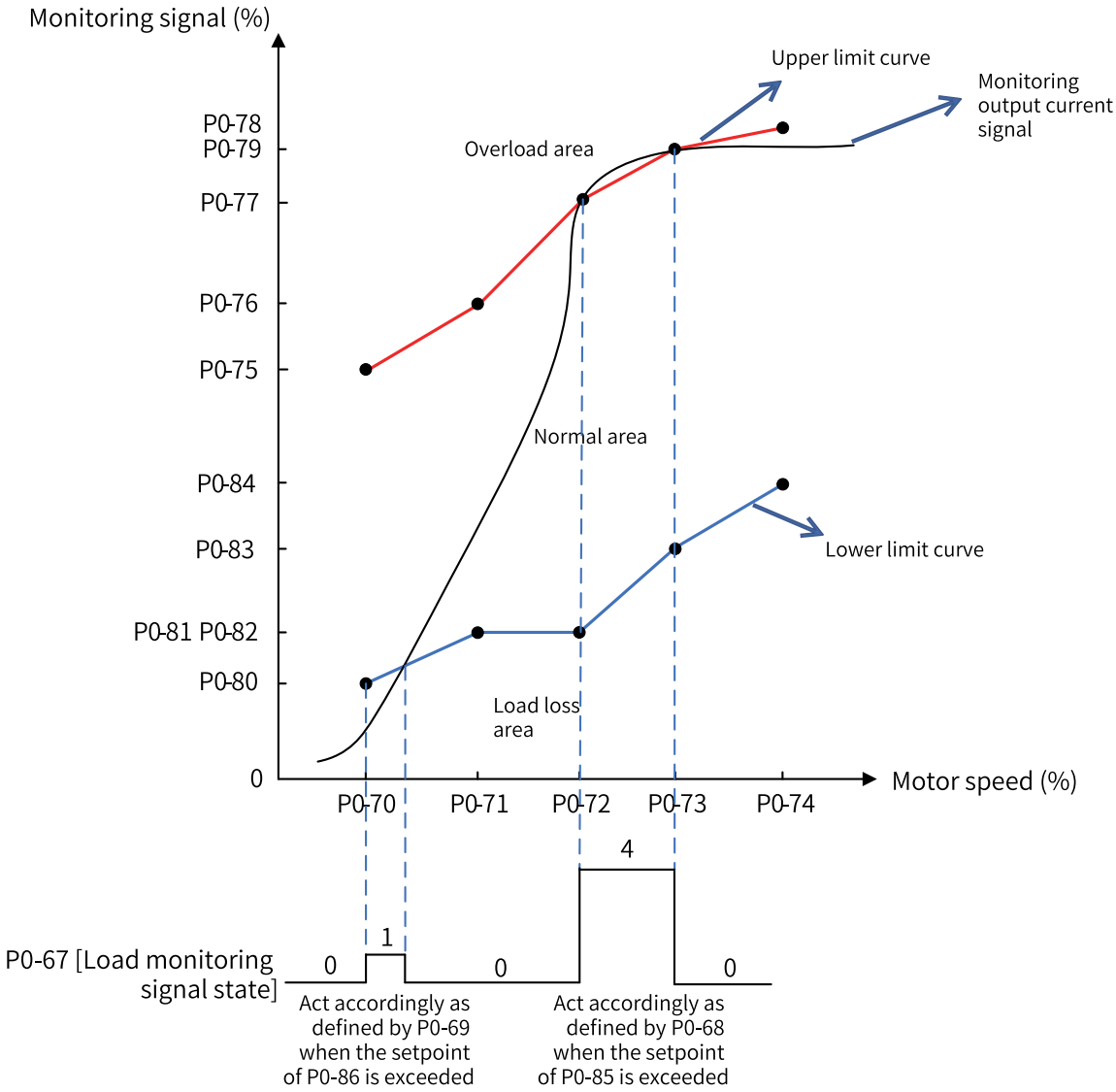


Figure 5-188 Load monitoring signal multi-point curve example

5.4.6 Process Functions

5.4.6.1 Wobble Control Function

Scenarios

The wobble control function is applicable to textile and chemical fiber industries, which involve traverse motion during production. In these cases, cyclic changing frequency is preferred rather than constant frequency. In these applications, adopts the wobble control function s through P0-95 and P0-97 to meet the requirements of these production scenarios.

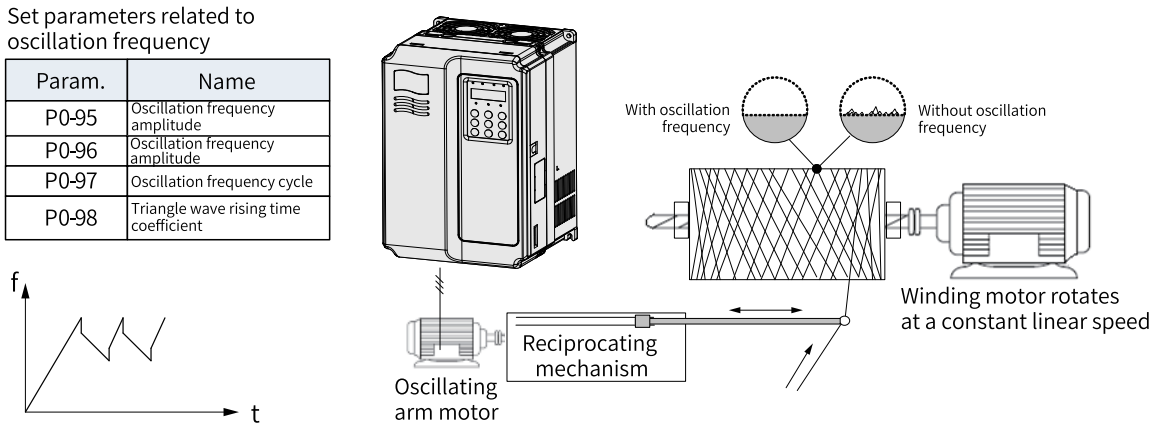


Figure 5-189 Application scenario of the wobble function

Description

Wobble control means that the output frequency of the AC drive wobbles up and down around the center frequency Fset in the wobble amplitude setting mode [P0-94], as shown in the following figure.

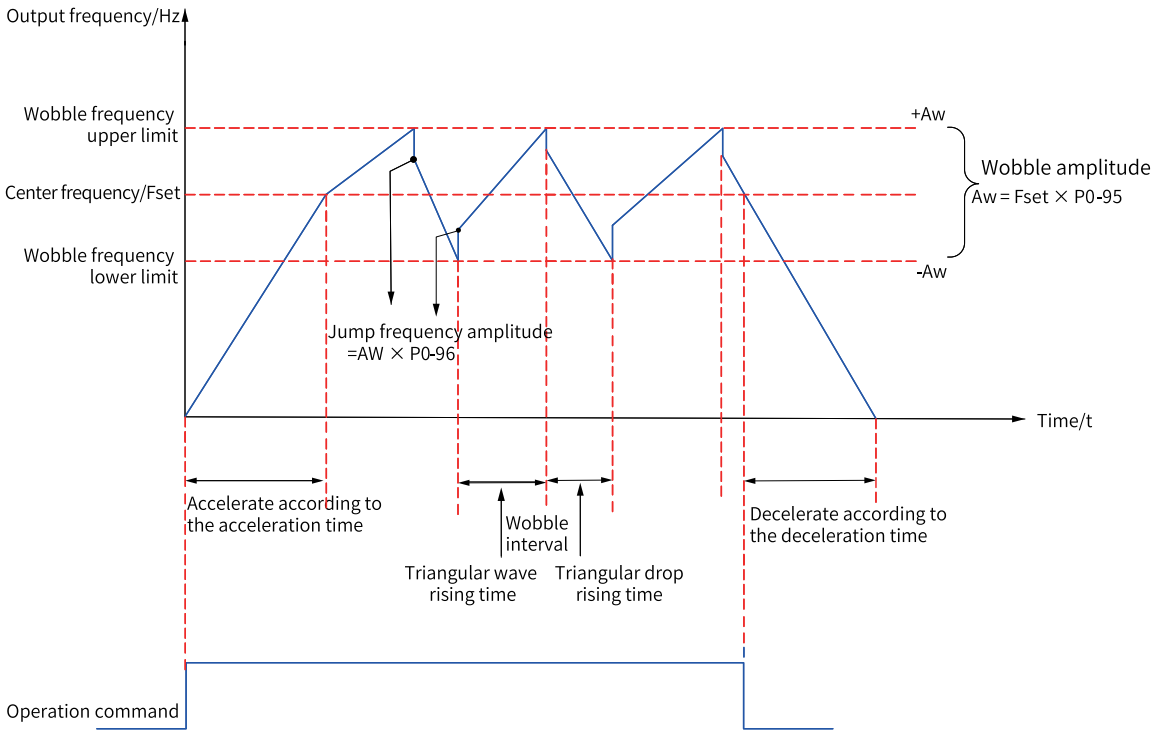


Figure 5-190 Working principle of the wobble function

- **Wobble calculation**

  When P0-94 is set to 0 (relative to the center frequency), wobble frequency (AW) = Main frequency source (b5-00/b6-00) x wobble amplitude (P0-95).

  When P0-94 is set to 1 (relative to the maximum frequency), wobble frequency (AW) = A2-17 (maximum frequency) x P0-95 (wobble amplitude).

- **Jump frequency calculation**

During wobble, jump frequency = wobble frequency (AW) x P0-96 (jump frequency amplitude).

When P0-94 is set to 0 (relative to the center frequency), the jump frequency is a variable.

When P0-94 is set to 1 (relative to the maximum frequency), the jump frequency is a fixed value.

- **Calculation of the triangular wave rise/fall time**
  Triangular wave rise time (unit: s) = P0-97 (wobble cycle) x P0-98 (triangular wave rise time coefficient)

  Triangular wave drop time = Wobble frequency cycle (wobble cycle) - Triangular wave rise time

  (Wobble cycle = Triangular wave rise time + Triangular wave fall time)

Related parameters

Param.	Name	Default	Value range	Descriptions
P0-94	Wobble amplitude setting mode	0	0: Relative to the center frequency	0: Relative to the center frequency (b5-00 or b6-00 main frequency source superposition selection). This mode is a variable wobble system, in which the wobble changes with the center frequency.
			1: Relative to the maximum frequency	1: Relative to the maximum frequency (A2-17). This mode is a fixed wobble system, in which the wobble amplitude is fixed.
P0-95	Wobble amplitude	0.0%	0.0% to 100.0%	Defines the wobble frequency amplitude, which is the percentage to the base frequency of the wobble frequency. Additional information: . When P0-95 is set to 0.0%, the wobble frequency function is disabled. 2. If P0-95 is not 0.0%, if P0-94 is set to 0, the wobble frequency amplitude is the target frequency×P0-95. If P0-94 is set to 1, the wobble amplitude is set to the maximum frequency×P0-95.
P0-96	Jump frequency amplitude	0.0%	0.0% to 50.0%	Defines the frequency percentage of the jump frequency to the wobble frequency amplitude during wobble operation. Additional information: The jump frequency is the wobble frequency amplitude× P0-96.
P0-97	Wobble cycle	10.0s	0.1s to 3000.0s	This parameter defines the time of a complete wobble cycle.
P0-98	Wobble triangular wave rise time coefficient	50.0%	0.1% to 100.0%	Defines the triangular wave rise time, which is the percentage to the wobble frequency cycle. Additional information: Triangular wave drop time = Wobble frequency cycle - Triangular wave rise time Triangular wave rise time = Wobble frequency cycle x P0-98

Instances

1. Set P0-94 to 0 0 to make the wobble changes with the center frequency.
2. Set b5-00 (Main frequency source) to 0 (Set by b5-01) and the target operating frequency through b5-01 (Main frequency digital setting).

3. For example, to perform winding operations at 30 Hz, set b5-01 (Main frequency digital setting) to 30 Hz.
4. Set P0-95 (Wobble amplitude) to 10%. This means the wobble amplitude frequency will be 3 Hz (calculated as 30 Hz × 10%). The AC drive will then wobbles between the lower limit (30 Hz - 3 Hz = 27 Hz) and the upper limit (30 Hz + 3 Hz = 33 Hz), with 30 Hz as the center frequency.
5. Set P0-97 (wobble cycle) to 10s, which means that the time required to perform a cycle (from the center frequency and return to the center frequency) is 10s.
6. Set P0-98 (Wobble triangular wave rise time coefficient) to 50%, that is, the trigonometric rise time is 10s x 50% = 5s. This means the time to rise from the lower limit to the upper limit of the wobble frequency is 5 seconds. and 5 seconds to run from the upper limit of the wobble frequency to the lower limit (10s-5s) .

5.4.6.2 Process PID Control

Scenarios

The output of process PID (Proportional Integral Derivative) control is used as the running frequency. The process PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

Function description

As a general process control method, the process PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction. (A proportional gain of 100.0 indicates that when the deviation between PID feedback and PID reference is 100.0%, the PID regulator regulates the output reference at the amplitude of the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity. (When the deviation between PID feedback and PID reference is 100.0%, the integral regulator performs continuous regulation within the time. The regulation amount reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. (Differential time indicates the time within which the feedback change reaches 100.0%. The regulation amount reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)

Related parameters

Param.	Name	Default	Setting range	Description
P2-00	Process PID enable	0	0: Disable	The PID function does not perform calculations, and the PID output is reset to zero.
			1: Enable	The PID function runs and calculates the PID output based on the set parameter.
			Others: B connector	Select the parameter in the bit connector to control whether the PID function runs.
P2-01	PID action direction	0	0: Forward action	If the feedback siganl is smaller than the PID reference, the drive output frequency increases.
			1: Reverse action	If the feedback signal is smaller than the PID reference, the drive output frequency decreases.
			Others: B connector	Select the parameter in the bit connector to control PID direction. (The value 0 represents forward action and 1 represents reverse action.)
P2-02	PID reference source	0	0: PID digital setting	Indicates the reference channel of the PID target value. The PID reference is a relative value. The value 100% corresponds to 100% of the feedback signal of the controlled system. The PID reference is set by P2-03 (PID reference value).
			1: AI1	The PID reference is set by AI1 input.
			2: AI2	The PID feedback reference is set by AI2 input.
			4: HDI reference (valid only for MD630S)	The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency.
			5: Multi-reference	In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-00 is set to 5 (Multi-reference), b8-08 (Source of multi-reference 0) cannot be set to 5 (PID reference).
			6: Simple PLC	The PID reference is set through simple PLC.
			8: Communication reference	The PID reference is set through remote communication.
			Others: F connector	The parameter in float connector is used as the PID target reference value.
P2-03	PID digital reference	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter must be set. When the parameter value is set to 100%, it corresponds to the maximum feedback value.

Param.	Name	Default	Setting range	Description
P2-04	PID feedback source	0	0: AI1	The PID feedback reference is set by AI1 input.
			1: AI2	The PID feedback reference is set by AI2 input.
			4: HDI reference (valid only for MD630S)	The PID feedback reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency.
			5: Communication reference	The PID feedback reference is set through remote communication.
			Others: F connector	The parameter in the float connector is used as the PID feedback value.
P2-05	PID reference feedback range	1000	0 to 65535	This parameter is used for display of the PID reference and feedback, which are dimensionless. For example, if this parameter is set to 1000, the PID reference (0% to 100%) corresponds to the feedback (0 to 1000) linearly, that is, 1000 (PID reference feedback dimension)/100 (PID output %) = 10 (dimension coefficient). PID output 0% is dimension 0. PID output 100% is dimension 1000.
P2-06	PID reference change time	0.00s	0.00s to 650.00s	This parameter defines the time required for the PID reference to change from 0.0% to 100.0%.
P2-07	PID feedback filter time	0.00s	0.00s to 60.00s	This parameter defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but degrades the responsiveness of the process closed-loop system. Note: An excessively high setpoint may result in slow PID feedback speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID feedback speed and large system vibration.
P2-08	PID output filter time	0.00s	0.00s to 60.00s	This parameter defines the filter time of PID output. The filter enhances smooth output but lowers the responsiveness of the process closed-loop. Note: An excessively high setpoint may result in slow PID output speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID output speed and large system vibration.
P2-09	PID reverse cut-off frequency	2.00 Hz	0.00 Hz to A2-07	When the frequency source is only the PID, the PID reverse cutoff frequency is the minimum value of the current PID output. When the frequency source is "main frequency + PID", P2-09 acts on the "main frequency + PID" and outputs the minimum frequency value after "main frequency + PID" operation. This parameter takes effect only when P2-09 is set to 0. Note: When using this function, you need to select connector L2480 (General PID reverse cut-off output) for the minimum PID output source.

Param.	Name	Default	Setting range	Description
P2-11	PID parameter switchover condition	0	0: No switchover, PID parameter group 1 by default	This parameter defines the switchover between two groups of PID parameters. When no switching occurs; the first group of PID parameters (P2-14 to P2-16) is used.
			1: Switchover by DI	To enable switchover through the DI, assign the DI with function 43 (PID parameter switchover). If the DI is invalid, group 1 (P2-14 to P2-16) is selected. If the DI is valid, group 2 (P2-17 to P2-19) is selected.
			2: Automatic switchover based on deviation	When the absolute value of the deviation between PID feedback and PID reference is smaller than PID parameter switchover deviation 1 (P2-12), group 1 is selected. When the absolute value of the deviation between PID feedback and PID reference is larger than PID parameter switchover deviation 2 (P2-13), group 2 is selected. When the deviation is between P2-12 and P2-13, the PID parameters are the linearly interpolated value of the two groups of PID parameter values, as shown in *"Figure 5-193 PID parameter switchover" on page 611*.
			3: Automatic switchover based on running frequency	In this mode, when the running frequency of the AC drive is between 0 and the maximum frequency, the PID parameters are the linearly interpolated value of the two groups of parameter values, as shown in *"Figure 5-193 PID parameter switchover" on page 611*.
P2-12	PID parameter switchover deviation 1	20.0%	0.0% to P2-13	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-13	PID parameter switchover deviation 2	80.0%	P2-12 to 800.0%	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	This parameter defines the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	PID parameter 1 integral time Ti1	2.00s	0.01s to 10.00s	Defines the integral time Ti in PID control. This parameter determines the integral adjustment intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity.
P2-16	PID parameter 1 differential time Td1	0.000s	0.000s to 10.000s	This parameter defines the derivative time Td in PID control. It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.

Param.	Name	Default	Setting range	Description
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	This parameter defines the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-18	PID parameter 2 integral time Ti2	2.00s	0.01s to 10.00s	Defines the integral time Ti in PID control. This parameter determines the integral adjustment intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity.
P2-19	PID parameter 2 differential time Td2	0.000s	0.000s to 10.000s	This parameter defines the derivative time Td in PID control. It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.
P2-20	PID initial value	0.0%	0.0% to 800.0%	When the AC drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value active time.
P2-21	Active time of PID initial value	0.00s	0.00s to 650.00s	When the AC drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value active time.
P2-22	PID deviation dead zone	0.0%	0.0% to 800.0%	When the deviation is within the PID deviation dead zone, no adjustment is required. This parameter is used to ensure the accuracy and stability of the system output.
P2-23	PID derivative limit	0.10%	0.00% to 600.0%	This parameter is used to set the PID derivative output range. In PID control, the derivative operation may easily cause system oscillation. Therefore, the PID derivative output is restricted to a specific range.

Param.	Name	Default	Setting range	Description
P2-26	Source of maximum PID output	0	0: 100.0%	This parameter defines the source of the maximum PID output. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the maximum PID output value is limited by this parameter. When 0 is selected, the default maximum PID output value is 100.0%.
			2: AI1	The maximum PID output value is defined by AI1 input.
			3: AI2	The PID feedback reference is set by AI2 input.
			5: Pulse reference	The maximum PID output value is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and running frequency.
			6: Multi-reference	When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 multi-reference values.
			7: Simple PLC	The maximum PID output value is defined by simple PLC output setting.
			8: PID	The maximum PID output value is set by the current PID output.
			9: Communication reference	The maximum PID output value is set through communication, and can be input through remote communication.
			Others: F connector	The parameter in the float connector is used as the maximum PID output value.

Param.	Name	Default	Setting range	Description
P2-27	Source of minimum PID output	0	0: -100.0%	This parameter defines the source of the minimum PID output. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the minimum PID output value is limited by this parameter. When 0 is selected, the default minimum PID output value is -100.0%.
			2: AI1	The minimum PID output source is the AI1 input.
			3: AI2	The minimum PID output source is the AI2 input.
			5: Pulse reference	The minimum PID output value is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and running frequency.
			6: Multi-reference	When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 multi-reference values.
			7: Simple PLC	The minimum PID output value is defined by simple PLC output setting.
			8: PID	The minimum PID output value is set by the current PID output.
			9: Communication reference	The minimum PID output value is set through communication, and can be input through remote communication.
			Others: F connector	The parameter in the float connector is used as the minimum PID output value.
P2-28	Forced value of PID output	0	0: 0.0%	This parameter defines the source of forced assignment of PID output. When P2-29 [Forced value assignment of PID output] is set to 1, the PID output is the forced value, that is, the value set by P2-28. When P2-29 [Forced value assignment of PID output] is set to 1 and P2-28 is set to 0, the PID output remains 0.0%, that is, the PID does not generate output.
			2: AI1	The forced value of PID output is defined by AI1.
			3: AI2	The forced value of PID output is defined by AI2.
			5: Pulse reference	The forced value of PID output is the pulse frequency reference of the DI terminal.
			6: Multi-reference	The forced value of PID output is the multi-reference output value.
			7: Simple PLC	The forced value of PID output is defined by simple PLC output.
			8: PID	The forced value of PID output is set by the current PID output.
			9: Communication reference	The forced value of PID output is set through communication.
			Others: F connector	The parameter in the float connector is used as the forced value of PID output.

Param.	Name	Default	Setting range	Description
P2-29	Forced assignment of PID output enable	0	0: Invalid	The forced output value is invalid, and the PID calculation is performed normally.
			1: Enable	The PID stops calculation and performs forced value assignment of the output. The PID output is the forced value, that is, the value set by P2-28.
			Others: B connector	Select the parameter in the bit connector to set whether to enable forced output value. 0: Invalid 1: Enable
P2-30	Upper limit for PID feedback loss detection	100.0%	P2-31 to 800.0%	This parameter is used to determine whether the PID feedback is lost. When the PID feedback has been greater than the value of this parameter for a period longer than the PID feedback loss detection time (P2-32), the AC drive reports E31.1. When this parameter is set to 800.0%, PID feedback loss detection is disabled.
P2-31	Lower limit for PID feedback loss detection	0.0%	0.0% to P2-30	This parameter is used to determine whether the PID feedback is lost. When the PID feedback has been lower than the value of this parameter for a period longer than the PID feedback loss detection time (P2-32), the AC drive reports E31.1. When this parameter is set to 0, PID feedback loss detection is disabled.
P2-32	Duration of PID feedback loss detection	0.0s	0.0s to 20.0s	Defines the duration of the PID feedback loss detection.
P2-33	Selection of PID operation at stop	0	0: Disabled	This parameter is used to determine whether to continue the PID operation when the AC drive stops. Generally, the PID operation needs to be stopped when the AC drive stops. When the drive stops, the PID function does not perform calculations, and the PID output is reset to zero.
			1: Enabled	When the drive stops, the PID function still perform calculation,.and the PID output changes based on PID feedback and PID reference.
			Others: B connector	Select the parameter in the bit connector to set whether to enable calculation at stop. 0: Disabled 1: Enabled

Param.	Name	Default	Setting range	Description
P2-34	PID integral property	10	Ones position: Integral pause/ separation 0: Invalid 1: Valid	When integral pause/separation is invalid, the integral remains invalid regardless of whether the multi-functional DI is valid. When the integral pause/separation is valid and the DI assigned with the PID integral pause function is valid (set to 22), the PID integral operation stops. In this case, only proportional and derivative operations take effect.
			Tens position: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation	Determines whether to stop the integral operation when the PID operation output reaches the maximum or minimum value. If you select "Stop the integral operation", the PID integral operation stops, which may help reduce the PID overshoot. If you select "Continue integral operation", the PID integral operation continues, which may result in PID overshoot.
P2-36	PID calculation during jog	0	0: Disabled 1: Enabled	Defines whether PID calculation is allowed during jogging. Value description: 0: Disabled - PID calculation is disabled during jogging. 1: Enabled - PID calculation is allowed during jogging.
P2-37	PID execution interval	1	0 to 20	Defines the PID execution interval. The larger the setting, the longer the calculation cycle; the smaller the setting, the shorter the calculation cycle.
P2-38	Valid mode selection for PID ramp setting	-	0: Valid when PID is enabled 1: Valid when PID calculation is started Others: B connector	0: Valid when PID is enabled When the PID function is enabled, the PID ramp setting is valid and the PID reference value is calculated based on the PID reference time. 1: Valid when PID calculation is started When PID operation starts, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. Others: B connector Select the parameter in the bit connector to select the active mode of PID ramp reference.

Application example

1. Set P2-00 to 1 to enable process PID function.
2. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the maximum value of PID feedback.

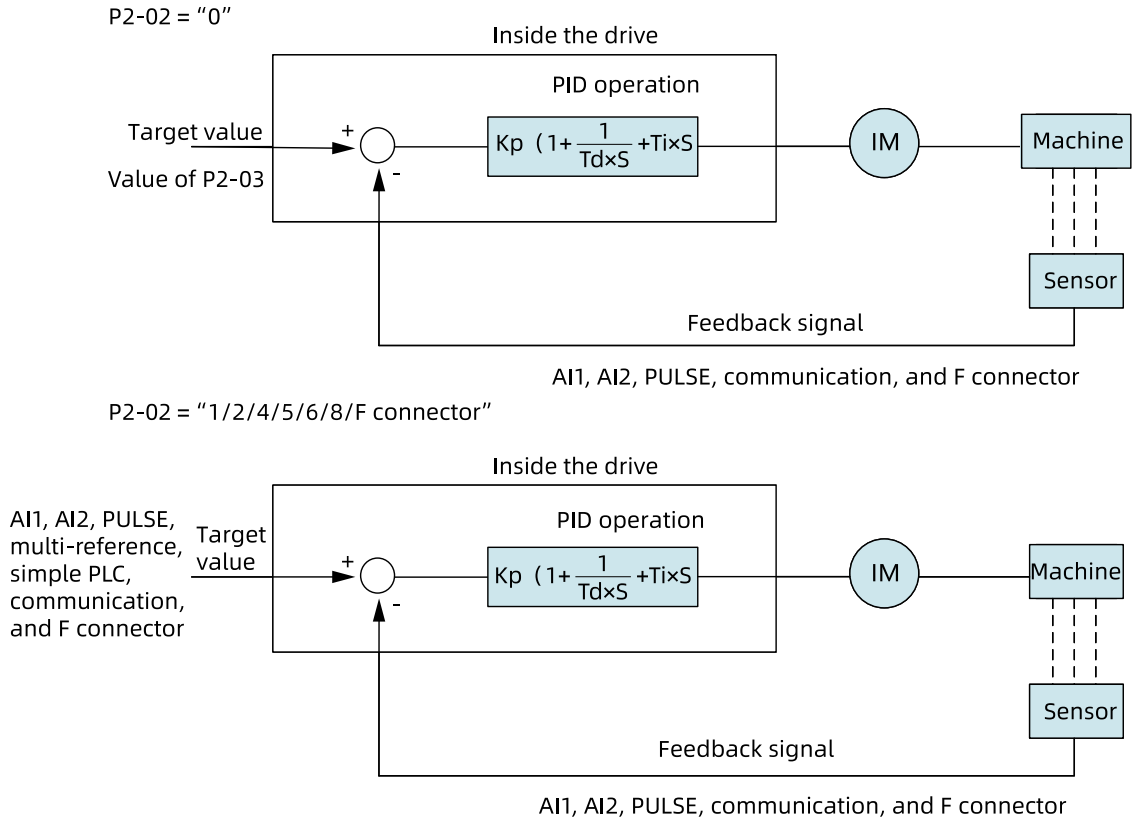


Figure 5-191 Principle of process PID control

3. Set P2-04 to select a PID feedback source.
4. Set P2-01 to select a PID action direction.

   The following figure shows the logic of process PID control parameter settings.

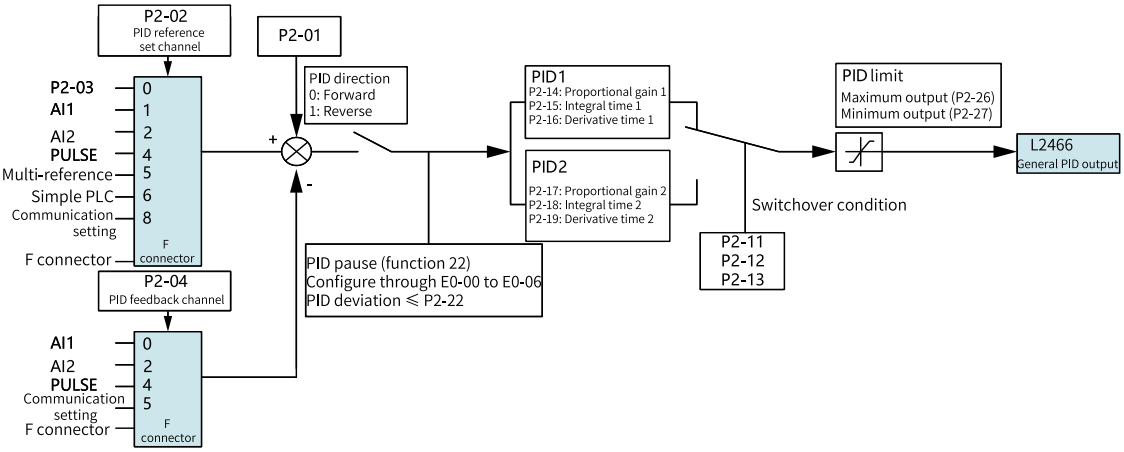


Figure 5-192 Parameter settings for process PID control

5. Select PID reference or connector L2466 as the control source.

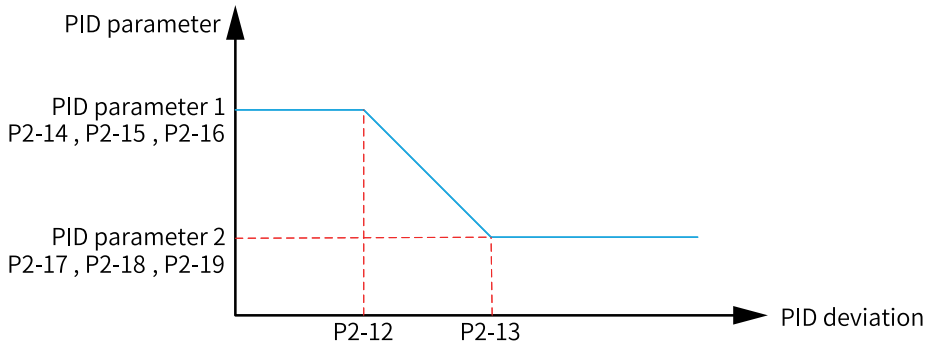


Figure 5-193 PID parameter switchover

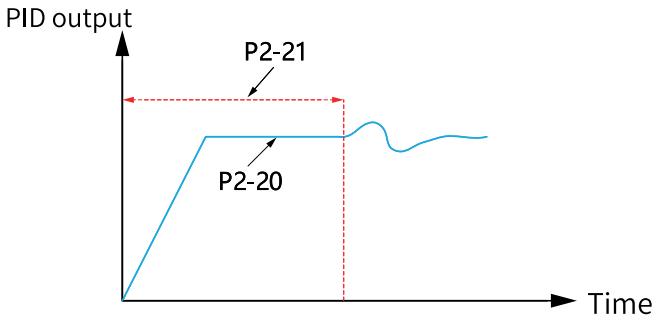


Figure 5-194 PID output function

5.4.6.3 Simple PLC Function

Scenarios

Simple PLCs are generally used in scenarios where multiple speeds are required. The execution time and frequency cannot be accurately controlled by the operating panel or other frequency sources. In this case, the drive can control different running frequencies at different times by using a simple PLC. The running time of different frequencies can also be controlled.

You need to set the frequency and running time through the P1-00 to P1-56.

Description

The simple PLC module performs a simple combination of 16 multi-references based on the setting of each operating time. In applications requiring multiple speeds, for example, when the conveyor belt is used to handle goods, the simple PLC can be used together with the main frequency source [F0-29] or auxiliary frequency source [F0-31]. You can control the acceleration/deceleration time and operating time of each speed by configuring simple PLC acceleration/deceleration time for segments 0 to 15.

When using the simple PLC module, you need to manually enable the simple PLC module. In addition, you need to configure the simple PLC references 0 to 15, operating time, acceleration/deceleration time, and operation mode. Then configure the source for enabling simple PLC calculation. When simple PLC calculation is enabled, the simple PLC module starts operating according to the set operating time and mode.

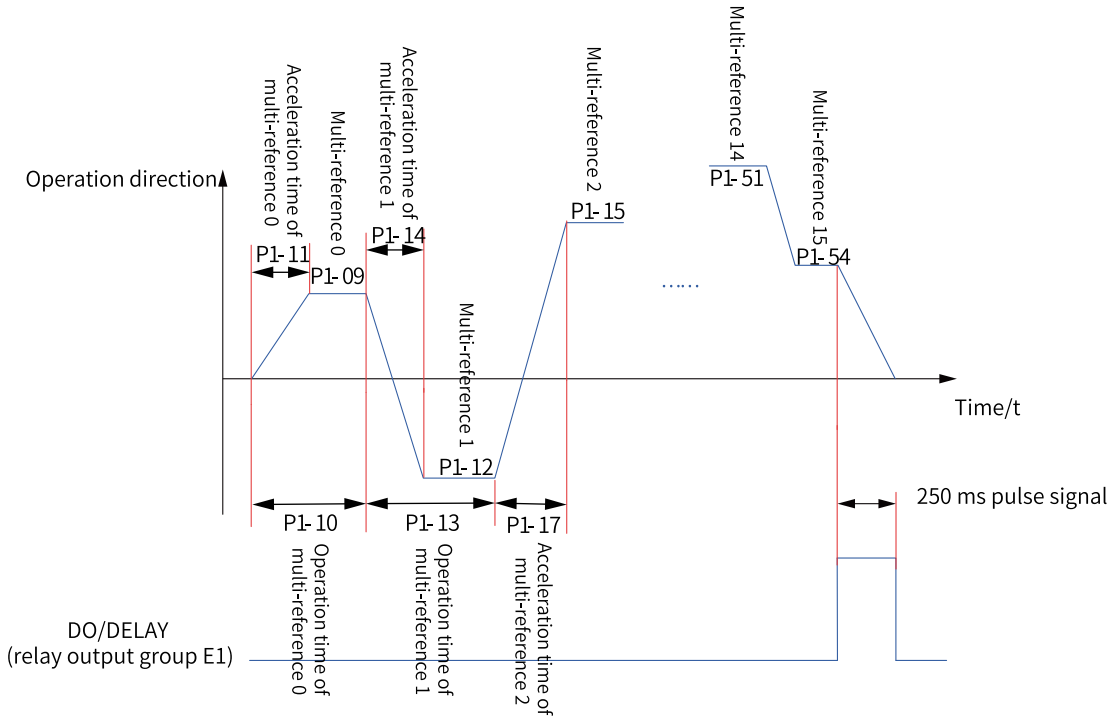


Figure 5-195 Operation diagram of the simple PLC

Technical data

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module enable	0: Disable	0: Disable 1: Enable	Used to enable/disable the simple PLC module. 0: Disable - The simple PLC module is disabled. In this case, the current STEP and current STEP running time (in hours and seconds) of the simple PLC, as well as the per unit value obtained in the simple PLC step, are all cleared. 1: Enable - The simple PLC module is enabled, but whether the PLC module is calculated and outputted normally depends on P1-01.
P1-01	Simple PLC calculation source	L0114 Motor running flag	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the source for enabling simple PLC calculation. 1. If the simple PLC calculation function is enabled, the simple PLC module runs according to the operation mode of the simple PLC. The simple PLC module also calculates the current STEP based on the running time and outputs the current STEP, current STEP running time (hours and seconds), and current STEP per unit value. 2. If the simple PLC calculation enable source is disabled, the current STEP, current STEP running time (in hours and seconds) of the simple PLC is the value when the calculation is stopped. The per unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default value	Value range	Description
P1-02	Simple PLC operation mode	0: Keep multi-reference 0 output after running for one cycle	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. 0: Keep multi-reference 0 output after running for one cycle After an individual cycle of operation of done by the simple PLC, the multi-reference 0 output is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 1: Keep final values after running for one cycle After an individual cycle of operation of done by the simple PLC, the final value is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2: Repeat after running for one cycle The simple PLC starts running again after completing a cycle. The simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed. 3: Output 0 after running for one cycle After an individual cycle of operation of done by the simple PLC, the value obtained in the PLC step is outputted as 0. In this case, the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms.
P1-03	Simple PLC function selection	0	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation configuration 0: Keep the current segment when calculation is invalid and re-calculate when it is valid 1: Keep the current segment when calculation is invalid and continue to run when it is valid	Defines the simple PLC function. Ones: 0: Current operating segment and operating time are not recorded. 1: The current operating segment and operating time are recorded upon power failure, and both the ones and tens need to be set to 1. Tens: 0: Current segment retained when disabled, which is recalculated after enabled 1: Current segment retained when disabled, and operation continued after enabled

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0: Invalid	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Used to reset the simple PLC status. Invalid: When the simple PLC state reset is invalid, the simple PLC operates according to the setting. Valid: When the simple PLC status reset is valid, the simple PLC module is restored to the initial state. The operation segment of the simple PLC is 0, and the output of the simple PLC is the setpoint of the multi-reference 0 defined by P1-09.
P1-05	Current STEP of the simple PLC	0	Displays the current STEP of the simple PLC.	Displays the STEP speed to which the simple PLC is running.
P1-06	Current STEP operating time (in hours) of the simple PLC	0	Displays the current STEP operating time (in hours) of the simple PLC.	Displays the current STEP operating time (in hours) of the simple PLC.
P1-07	Current STEP operating time (in seconds) of the simple PLC	0	Displays the current STEP operating time (in seconds) of the simple PLC.	Displays the current STEP operating time in seconds of the simple PLC.
P1-08	Operating time unit of simple PLC	0: s (second)	0: s (second) 1: h (hour)	Defines the operating time unit of simple PLC.
P1-09	Multi-reference 0 set by simple PLC	0.0%	-800.0% to +800.0%	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Operating time of multi-reference 0 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency.

Param.	Name	Default value	Value range	Description
P1-11	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05).	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05). 1: Acceleration/ Deceleration time of ramp 2 (B7-10/B7-11). 2: Acceleration/ Deceleration time of ramp 3 (B7-16/B7-17). 3: Acceleration/ Deceleration time of ramp 4 (B7-22/B7-23).	Defines the acceleration/deceleration time of multi-reference 0 set by simple PLC.
…	…	…	…	…
P1-54	Multi-reference 15 set by simple PLC	0.0%	-800.0%-800.0%	Defines the target frequency of multi-reference 15 of the simple PLC, which is a percentage to the rated motor frequency.
P1-55	Operating time of multi-reference 15 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operating time of multi-reference 15 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency.
P1-56	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05)	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05) 1: Acceleration/ Deceleration time of ramp 2 (acceleration time B7-10/ deceleration time B7-11) 2: Acceleration/ Deceleration time of ramp 3 (acceleration time B7-16/ deceleration time B7-17) 3: Acceleration/ Deceleration time of ramp 4 (acceleration time B7-22/ deceleration time B7-23)	Defines the acceleration/deceleration time of multi-reference 15 set by simple PLC.

Application instance

1. Set P1-00 [Simple PLC module enable] to 1 to enable the simple PLC module function.
2. Set P1-01 [Simple PLC calculation enable source] to 1 to enable the 16 multi-references values of simple PLC.
3. Set P1-02 [Simple PLC operation mode] to 0, that is, the drive remains at P1-09 (Multi-reference 0 set by simple PLC) after all 16 setpoints of the simple PLC are done executing.
4. Set P1-03 [Simple PLC function selection] to 0, that is, the 16 multi-references set by the simple PLC is non-retentive at power failure and calculation starts from multi-reference 0 again at next power-on.
5. Set P1-04 [Simple PLC state reset] to 0 to disable the reset function of the simple PLC.
6. Set P1-08 [PLC operating time unit] to 0 to set the operating time in seconds (s).
7. Set P1-09 [Multi-reference 0 set by simple PLC] to 10%, that is, the frequency of multi-reference 0 during operation = 10% [P1-09] x rated frequency [F1-06].
8. Set P1-10 [Simple PLC operating time 0] to 5s, which is the sum of the acceleration/deceleration time at start and operating time.
9. Set P1-11 [Simple PLC acceleration/deceleration time selection 0] to 0, which means that the target frequency acceleration/deceleration time is converted based on ramp 1 acceleration/ deceleration time (B7-04/B7-05).
10. Set P1-12 to P1-14, P1-15 to P1-17, P1-18 to P1-20, P1-21 to P1-23, P1-24 to P1-26, P1-27 to P1-29, P1-30 to P1-32, P1-33 to P1-35, P1-36 to P1-38, P1-39 to P1-41, P1-42 to P1-44, P1-45 to P1-47, P1-48 to P1-50, P1-51 to P1-53, and P1-54 to P1-56, together with P1-09 to P1-11, a total of 16 groups of simple PLC parameters;
11. Run the AC drive, that is, the drive runs at variable speed according to the target frequency set in 16 groups of parameters. P1-05 [Current STEP of simple PLC) can be used to observe the simple PLC stage. P1-07 [Current STEP operating time (in seconds) of simple PLC] can be used to observe the number of operating hours in the current stage.

5.4.6.4 Motorized Potentiometer

Scenarios

The motorized potentiometer function is applicable to industries such as logistics and ceramics that require flexible speed control.

In these applications, the motorized potentiometer replaces the physical potentiometer as the frequency source and provides parameters P3-05 [Motor potentiometer increase command source] and P3-06 [Motor potentiometer decrease command source]. Speed control is performed through the acceleration/deceleration button of these two custom sources instead of the rotary knob.

Operation principles

The motorized potentiometer function can be used to simulate the potential difference of analog potentiometer input. The per unit value calculated based on P3-07 (Maximum value of potentiometer), P3-08 (Minimum value of potentiometer), P3-03 (Increase time), and P3-04 (Decrease time) is used as the output value of the potentiometer. The motorized potentiometer function can be used as the source for functions such as the main frequency or jog frequency.

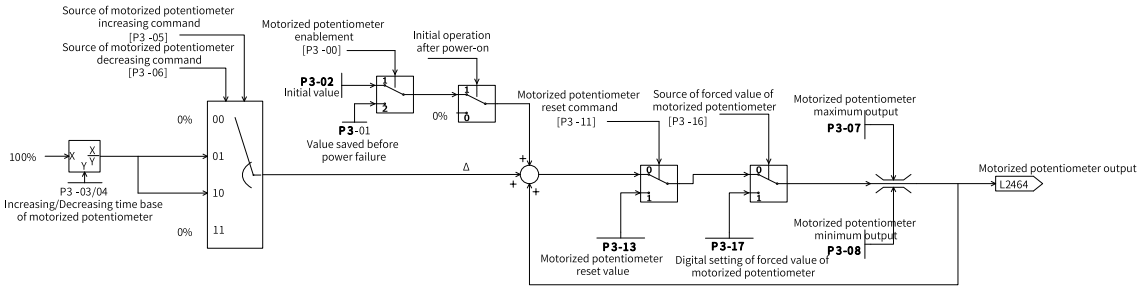


Figure 5-196 Motorized potentiometer functions

Technical data

Param.	Name	Default	Value range	Description
P3-00	Motorized potentiometer enable	0	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer function is enabled. Value description: 0: Inhibited - The motorized potentiometer is not enabled. 0: Enabled - The motorized potentiometer is enabled. 3 to 9: DI1 to DI7 - Whether the motorized potentiometer is enabled depends on the terminal state of the DI. Others: B connector - Whether the motorized potentiometer is enabled depends on the B connector state (0: Inhibited; 1: Enabled)
P3-01	Retention at power failure of motorized potentiometer	0	0: Disable 1: Enable	Defines whether the motorized potentiometer is retentive at power failure. Value description: 0: Disable - Non-retentive upon power failure 1: Enable - Retentive Value: If memory retention at power failure is enabled and the motorized potentiometer is enabled before power failure, the output value of the motorized potentiometer after power-on is the last output value before the power failure. When memory retention is disabled, the output value of the motorized potentiometer after power-on is P3-02 (Initial value of the motorized potentiometer).
P3-02	Initial value of motorized potentiometer	0.0%	-600.0% to +600.0%	Indicates the initial value of the motorized potentiometer.

Param.	Name	Default	Value range	Description
P3-03	Time increase base of motorized potentiometer	20.00s	0.00 to 655.35s	Defines the increase rate of the motorized potentiometer, which is the time taken to increase from 0% to 100%.
P3-04	Time decrease base of motorized potentiometer	20.00s	0.00 to 655.35s	Defines the decrease rate of the motorized potentiometer, which is the time taken to decrease from 100% to 0%.
P3-05	Source of motorized potentiometer increase command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the motorized potentiometer increase command is valid. Value description: 0: Invalid - The increase command is invalid. 1: Active - The increase command is valid. 3 to 9: DI1 to DI7 - Whether the increase command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the increase command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: 1. After the increase command is active, the value is increased according to the rate defined by P3-03. 2. If the increase command and the decrease command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-06	Source of motorized potentiometer decrease command	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer decrease command is valid. Value description: 0: Invalid - The decrease command is invalid. 1: Valid - The decrease command is valid. 3 to 9: Whether the decrease command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the decrease command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: 1. After the decrease command is activated, the value is decreased according to the rate defined by P3-04. 2. If the increase command and the decrease command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-07	Maximum value of motorized potentiometer output	600.0%	P3-08 to 600.0%	Defines the maximum range that can be outputted by the motorized potentiometer.

Param.	Name	Default	Value range	Description
P3-08	Minimum value of motorized potentiometer output	-600.0%	-600.0% to P3-07	Defines the minimum range that can be outputted by the motorized potentiometer.
P3-09	Source 1 of motorized potentiometer pause command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer pause command 1 is valid. Value description: 0: Invalid - The pause command is invalid. 1: Valid - The pause command is valid. 3 to 9: Whether the pause command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the pause command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the pause command is 1, the motorized potentiometer change pauses. When the pause command is 0, the pause is inactive.
P3-10	Source 2 of motorized potentiometer pause command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer pause command 2 is valid. The function description is the same as P3-09.

Param.	Name	Default	Value range	Description
P3-11	Source 1 of motorized potentiometer reset command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether motorized potentiometer reset command 1 is valid. Value description: 0: Invalid - The fault reset command is invalid. 1: Valid - The fault reset command is valid. 3 to 9: Whether the reset command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the reset command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the reset command changes from 0 to 1, the output value of the motorized potentiometer is reset to the values of P3-13 and P3-14.
P3-12	Source 2 of motorized potentiometer reset command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether motorized potentiometer reset command 2 is valid. The function description is the same as P3-11.
P3-13	Source of reset value of motorized potentiometer	0	0: Digital setting 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the source of motorized potentiometer reset value. Value description: 0: P3-14 2 to 3: AI output value 5: HDI output value 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Others: F connector. - Value of the selected connector

Param.	Name	Default	Value range	Description
P3-14	Digital setting of the reset value of motorized potentiometer	0.0%	-600.0% to +600.0%	Defines the digital setting of the reset value of motorized potentiometer. Value description: When P3-13 is set to 0, the reset value of the motorized potentiometer is the setpoint of P3-14.
P3-15	Source of motorized potentiometer forced command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the whether the forced command of the motorized potentiometer is valid. Value description: 0: Invalid - The forced command is invalid. 1: Valid - The forced command is valid. 3 to 9: DI1 to DI7 - Whether the forced command is valid depends on the terminal state of the DI. 0: Invalid; 1: Valid Others: B connector - Whether forced command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the forced command (P3-15) is 1, the output value of the motorized potentiometer is set to the forced values of P3-16 and P3-17.
P3-16	Forced value source of motorized potentiometer	0	0: Digital setting 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the source of the forced value after the forced command of the motorized potentiometer is activated. Value description: 0: P3-17 2 to 3: AI output value 5: HDI output value 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Others: F connector. - Value of the selected connector
P3-17	Digital setting of the force value of motorized potentiometer	0.0%	-600.0% to +600.0%	Defines the digital setting of forced value of motorized potentiometer. Value description: When P3-16 is set to 0, the reset value of the motorized potentiometer is the setpoint of P3-17.
P3-38	High bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the high bits (those higher than 65535) saved by the motorized potentiometer at next power-on after the memory retention function (P3-01) is enabled.
P3-39	High bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the high bits (those lower than 65535) saved by the motorized potentiometer at next power-on after the memory retention function (P3-39) is enabled.

Application instance

The following describes how to use the output of the motorized potentiometer as the frequency source.

1. Set P3-00 [Motorized potentiometer enable] to 1, which means that the jog potentiometer function is activated.
2. Set b5-00 [Main frequency source] to L2464 (Final output value of jog potentiometer) in "Others [F connector]".
3. Set P3-03 [Time increase base of motorized potentiometer] to 10s and [Time decrease base of motorized potentiometer] P3-04 to 10s.
4. Set P3-05 [Increase command source of motorized potentiometer] to 3 [DI1] and P3-06 [Decrease command source of motorized potentiometer] to 4 [DI2]. Set P3-07 [Maximum output value of motorized potentiometer] to 100% and P3-08 [Minimum output value of motorized potentiometer] to 0%.
5. After setting is done, when DI1 is valid and DI2 is invalid, the output of the potentiometer increases from 0% to 10% per second until P3-03 [Time increase base of motorized potentiometer] is 10s where 100% rated frequency is outputted. On the contrary, when DI1 is invalid and DI2 is valid, the output of the potentiometer decreases from 100% to 10% per second until P3-04 [Time decrease base of motorized potentiometer] is 10s where the 0% rated frequency is outputted.

5.4.6.5 Brake Control

5.4.6.5.1 Brake Control

Application scenarios

When the drive module is not running, the motor and the driven device are locked at zero speed by the mechanical brake. When brake control is enabled, set relevant parameters based on the actual working conditions of equipment and load for effective control by the brake logic to achieve operation safety.

Function description

After the brake control function is enabled, the brake function module outputs L0700 brake command after internal processing logic. Set E1-00 to L0700 (Brake command output) to implement the RO1 relay of the AC drive to control the external mechanical brake mechanism. The brake function can be set through P4-00. There are two conditions, one is the brake without detection information and the other is the brake belt detection information. See detailed descriptions below.

1. Set P4-00 to 2 (Brake with detection information). The brake detects the brake feedback state set by P4-04. When the brake open action time of P4-02 is reached, the brake open signal is not received within the delay time of P4-05 brake feedback fault, and the brake cannot be opened is reported. When the brake closing action time of P4-03 is reached, the brake closing failure fault is reported when the brake closing signal is not received within the delay time of P4-05 brake feedback fault. When the brake feedback signal is high, the brake feedback signal is closed, and when the brake feedback signal is low, the brake feedback signal is on.

2. Set P4-00 to 1 (Brake without detection information). The brake is controlled only by the set open and close action time, and the actual state is not detected. P4-25, P4-26, and P4-27 can be used to set the brake release conditions. For example, you can set the brake to be released only when the output torque is greater than a specified value. This ensures that the gravity load does not slip at the moment of brake release. Note that the system speed loop neither works or generates torque output before the brake is released. Therefore, when the comparison value source of P4-25 is set, and the comparison value source is output torque, you need to set P4-09 to set a start torque to meet the conditions of brake opening.

5.4.6.5.2 Working Principle

Brake time sequence

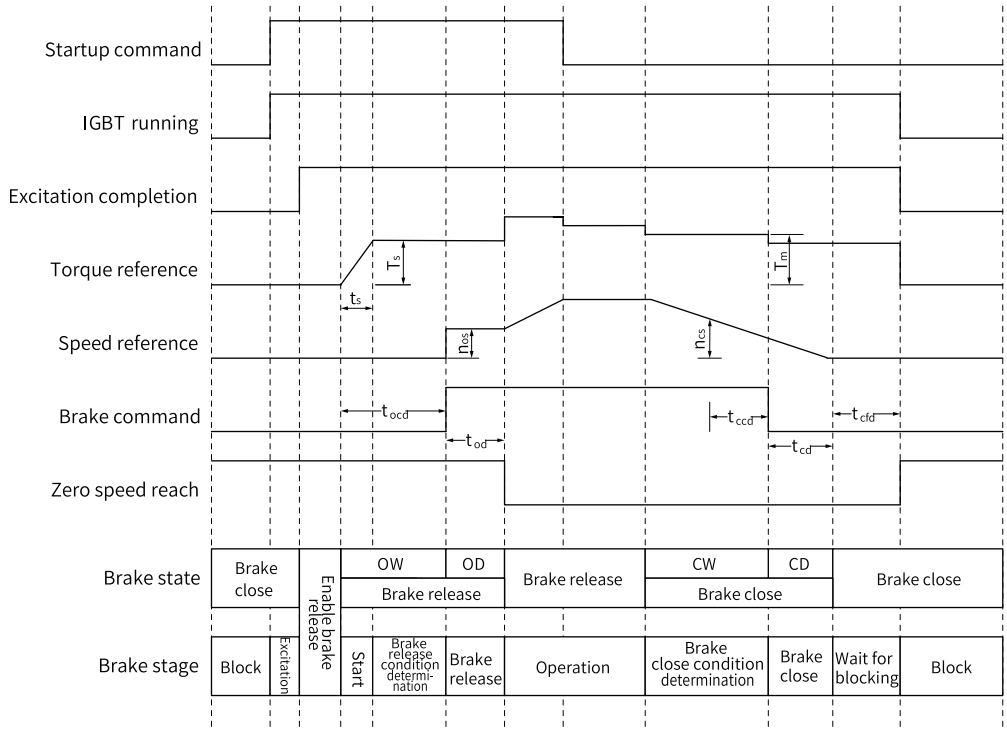


Figure 5-197 Brake time sequence

Abbreviation	Description	Abbreviation	Description
T_s	Starting torque upon brake release	T_m	Memory torque upon brake close
n_{os}	Starting speed upon brake release	n_{cs}	Speed threshold upon brake close
t_s	Acceleration time for brake starting torque	t_{ocd}	Brake release comparison delay
t_{od}	Brake releae (or brake open) action time	t_{ccd}	Brake close delay
t_{ccd}	Brake close action time	t_{cfd}	Brake feedback fault delay time
OW	Brake release waiting time	OD	Brake release delay
CW	Brake close waiting time	CD	Brake close delay

Running timing diagram

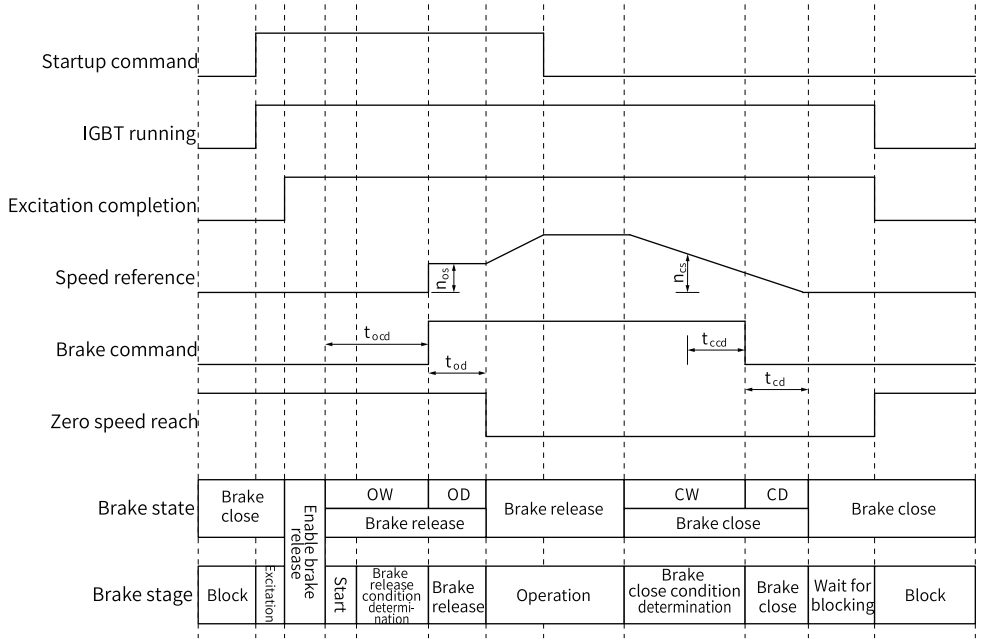


Figure 5-198 Brake time sequence

Abbreviation	Description	Abbreviation	Description
n_{os}	Starting speed upon brake release	n_{cs}	Speed threshold upon brake close
t_{ocd}	Brake release comparison delay	t_{od}	Brake releae time
t_{ccd}	Brake close delay	t_{cd}	Brake close time
OW	Brake release waiting time	OD	Brake release delay
CW	Brake close waiting time	CD	Brake close delay

5.4.6.5.3 Overview of Braking Stages

All brake actions can be performed only after the operating command is received and the motor is prepared. For asynchronous motors, brake starts after motor pre-excitation. For synchronous motors, brake starts after the motor magnetic pole angle is obtained.

In case of a fault or an emergency stop command, a brake that is being released immediately enters the closed stage and the brake close command is output.

Brake release and close are generally triggered by operating commands.

In case of OFF2 emergency stop, coast to stop, or that P4-17 is set to 1 at any time, the brake module immediately outputs the close signal (L0700 = 0).

Param.	Name	Description
P4-17	Forced brake close command source	0: Invalid 1: Brake close signal outputted immediately (L0700 = 0)

Note: When the forced brake close command (P4-17) is activated, the brake module outputs a close signal (L0700 = 0) immediately. In this case, the brake module does not exit the operation state and may generate torque output.

This function is generally used for brake force test. You can use the forced brake close command to test whether the brake mechanism meets the brake force requirements during high-speed operation.

Braking force test stage

The braking force test is optional and can be skipped if not activated.

The braking force may decrease after the brake is used for a long time. To check whether the braking force meets requirements through the internal logic function before start, set P4-40 to 1 to enable the braking force test.

This function is active only when d0-00 is set to 1 (FVC). During the test, the drive continues to output the torque according to the setting of P4-42 and checks whether the feedback torque is normal. If the feedback torque is excessively low or the motor rotates, the braking force is insufficient and the fault E084.3 or E084.4 can be triggered.

Param.	Name	Description
P4-40	Enable brake self-test	You can use the connector to enable or disable self-test. When this parameter is set to 1, the test is performed when pre-excitation is completed but the brake is not opened.
P4-41	Brake test hold time	Defines the test duration.
P4-42	Maximum verification torque for brake test	During the test, the output torque increases gradually but the maximum torque cannot exceed the torque specified by this parameter.
P4-43	Torque direction for brake test	Defines the torque direction, which can be modified in the connector. The torque is output and tested in the forward direction by default.
P4-44	Slip speed threshold for brake test	During brake test, if the motor speed keeps exceeding the value of P4-44 for a period longer than that specified by P4-45, the motor starts rotating actually.
P4-45	Slip speed hold time for brake test	

Brake release preparation stage

Brake release preparation stages include start torque establishment, brake release condition determination, and brake release.

1. Establishing the starting torque:
   Establishing the starting torque: This stage is active only in the vector control mode. To prevent the gravity load from slipping upon the moment of brake release, the torque that corresponding to the set starting torque can be outputted first. Before brake release, the speed loop does not act. If P4-08 is set to 0, no torque is outputted before brake release.

2. Brake release condition determination:
   After the starting torque is established, you can set two groups of additional startup conditions through P4-24...P4-27. By default, there is no additional condition. After the starting torque is established, the brake releases.

3. Brake release:
   The brake release signal (L0700 = 1) is outputted in this stage. In addition, the ramp function generator (RFG) is enabled. If P4-13 is valid, the RFG starts to accelerate from the speed indicated by P4-14. Otherwise, the RFG starts to accelerate from 0.

Param.	Name	Description
P4-08	Starting torque source in vector control	Used to select the torque to be outputted before brake release.
P4-09	Digital setting of starting torque	It is active when P4-08 is set to 2.
P4-10	Retentive starting torque gain coefficient	This parameter is active when P4-08 is set to 1, and it is used to adjust the retentive torque.
P4-13	Enable starting speed	P4-13 = 0: After the brake is released, the RFG accelerates from 0.
P4-14	Digital setting of starting speed	P4-13 = 1: After the brake is released, the RFG accelerates from P4-14.
P4-11	Torque ramp-up time upon start of the brake	Defines the time required to accelerate from zero torque to 100% torque.
P4-24	Brake release command source	Defines the external brake control condition. When it is set to 0, the brake cannot be released. When the brake is released, it will not apply when you set P4-24 to 0.
P4-25	Comparison value source for brake release	Defines the additional condition for determining brake release. If P4-25 is set to 0, the condition is invalid. The brake is in the release state only after P4-25 is set to "Connector", the brake release condition is met, and the connector value keeps exceeding the compared threshold for a duration indicated by P4-27
P4-26	Comparison threshold for brake release	
P4-27	Brake release delay	

Note: FVC is recommended as the motor control mode where the starting torque needs to be set.

Brake release action stage

Brake release includes the brake release detection stage and brake release completion stage.

- Brake release detection:
  Brake release detection: When the value of L0711 is 1, the RFG output remains unchanged and the system waits for the brake to be released. If P4-00 is set to 1, the device waits for the time set by P4-02 and exits this stage after the set delay elapses. When P4-00 is set to 2, the feedback point of P4-04 is detected to check whether it is low level. When low level is detected, the brake apply action is canceled. When the delay time defined by P4-02 elapses and the feedback (P4-04) keeps being high level, the brake detection error will be triggered. When the error persists after the time defined by P4-05 elapses, E084.1 (Brake release fault) can be triggered.
- Brake release completion:
  The RFG is enabled and the RFG output speed increases based on the set time. The brake output state remains unchanged unless the stop or brake closing command is received. If P4-00 is set to 2, whether the feedback point of P4-04 is at a low level will be always detected.

Brake apply preparation stage

When the brake apply command is received, the brake does not apply immediately but enters the preparation stage for close.

- Condition for brake apply: Actual speed or set speed, only one of which is met when the actual speed keeps lower than the value of P4-18 for a duration defined by P4-19, or set speed keeps lower than the value of P4-20 for a duration longer than the value of P4-21, the brake apply

condition is met, and the retentive torque and brake output close stage starts. When P4-20 is set to 0%, the set speed is not judged.

- Retentive torque: When P4-08 is set to 1, the torque before brake apply is recorded as the torque output for the next startup.
- Brake apply: In this stage, the brake apply signal (L0700 = 0) is outputted and then the brake apply action stage starts.

Brake apply action stage

Brake apply actions include the brake apply detection and brake apply completion.

- Brake apply detection: After the value of L0700 is set to 0, the system waits until brake is applied. Before the brake apply action is done, the system keeps the current output to prevent the motor from sliding. If P4-00 is set to 1, the device waits for the time set by P4-03 and exits this stage after the set delay elapses.
  - When P4-00 is set to 2, the feedback point state of P4-04 is detected. When the feedback point is at the low level, the device exists this stage.
  - When the delay defined by P4-03 elapses and the feedback (P4-04) keeps being low level, the brake detection error can be triggered. When the error persists for a period longer than the time defined by P4-05, E084.2 (Brake apply fault) can be triggered.
- Brake apply completion: The brake output remains at the close state unless the operation and brake release instructions are received. If P4-00 is set to 2, the level state of P4-04 is always detected.

Blockage waiting stage

The blockage waiting stage starts from the time when the brake apply command is activated to the time when the motor speed reaches zero and the torque decreases to zero.

The torque ramp-down time during the blockage waiting stage can be set by P4-34.

Param.	Name	Description
P4-34	Brake torque ramp-down time	Defines the time for decreasing from 100% torque to zero torque.

5.4.6.5.4 Related Parameters

You can configure the brake according to the following templates. (The P4 group parameters not included in the following table keeps the default values.)

- Simple brake configuration

Item	Parameter Name	Value
P4-00	Brake function selection	1: With brake but without detection information
E1-00	RO1 function selection	Brake command output

Note: Use the default values for the remaining parameters.

- The brake has no feedback and only has the start torque to avoid shorting stator during brake release.

Item	Parameter Name	Value
P4-00	Brake function selection	1: With brake but without detection information
P4-02	Brake opening time	Set the parameter according to the actual brake release time.
P4-03	Brake closing time	Set the parameter according to the actual brake close time.
P4-08	Starting torque source in the vector control mode	2: Digital setting of start torque
P4-09	Digital setting of starting torque	Set according to the estimated load weight.
E1-00	RO1 function selection	L0700 (Brake command output)

- The brake has no feedback and only has the start torque to avoid shorting stator during brake release.

Item	Parameter Name	Value
P4-00	Brake function selection	1: With brake but without detection information
P4-02	Brake opening time	Set the parameter according to the actual brake release time.
P4-03	Brake closing time	Set the parameter according to the actual brake close time.
P4-13	Start speed source	1: Digital setting of start speed
P4-14	Digital setting of starting speed	Set according to the estimated load weight.
E1-00	RO1 function selection	L0700 (Brake command output)

- The brake has no feedback. The retentive torque is used as the start torque.

Item	Parameter Name	Value
P4-00	Brake function selection	1: With brake but without detection information
P4-02	Brake opening time	Set the parameter according to the actual brake release time.
P4-03	Brake closing time	Set the parameter according to the actual brake close time.
P4-08	Starting torque source in the vector control mode	1: Retentive torque
P4-09	Digital setting of starting torque	Use the torque as the retentive torque when the motor is started for the first time. You can also set the parameter according to the estimated load weight.
P4-10	Retentive start torque gain coefficient	Set it to 100% in normal scenarios. To adjust the proportion of the retentive torque, set this parameter.
P4-24	Brake opening permission source	The external brake control condition. When this condition is met, the brake cannot be released. When the brake is released, setting P4-24 to 0 will not close the brake.

Item	Parameter Name	Value
P4-25	Comparison value source of brake opening	This parameter specifies an additional condition for determining brake release. If P4-25 is set to 0, the condition is invalid. After P4-25 is set to a connector, the brake release condition is met, and the connector value is greater than the threshold value for a duration set by P4-27, the brake will be released.
P4-26	Comparison threshold of brake opening	
P4-27	Brake opening delay	
E1-00	RO1 function selection	L0700 (Brake command output)

- The brake can be released only when the brake has feedback and the output torque is higher than 35% of the rated torque.

Item	Parameter Name	Value
P4-00	Brake function selection	2: With brake and detection information
P4-02	Brake opening action time	Set the parameter according to the actual brake release time.
P4-03	Brake closing action time	Set the parameter according to the actual brake close time.
P4-04	Brake opening feedback point source	4: DI1. When the brake feedback source is set to DI1, the value 1 indicates brake release and 0 indicates brake close.
P4-08	Starting torque source in the vector control mode	2: Digital setting of start torque
P4-09	Digital setting of starting torque	40% (the value must be greater than 35%)
P4-25	Comparison value source of brake opening	L3260 (output torque)
P4-26	Comparison threshold of brake opening	35%
P4-27	Brake opening delay	0.2s (You can decrease this value to avoid fluctuation of measured value and to accelerate brake release.)
E1-00	RO1 function selection	L0700 (Brake command output)

5.4.6.5.5 Brake Function Application

Automatic memory of start torque

When P4-08 is set to 1, the internal torque memory function of the AC drive is activated. Upon each stop, the torque before brake closing is recorded and will be used as the start torque output upon the next startup. This reduces load drop during brake release. The automatic torque memory function can be used to adapt the load to situations where the load changes during running.

When automatic torque memory is activated for the first time, the initial value of torque memory is derived from P4-09.

You can adjust the start torque memory coefficient by setting P4-10. If P4-10 is set to 80% and the retentive torque during the stop process is 50%, the start torque will be 40%.

Excitation disabling delay

To improve the efficiency of the operation, you may want to control the asynchronous motor even if the brake is closed during stop. It also keeps the excitation current output of the motor for a period of time. In this way, when users start motors again within a short period, the brake can directly run without motor excitation (excitation time for some motors may take 3s to 5s).

After the brake is closed and the motor feedback speed reaches zero speed, the PWM output is blocked. Increase the stop delay time of d0-16 to maintain excitation for a longer time after the brake is closed, eliminating the excitation process for the next brake release. The stop delay time of d0-16 must be greater than the brake close action time. If d0-16 is smaller than the brake close action time, the excitation cannot be maintained after the brake is closed.

Parameter	Name	Description
d0-16	Shut-down delay time	When the actual speed is lower than d0-09 and the time exceeds d0-16, the PWM output is allowed to be blocked.
P4-03	Brake close time	After the brake close signal (L0700 = 0) is output, the PWM output can be blocked after P4-03.

Start torque restriction

In some lifting load scenarios, the brake can be released only when the load torque is greater than the threshold for security reasons. As the speed loop does not work before the brake is released, the torque cannot be output even if the speed is set. This requires the starting torque (see section 5.4.6.5.4 Typical Brake Configuration). The torque detection method is as follows:

This can be achieved by using the comparison function of P4-25. Set the starting torque higher than the comparison threshold, then set P4-25 to L3260, P4-26 to the threshold to be compared, and P4-27 to a delay time. When the absolute value of P4-25 keeps greater than the value of P4 for the time longer that the value of P4-27, the AC drive enters the brake release state.

Start torque direction and gain coefficient

For start torque, set P4-08 to 3 (start torque direction determined by digital setting and the motor running direction). In this case, the direction of the startup torque is related to the sign of the set speed, and the magnitude of the startup torque is related to P4-28, P4-29, and the sign of the set speed. The actual effective startup torque direction and magnitude are shown in the following examples.

RFG setting input (L3042)	Start torque digital setting (P4-09)	Positive speed-start torque gain coefficient (P4-28)	Negative speed - start torque gain coefficient (P4-29)	Actual start torque
50%	50%	50%	100%	25%
-50%	50%	50%	100%	-50%
50%	-50%	50%	100%	-25%
-50%	-50%	50%	100%	50%

Start speed direction

For the start speed, set P4-13 to 2 (start speed determined by digital setting and motor running direction). In this case, the start speed direction is related to the symbol of the set speed. The actual start speed direction is shown in the following table.

RFG setting input (L3046)	Start speed digital setting (P4-14)	Actual start speed
50%	50%	50%
-50%	50%	-50%
50%	-50%	-50%
-50%	-50%	50%

5.4.7 Tension control

5.4.7.1 Tension control

Function description

Tension control is a typical process. It is mainly used in the winding equipment to control the extension tension of material.

Related parameters

Function	Description	Details
Control mode selection	Select a proper tension control mode and winding mode based on actual situations.	"5.4.7.2.1 Control Mode Selection" on page 634
Roll diameter calculation	The roll diameter is a necessary parameter for any tension control mode. An unreasonable roll diameter value can cause the tension control function to be abnormal.	"5.4.7.2.2 Roll diameter calculation condition" on page 635
Linear speed	Linear speed plays a key role in tension control: It is used to adjust the winding synchronous running frequency, calculate the material roll diameter, and support auxiliary functions such as pre-charge, inertia compensation, and friction compensation.	"5.4.7.2.3 Linear speed" on page 639
Tension setting	In both open-loop and closed-loop torque control modes, tension control is achieved by adjusting the output torque. The target tension must be set based on material characteristics and production requirements.	"5.4.7.2.4 Tension reference" on page 641
PID closed-loop adjustment	In the closed-loop speed/torque control mode, use PID adjustment to improve accuracy. You need to set the FA group parameters (such as PID channel, direction, ratio, and integral value).	"5.4.7.2.5 PID Closed-Loop Adjustment" on page 641
Winding speed limits and unwinding reverse tightening	The winding speed limit prevents material overload breakage by setting a maximum speed. Unwinding scenarios, where revers tightening is enabled, cancels inertia with reverse torque to avoid slack, and together ensures a stable tension.	"5.4.7.2.6 Winding Speed Limits and Unwinding Reverse Tightening" on page 642

Function		Description	Details
PID adjustment limit		The PID adjustment limit controls the range of output adjustments to prevent overshoot or oscillation, ensuring smooth control and stable system.	"5.4.7.2.7 PID Adjustment Limit" on page 643
Tension torque compensation[1] (Only applicable to torque control mode)	Running friction compensation parameters	When the motor runs stably, the output torque is used for material tension establishment and rotation friction. If the rotation friction cannot be ignored, the output torque needs compensation for friction.	"5.4.7.2.8 Running Friction Compensation Parameters" on page 643
	Startup friction compensation parameters	In some scenarios, the reel is subject to large startup friction, which makes system startup difficult. In this case, torque compensation can be provided during startup and canceled once the system runs properly to ensure constant tension.	"5.4.7.2.9 Startup Friction Compensation Parameters" on page 646
	Inertia compensation parameters	In the open-loop torque control mode, the output torque is used for material tension and rotation inertia of the system during acceleration or deceleration.	"5.4.7.2.10 Inertia Compensation Parameters" on page 647
	Terminal tension rise	When the DI terminal is assigned with the corresponding function and is activated, the tension torque is boosted by certain ratio. After the DI terminal is deactivated, the boost part is canceled gradually.	"5.4.7.2.11 Terminal tension rise" on page 648
	Torque direction control parameters	This parameter takes effect only when PD-00 is set to 1 or 3. After the friction and inertia compensation are added, the calculated torque is likely to be negative. The processing method can be set by this parameter when the torque is reversed.	"5.4.7.2.12 Torque Direction Control Parameters" on page 649
Taper		In some scenarios, the tension should be reduced with the increase of the roll diameter to ensure smooth winding. For this purpose, set taper parameters properly.	"5.4.7.2.13 Taper" on page 649
Pre-charge		The pre-charge function is applied to automatic reel replacement scenarios. To achieve shockless roll change, ensure that the linear speed of the new roll matches that of the material when replacing a full roll with a new roll.	"5.4.7.2.14 Pre-charge" on page 651
Constant Linear Speed Mode		In this mode, the running frequency for winding and unwinding is automatically calculated based on the set target linear speed.	"5.4.7.2.15 Constant Linear Speed Mode" on page 652

Function		Description	Details
Optimization for control mode	Tension Setup at Zero Speed in Closed-Loop Control Mode	In scenarios demanding accurate tension setup at zero speed or roll diameter auto-tuning during tension setup at zero speed, the accurate tension setup process can be configured.	"5.4.7.2.16 Tension Setup at Zero Speed in Closed-Loop Control Mode" on page 653
	Initial roll diameter auto-tuning	When the tension setup at pre-speed function is enabled, you can also enable the initial roll diameter auto-tuning function. During tension setup, the AC drive auto-tunes the initial roll diameter to remove the need for roll diameter reset or initial roll diameter input (for tension setup at zero speed in FVC mode only).	"5.4.7.2.17 Initial Roll Diameter Auto-tuning" on page 654
	Closed-loop Tension Torque Mode	You can set the tension in closed-loop torque control mode by using PID alone or main torque + PID.	"5.4.7.2.18 Closed-loop Tension Torque Mode" on page 654
Related I/O Functions	DI Function	Tension control achieved through the DI terminal	"5.4.7.2.19 DI Function" on page 655
	AO/Pulse Output Functions	Supports output of variables related to tension control	"5.4.7.2.20 AO/Pulse Output Functions" on page 656
Monitoring		You can monitor the parameters in real time through the operating panel or the software.	"5.4.7.2.21 Monitoring" on page 656

Typical applications

Function	Description	Details
Tension Open-Loop Torque Control	Select a proper tension control mode and winding mode based on actual situations.	"5.4.7.3.1 Tension Open-Loop Torque Control" on page 659
Tension Closed-Loop Speed Control	The roll diameter is a necessary parameter for any tension control mode. An unreasonable roll diameter value can cause the tension control function to be abnormal.	"5.4.7.3.2 Tension Closed-Loop Speed Control" on page 659
Tension Closed-Loop Torque Control	In this mode, a tension sensor is used to feed back the material tension and the target frequency is regulated in closed-loop mode to ensure constant tension.	"5.4.7.3.3 Tension Closed-Loop Torque Control" on page 660
Constant linear speed control	This mode is applicable to scenarios where no specific traction is used to directly control the material tension; instead, the winding or unwinding machine runs at a constant linear speed and serves as the traction motor, and the material tension is controlled by the winding/unwinding operation.	"5.4.7.3.4 Constant linear speed control" on page 660
Application Restrictions	Description of the limitations of the four tension controls modes.	"5.4.7.3.5 Application Restrictions" on page 661

Note

[1]: These parameters can be set for the open-loop torque control mode (PD-00 = 1) and generally do not need to be set for the closed-loop torque control mode (PD-00 = 3).

5.4.7.2 Functions

5.4.7.2.1 Control Mode Selection

Select a proper tension control mode and winding mode based on actual situations. Correct running direction setting is necessary for proper tension control.

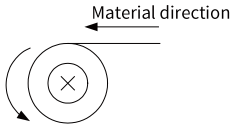
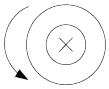
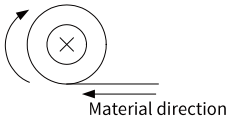
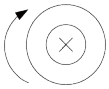
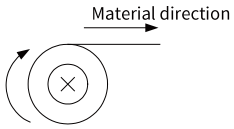
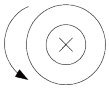
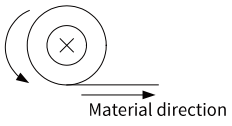
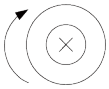
Parameter	Name	Default	Value Range	Descriptions
PD-00	Tension control mode	0	0: Disabled 1: Open-loop torque control 2: Closed-loop speed control 3: Closed-loop torque control 4: Constant linear speed control	B0-00 is used to select the tension control mode. 0: Disabled Used for direction judgment and parameter auto-tuning. 1: Open-loop torque control Tension/Position detection and feedback are not required. The drive controls torque output to control the tension on the material in the torque control mode. Use FVC to achieve optimal control effect. 2: Closed-loop speed control Tension/Position detection and feedback are required. Based on the set main frequency calculated through linear speed and roll diameter, the AC drive adjusts the output frequency by superposing the PID closed-loop operation to achieve stable tension or position in the speed control mode. The SVC, V/f control, or FVC mode can be used. 3: Closed-loop torque control Tension detection and feedback are required. Based on the set torque in the open-loop torque control mode, the AC drive controls the output torque to obtain the required tension by superposing the PID closed-loop operation. Use FVC to achieve optimal control effect. 4: Constant linear speed control In the speed mode, the AC drive adjusts its own operating frequency according to the change of roll diameter to ensure that the system runs at a constant linear speed. The SVC, V/f control, or FVC mode can be used.

When DI function 60 (exit tension control) is activated, settings in the preceding modes become invalid and the AC drive exits the tension control mode.

Parameter	Name	Default	Value Range	Descriptions
PD-01	Winding mode	0	0: Winding 1: Unwinding	Used with the DI function 58 (winding/unwinding switchover terminal) to determine the winding mode. When the terminal assigned with function 58 is inactive, the winding mode is consistent with that set by this parameter. When the terminal assigned with function 58 is active, the winding mode is reverse to that set by this parameter.
F0-09	Running direction selection	0	0: Default direction 1: Direction opposite to the default direction	You can change the rotation direction of the motor by modifying this parameter without changing the motor wiring. Modifying this parameter is equivalent to exchanging any two of the motor's U, V, W wires.

Judging the running direction:

When PD-00 is set to 1 (tension control mode disabled), the AC drive runs in speed control mode and its running direction should be the same as the target winding direction (opposite to the target unwinding direction). Otherwise, edit the parameter to correct the direction. Check the running direction according to the following figure:

Winding/ Unwinding	With-load Running Direction	No-load Running Direction (Speed Control Mode)
Winding		
		
Un-winding		
		

For the first run, determine the running direction and set the parameter properly. When the switchover between winding and unwinding is required, modify B0-01 directly, or change the state of the winding/unwinding switching terminal without modifying B0-01 (otherwise, misfunction may occur).

5.4.7.2.2 Roll diameter calculation condition

The roll diameter is a required parameter in any tension control mode. Select a proper calculation method and set the related parameters correctly to ensure accuracy of the roll diameter. Otherwise, the tension control function may fail.

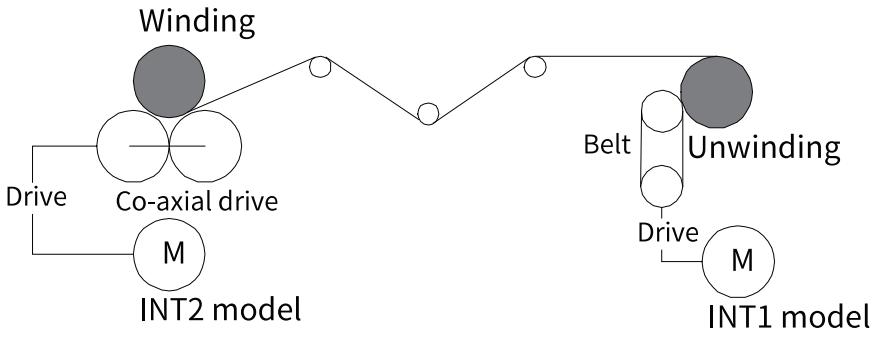


Figure 5-199 Surface winding/unwinding

Roll diameter calculation method

Table 5–97 Roll diameter calculation method

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PD-09	Winding diameter calculation method	0	0: Calculated based on linear speed 1: Calculated based on cumulative thickness 2: AI1 3: AI2 4: AI3 5: Pulse input (DI7) 6: Communication (1000H) 7: Digital setting (PD-16)	0: Calculated based on linear speed This calculation method is independent of material thickness. The roll diameter is calculated based on the linear speed and running frequency in real time, so the error is not accumulated. 1: Calculated based on accumulative thickness This calculation method does not require linear speed. The roll diameter is calculated based on the cumulative material thickness and revolution counting signals. The calculation result is stable, but the error is accumulated. 2 to 6: The reel diameter can be obtained through channels 2 to 6 to meet the situation that the reel diameter is directly measured by sensors or the reel diameter operation is performed outside the AC drive. When using the preceding channels, the maximum reel diameter (PD-10) should be set correctly according to the per-unit relationship. If AI1 is used as the reel diameter channel, the reel diameter corresponding to 100.0% of AI1 input will be the maximum reel diameter (PD-10). 7: Set by PD-16 (Digital setting of torque limit in speed control) When calculation method 7 is used, the roll diameter is directly set through D1-16 and used for additional communication address or manual roll diameter setting.

Initial reel diameter

Table 5–98 Relationship between the initial winding sources and settings

DI2	DI1	Initial Roll Diameter Source
0	0	PD-11 (winding) or PD-10 (unwinding)
0	1	PD-13
1	0	PD-14
1	1	PD-15

Note

When the system is shut down due to reel replacement, running faults, or other reasons, the roll diameter often changes. To ensure accurate roll diameter during startup of the system, roll diameter reset must be performed by enabling the function 54 of the DI terminal (roll diameter reset).

Table 5–99 Parameters related to the initial roll diameter

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PD-10	Maximum roll diameter	500.0 mm	PD-116000.0mm	Actual full roll diameter
PD-11	Empty roll diameter	100.0 mm	0.1 m to -10 mm	Actual full roll diameter
PD-12	Initial Roll Diameter Source	0	0: PD-13 (Initial winding diameter 1) to PD-15 (Initial winding diameter 3) 1: AI1 2: AI2 3: AI3 4: Communication setting (1000H)	By default, the source of the initial roll diameter is set to PD-10 or PD-11, depending on the winding mode. 1 to 4: The initial winding diameter can be obtained through channels 1 to 4. When using the preceding channels, the maximum winding diameter (b0-08) should be set correctly according to the per unit relationship.
PD-13	Initial roll diameter 1	100.0 m/min	PD-11 ± -10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-14	Initial roll diameter 2	100.0 m/min	PD-11 ± -10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-15	Initial roll diameter 3	100.0 m/min	PD-11 ± -10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-16	Current roll diameter	100.0 m/min	PD-11 ± -10 mm	This parameter shows the current roll diameter in real time. Modifying this parameter can modify the current roll diameter, and the result of roll diameter calculation will override this parameter (except PD-09 = 7). It can also be used as a way to reset the roll diameter.
PD-21	Roll diameter reset during running	0	0: Disabled 1: Enabled	This parameter can be used to enable roll diameter reset during operation.

Linear speed calculation roll diameter

Table 5–100 Parameters for roll diameter calculation based on linear speed (roll diameter calculation is affected only when PD-09 is set to 0)

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PD-03	Mechanical transmission ratio	1.00	0.01 to 300.00	This parameter specifies the ratio of motor speed to reel speed. Set B0-03 based on the mechanical transmission structure. When the linear speed is used to calculate the winding diameter (PD-09 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the winding diameter.
PD-07	Minimum linear speed for winding diameter calculation	20.0 m/min	0.0 m/min to 6500.0 m/min	This parameter takes effect only when PD-09 is set to 0. When the linear speed is lower than the value of B0-06, the current roll diameter is maintained. When the linear speed is higher than the value of B0-06, the roll diameter is calculated. This parameter can be used to solve the problems that the running frequency is low or the winding diameter calculation is incorrect during acceleration.
PD-18	Roll diameter filter time	5.00s	0.00 to 10.00s	This parameter takes effect only when PD-09 is set to 0. The user can set this parameter to filter the result of winding diameter operation and suppress the jitter of winding diameter. The larger the parameter value, the smoother the winding diameter operation, and the longer the winding diameter change delay. Rule: When the winding diameter changes linearly, the time that the calculated winding diameter lags behind the actual winding diameter is basically equal to the parameter value.
PD-19	Roll diameter change rate	0	0: Unlimited 0.1 to 1000.0 mm/s.	This parameter takes effect only when PD-09 is set to 0. You can set B0-16 to a non-zero value to limit the change of roll diameter per unit of time and prevent abnormal fast change. An excessively low setpoint can limit the reel diameter change, affecting the real-time reel diameter operation. Set this parameter based on actual conditions (you can set this parameter based on the maximum change rate at a linear speed of 100.0 m/min).
PD-20	Roll diameter change direction limit	0	0: Disable 1: Decrease inhibited during winding, and increase inhibited during unwinding	This parameter takes effect only when PD-09 is set to 0. Set this parameter to limit the direction change of the roll diameter. Use it under the condition of setting B0-16 reasonably. Otherwise, if there is abnormal fluctuation of roll diameter, excessive deviation of winding diameter calculation result will be caused.

Roll diameter calculated by accumulative thickness

Table 5–101 Parameters for roll diameter calculation based on cumulative thickness (roll diameter calculation is affected only when PD-09 is set to 1)

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PD-35	Pulses per revolution	1	1 to 60000	This parameter specifies the number of pulses per revolution of the reel.
PD-36	Revolutions per layer	1	1 to 10000	This parameter specifies the number of revolutions for each layer of winded materials, generally used for wire rods. For wire rods, set B0-30 to 1.
PD-37	Material thickness reference source	0	0: Digital setting 1: AI1 2: AI2 3: AI3	You can set B0-31 to select an input channel of material thickness. 0: Digital setting The material thickness is affected by the DI functions 62 and 63 (material thickness selection terminal). Example: PD-37 is set to 0, DI1is set to function62, and DI2 is set to function63. The material thickness is as follows. 1 to 3: The initial winding diameter can be obtained through channels 1 to 3. When the preceding channels are used, the maximum material thickness (PD-42) must be set correctly based on the per-unit relationship.
PD-38	Material thickness 0	0.01 mm	0.00 mm to 100.00 mm	For details about the material thickness 0 to 3, see PD-37.
PD-39	Material thickness 1	0.01 mm	0.00 mm to 100.00 mm	
PD-40	Material thickness 2	0.01 mm	0.00 mm to 100.00 mm	
PD-41	Material thickness 3	0.01 mm	0.00 mm to 100.00 mm	
PD-42	Maximum material thickness	1.00 mm	0.00 mm to 100.00 mm	For details about the material thickness, see PD-37.

Table 5–102 Material Thickness

DI2	DI1	Initial Roll Diameter Source
0	0	It is determined by PD-38.
0	1	It is determined by PD-39.
1	0	It is determined by PD-40.
1	1	It is determined by PD-41.

5.4.7.2.3 Linear speed

In the closed-loop speed control mode, the winding synchronous frequency reference is calculated based on the linear speed. Linear speed is required in roll diameter calculation. Linear speed can also be used for pre-drive, inertia compensation, friction compensation, and other functions. Therefore, the linear speed is an important part in tension control.

Table 5–103 Related parameters

Parameter Code	Description	Default Value	Value Range	Descriptions
PD-04	Linear speed input source	0	0: PD-05 1: AI1 2: AI2 3: AI3 4: Pulse input (DI7) 5: Communication (1000H)	0: Defined by PD-05. The setpoint is non-retentive upon power failure. 1 to 5: If the linear speed is input through the preceding channels, the maximum linear speed (PD-06) must be set properly based on per-unit relationship.
PD-05	Digital setting of linear speed input	0.0 m/min	0.0 m/min to -06 m/min	When the linear speed input source is digital setting. The linear speed value is determined by this parameter. This parameter is non-retentive upon power failure. It can be used as an additional communication address to directly communicate the speed of a given line.
PD-06	Maximum linear speed	1000.0 m/min	0.0 m/min to 6500.0 m/min	Used to set the maximum linear speed. It corresponds to the actual linear speed when 100.0% is input for channel 1 to 5 of PD-04. (It differs from the maximum linear speed required by production. Verify them during settings.) When the linear speed is used to calculate the winding diameter (PD-09 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the roll diameter.
PD-44	Constant linear speed source selection	0	0: PD-45 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI7) 5: Communication (1000H)	B0-41 is used to select the target linear speed source in the constant linear speed control mode. 0: Defined by PD-45. The setpoint is non-retentive upon power failure. 1 to 5: If the linear speed is input through the preceding channels, the maximum linear speed (PD-06) must be set properly based on per-unit relationship.
PD-45	Digital setting of constant linear speed input	0.0 m/min	0.0 m/min to -06 m/min	When digital setting is used as the source for constant linear speed, the constant linear speed is defined by this parameter, which is non-retentive upon power failure. It can be used as an additional communication address to directly communicate the fixed line speed.

5.4.7.2.4 Tension reference

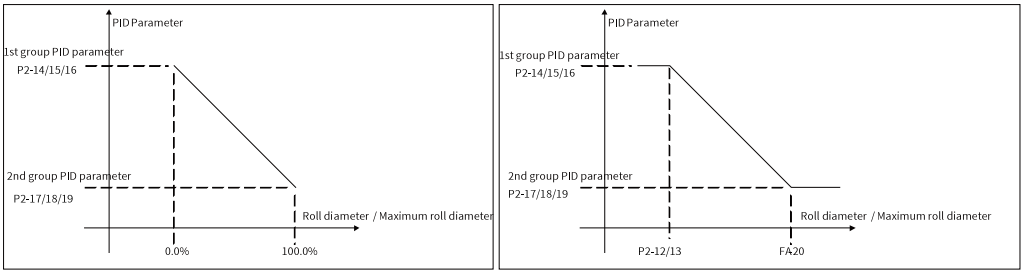
In either open-loop torque control mode (PD-00 is set to 1) or closed-loop torque control mode (PD-00 is set to 3), tension control is implemented by controlling the output torque. Therefore, a target tension must be set based on material characteristics and production requirements.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-00	Tension reference source	0	0: PE-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI7) 5: Communication (1000H)	0: PE-01 1 to 5: Indicates the ratio (in percentage) of the target tension to the maximum tension. The maximum tension (PE-02) must be set properly based on the per-unit relationship.
PE-01	Tension digital setting	50 N	0–PE-02N	See channel 0 of PE-00.
PE-02	Maximum tension	500 N	0~65000N	Used to set the maximum tension, corresponding to the tension value when 100.0% is input for channels 1 to 5 of PE-00. When the actual tension does not meet requirements, corrections can be performed by editing this parameter without changing AI, pulse input signals, or curves.

5.4.7.2.5 PID Closed-Loop Adjustment

In closed-loop speed control mode (PD-00 is set to 2) and closed-loop torque control mode (PD-00 is set to 3), PID closed-loop control based on the open-loop reference is important to ensure control accuracy. Therefore, the parameters for PID closed-loop control must be set properly. When B0-00 is set to 2 or 3, Group FA parameters required for closed-loop control, such as PID reference source, PID feedback source, PID direction, and PID proportional and integral parameters, need to be set properly based on actual conditions. Only some particular PID parameters are introduced here. For details of standard parameters, see descriptions of Group FA parameters.

The roll diameter based PID parameter switchover function is added for the tension control mode.



4: Automatic adjustment based on roll diameter 1 5: Automatic adjustment based on roll diameter 2

Figure 5-200 Automatic adjustment based on roll diameter

Parameter Code	Parameter Name	Default	Value Range	Descriptions
P2-11	PID parameter switchover condition	0	4: Automatic adjustment mode 1 based on roll diameter 5: Automatic adjustment mode 2 based on roll diameter	4: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. For other situations, thePIDparameters change linearly. 5: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. If the roll changes between a specific range determined by P2-12 and FA-20, the PIDparameters change linearly.

5.4.7.2.6 Winding Speed Limits and Unwinding Reverse Tightening

This function is valid only in torque mode (PD-00 is set to 1 or 3).

No.	Scenario	Description
1	Winding scenarios where the winding speed is not limited (subject to the frequency upper limit).	Pd-32 = 0. The winding speed is subject to the frequency upper limit.
2	Winding scenarios where the winding speed is limited	PD-32= 1. The winding speed limit is calculated according to the following formula, where the synchronous frequency is the running frequency of the winding machine that matches the current linear speed: Frequency upper limit of winding = Linear speed synchronous frequency x (1+PD-30)+PD-31.
3	Unwinding scenarios where revers tightening is disabled	PD-02 = 0
4	Unwinding scenarios where revers tightening is enabled	Reverse tightening at fixed linear speed can be enabled through P0-02.

Parameter	Name	Default	Value Range	Descriptions
PD-30	Tension frequency limit	50.0%	0.0 to 100.0%	Winding lower limit percentage (a percentage of the linear speed synchronous frequency)
PD-31	Tension frequency limit offset	5.00 Hz	0.00-100.00 Hz	Winding lower limit offset (fixed frequency)
PD-02	Unwinding reverse tightening selection	0	0: Disabled 0.1-500.0 m/min	When B0-02 is set to 0, at zero material speed, the unwinding reel has no output and the material is not tightened. If this parameter is set to 0.1 m/min to 500.0 m/min, the reel runs in the direction reverse to the set linear speed when running without material or with loose material. Under the condition of zero speed of material, the output is maintained and the material is tightened.

5.4.7.2.7 PID Adjustment Limit

This function is valid only in closed-loop mode (PD-00 is set to 2 or 3).

No.	Scenario	Description
1	The closed-loop speed control mode is used and the closed-loop limit is associated with the synchronous frequency.	PD-32 = 0 Closed-loop adjustment limit = Linear speed synchronous frequency x PD-30 + PD-31
2	The closed-loop speed control mode is used and the closed-loop limit is set to a fixed frequency.	PD-32 = 1 Closed-loop adjustment limit = PD-31
3	The closed-loop torque control mode is used and the closed-loop limit is set to a fixed torque.	The limit is set through PD-34 and the value is a percentage of the motor rated torque.

Parameter	Name	Default	Value Range	Descriptions
PD-30	Tension frequency limit	50.0%	0.0 to 100.0%	Winding lower limit percentage (a percentage of the linear speed synchronous frequency)
PD-31	Tension frequency limit offset	5.00 Hz	0.00-100.00 Hz	Winding lower limit offset (fixed frequency)
PD-34	Tension closed-loop torque limit	100.0%	0.0 to 200.0%	Used to limit the ratio (in percentage) of the closed-loop torque control value to the open-loop control torque reference in the closed-loop torque control mode (PD-00 is set to 3).

5.4.7.2.8 Running Friction Compensation Parameters

When the motor runs stably, the output torque is used for material tension establishment and rotation friction. If the rotation friction cannot be ignored, the output torque needs compensation for friction.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-07	Friction force compensation	0.0%	0.0 to 50.0%	In tension control mode, the AC drive automatically sets the target torque according to the tension reference and reel diameter. The target torque is increased (winding)/decreased (unwinding) according to the setting of this parameter to offset the effect of friction on material tension. This parameter value is a percentage to the rated torque of the drive.
PE-16	Friction force compensation correction coefficient	0.0%	50.0 to 50.0%	In most scenarios, friction may vary with running frequency. Using PE-07 may not achieve ideal friction compensation effect, so it can be used with this parameter. See PE-17 for details. This parameter value is a percentage to the rated torque of the drive.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-17	Friction force compensation curve	0	0: Running frequency 1: Linear speed 2: Multi-segment friction force compensation curve 1 3: Multi-friction force compensation curve 2	Five friction compensation modes are available to meet the complex friction change rule. 0: Compensation is performed according to the running frequency. In some cases, the friction force will change with the running frequency of the system. When this mode is set, the friction force compensation value is determined by the following formula: Friction compensation torque = PE-07 x (1 + Linear speed conversion frequency/Maximum frequency x PE-16). 1: Compensation is performed according to the linear speed, which is similar to Mode 0. The compensation correction is based on the linear speed, and the value of friction compensation is determined by the following formula: Friction compensation torque = PE-07 x (1 + Linear speed/Maximum linear speed x PE-16). 2. Multi-friction force compensation curve 1. In some cases, the friction force does not change linearly with frequency. At this time, the frequency can be converted based on the linear speed in the multi-section curve to obtain dynamic friction force compensation. For details, see PE-18 to PE-23. 3. Multi-friction compensation curve 2. Compared with the compensation curve 1, the compensation curve 2 is more flexible, but more parameters need to be set.
PE-18	Multi-segment friction compensation torque 1	0.0%	0.0 to 50.0%	-
PE-19	Multi-segment friction compensation torque 2	0.0%	0.0 to 50.0%	-
PE-20	Multi-segment friction compensation torque 3	0.0%	0.0 to 50.0%	-
PE-21	Multi-segment friction compensation torque 4	0.0%	0.0 to 50.0%	-
PE-22	Multi-segment friction compensation torque 5	0.0%	0.0 to 50.0%	-

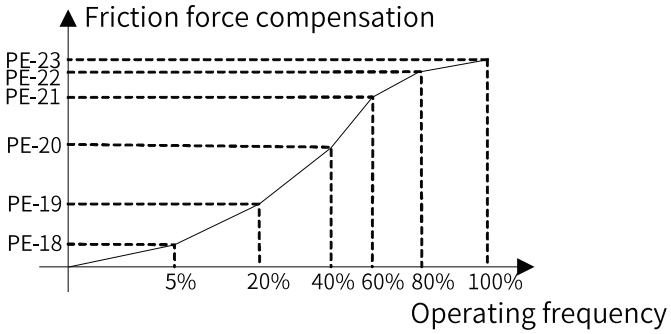
Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-23	Multi-segment friction compensation torque 6	0.0%	0.0 to 50.0%	-
PE-24	Multi-segment friction compensation inflection point 1	0.00 Hz	0.00 Hz to maximum frequency	-
PE-25	Multi-segment friction compensation inflection point 2	0.00 Hz	0.00 Hz to maximum frequency	-
PE-26	Multi-segment friction compensation inflection point 3	0.00 Hz	0.00 Hz to maximum frequency	-
PE-27	Multi-segment friction compensation inflection point 4	0.00 Hz	0.00 Hz to maximum frequency	-
PE-28	Multi-segment friction compensation inflection point 5	0.00 Hz	0.00 Hz to maximum frequency	-
PE-29	Multi-segment friction compensation inflection point 6	0.00 Hz	0.00 Hz to maximum frequency	-

The preceding parameters are used for multi-friction compensation curves 1 and 2.

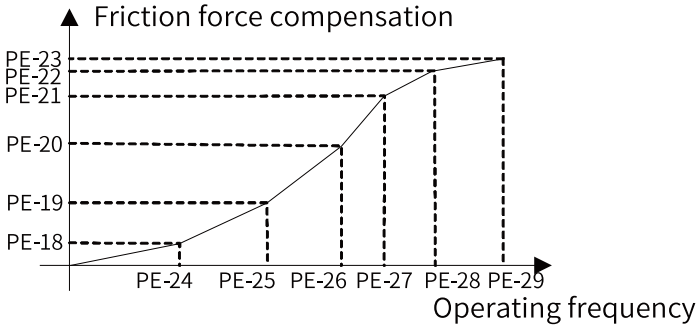
When PE-17 is set to 2, parameters PE-18 to PE-23 take effect. When PE-17 is set to 3, PE-18 to PE-29 take effect.

The change curves of friction compensation values are as shown in the following figures. You can set B1-18 based on actual conditions.

When PE-17 is set to 2, friction compensation curve 1 is as follows.



When PE-17 is set to 3, friction compensation curve 2 is as follows.



5.4.7.2.9 Startup Friction Compensation Parameters

In some scenarios, the reel is subject to large startup friction, which makes system startup difficult. In this case, torque compensation can be provided during startup and canceled once the system runs properly to ensure constant tension.

Parameter	Name	Default	Value Range	Descriptions
PE-03	Zero-speed threshold	0.0%	0.0 to 20.0%	If the running frequency is lower than the value of this parameter, startup friction tension compensation will be carried out according to PE-04. If the running frequency is higher than the value of this parameter, startup friction tension compensation will not be carried out.
PE-04	Zero-speed tension rise	0.0%	0.0 to 100.0%	This parameter corresponds to the percentage of tension reference and must be set properly according to the range of allowable material tension. On the premise of ensuring startup, the parameter value must be as small as possible.
PE-14	Zero-speed compensation over-frequency	2.00 Hz	0.00 Hz to 20.00 Hz	This parameter supports smooth switchover of zero-speed tension rise at the threshold.

The preceding three parameters can be used together for static compensation, as shown below.

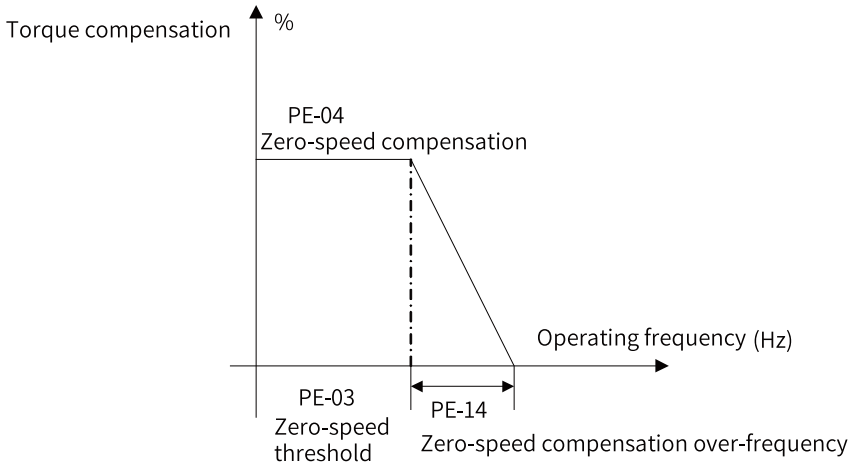


Figure 5-201 Static friction compensation function

5.4.7.2.10 Inertia Compensation Parameters

In the open-loop torque control mode, the output torque is used for material tension and rotation inertia of the system during acceleration or deceleration.

In any of the following cases, consider inertia compensation:

- Small material tension during acceleration of winding
- Large material tension during deceleration of winding
- Large material tension during acceleration of unwinding
- Small material tension during deceleration of unwinding

The inertia of a winding/unwinding system consists of mechanical inertia and material inertia. The parameter can be set according to the value mapping between mechanical inertia and material inertia. If the material is heavy and the reel is light, only the parameters related to material inertia need to be set, and vice versa.

Accurate linear speed is required for inertia compensation.

Parameter	Name	Default	Value Range	Descriptions
PE-08	Mechanical inertia compensation coefficient	0 Nm^2	0 to 65535 Nm^2	Set B1-08 based on the actual mechanical flywheel inertia. For general cylindrical mechanical reels, the theoretical value of mechanical flywheel inertia can be obtained using the following formula: $GD_M^2=\frac{\pi g}{8i^2}\gamma b\,(D^4-D_0^4)$ Where, g is the gravitational acceleration (9.8 m/s^2), γ is the density of machine materials, b is the length of the mechanical reel, D and D1 are respectively the outer diameter and inner diameter (0 for a solid reel) of the mechanical reel, and i is the transmission ratio. The international system of units (SI) is applied. The setting value can be adjusted according to the actual change of material tension during acceleration or deceleration.
PE-11	Material density	0 Kg/m^3	0 x 65535 Kg/m^3	Set this set of parameters with reference to the actual material properties, and set the exact mechanical transmission ratio (D1-03) at the same time. The AC drive automatically calculates the flywheel inertia according to the material density, material width, reel diameter, and material roll diameter.
PE-12	Material width	0 mm	0-65535 mm	
PE-09	Correction of acceleration inertia compensation	100.0%	0.0 to 200.0%	An inevitable deviation exists between the theoretical inertia and the actual inertia, so the inertia compensation effect may not be ideal even after the inertia parameters are set. This set of parameters can be fine-tuned to optimize the control effect. Taking the winding acceleration as an example, if the material tension is small, PE-09 can be increased to strengthen the compensation effect, otherwise, the parameter can be reduced. It works the same for deceleration. This group of parameters can facilitate commissioning.
PE-10	Correction of deceleration inertia compensation	100.0%	0.0 to 200.0%	

5.4.7.2.11 Terminal tension rise

In some scenarios, customized torque boost is required.

When the DI terminal (assigned with function 61) is activated, the tension torque is boosted by certain ratio. After the DI terminal is deactivated, the boost part is canceled gradually.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-33	Terminal tension rise ratio	50.0%	0.0 to 500.0%	/
PE-34	Terminal torque boost cancellation time	0.0s	0.0–50.0s	-

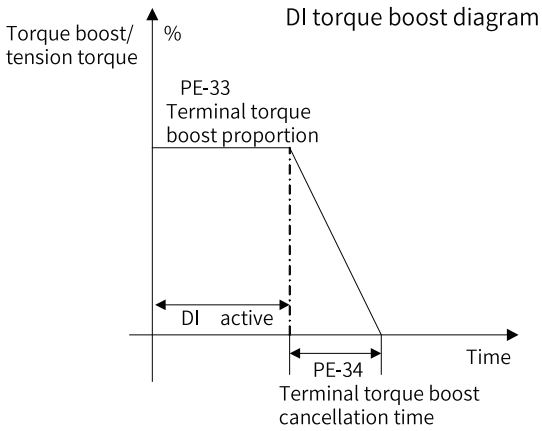


Figure 5-202 DI torque boost function

5.4.7.2.12 Torque Direction Control Parameters

Parameter	Name	Default	Value Range	Descriptions
PE-15	Open-loop torque reversal	0	0: Reverse torque inhibited 1: Enabled	This parameter takes effect only when PD-00 is set to 1 or 3. After the friction and inertia compensation are added, the calculated torque is likely to be negative. The processing method can be set by this parameter when the torque is reversed. The torque direction is limited by default. You can set this parameter to allow reverse direction.

5.4.7.2.13 Taper

In some scenarios, the tension should be reduced with the increase of the roll diameter to ensure smooth winding. For this purpose, set taper parameters properly. This group of parameters is valid only in the winding mode (PD-01 is set to 0).

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-00	Taper curve selection	0	0: Curve taper 1: Multi-taper	Used to set the generation mode of the taper curve. 0: The specific taper curve is generated according to the tapper setting and taper compensation correction value (b2-03). See the description of b2-03. 1: For details of the linear multi-taper, see description of PE-08 to PE-19.
PE-01	Tension taper source	0	0: PE-02 1: AI1 2: AI2 4: Communication (1000H)	0: PE-02 1–2: Set by analog channels 1 to 2 4: Communication setting (1000H)
PE-02	Taper digital setting	0.0%	0.0 to 100.0%	See channel 0 of PE-01.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-03	Correction of tension taper compensa-tion	0 mm	0-10000 mm	Used to set the correction value of tension taper compensation. The curve taper is implemented together with the taper setting, and the taper value can be determined according to the following formula (the taper is implemented in a variety of ways, and the current software uses one of the following typical implementation methods): F=F_0*{1-K*[1-(D_0+D_1)/(D+D_1) Where, F is the tension after taper is set; F_0 is the tension before taper is set, determined by B1-00; K is the taper value, determined by B2-01; D_0 is the reel diameter set through B0-09; D is the current roll diameter set through B0-14; D1 is the correction coefficient of taper compensation.
PE-05	Maximum external taper source	0	0: PE-06 1: AI1 2: AI2 4: Communication (1000H)	In some cases, the material tension is determined by the external actuator. In this case, the external taper output function can be used to control the external executive parts to obtain the tension taper. The maximum external taper value determines the maximum taper output value when the external taper output (DO function 19) is selected for FMP or AO (F5-06 to F5-08) , that is, the corresponding output value when the roll is empty. Its value setting channel is determined by this parameter. 0: PE-06 1-2: Set by analog channels 1 to 2 4: Communication setting (1000H)
PE-06	External taper setting	100.0%	0.0 to 100.0%	It defines the digital setting of the maximum external taper value. See value 0 of PE-05.
PE-08	Minimum roll diameter taper	100.0%	0.0 to 100.0%	Taper corresponding to minimum winding diameter
PE-09	Linear taper switchover point 1	150.0 mm	PD-11 to PE-11	-
PE-10	Taper of switchover point 1	100.0%	0.0 to 100.0%	-
PE-11	Linear taper switchover point 2	200.0 mm	**PE-09** to **PE-13**.	-
PE-12	Taper of switchover point 2	90.0%	0.0 to 100.0%	-
PE-13	Linear taper switchover point 3	250.0 mm	**PE-11** to **PE-15**.	-
PE-14	Taper of switchover point 3	80.0%	0.0 to 100.0%	-

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PE-15	Linear taper switchover point 4	300.0 mm	**PE-13** to **PE-17**.	-
PE-16	Taper of switchover point 4	70.0%	0.0 to 100.0%	-
PE-17	Linear taper switchover point 5	400.0 mm	**PE-15** to **PD-10**.	-
PE-18	Taper of switchover point 5	50.0%	0.0 to 100.0%	-
PE-19	Max. roll diameter taper	30.0%	0.0 to 100.0%	-

The following figure shows a multi-point linear taper curve, where the ordinate represents the ratio of tension after taper is set to original tension, and the abscissa represents the roll diameter. You can set the preceding parameters to obtain a multi-liner taper curve.

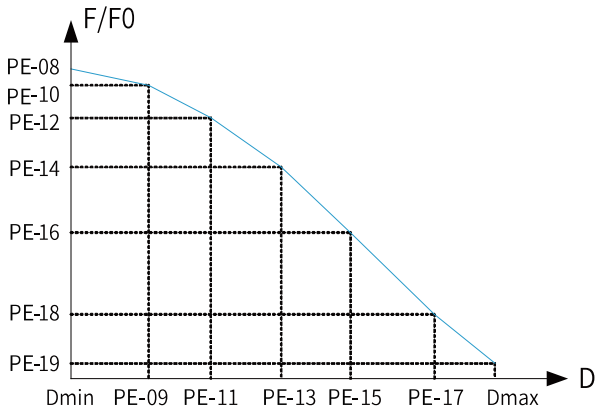


Figure 5-203 Multi-point linear taper curve

5.4.7.2.14 Pre-charge

The pre-charge function is applied to automatic reel replacement scenarios. To achieve shockless roll change, ensure that the linear speed of the new roll matches that of the material when replacing a full roll with a new roll. For this purpose, enable function 57 (pre-charge terminal) of the DI terminal and set the pre-charge parameters properly.

Accurate linear speed and roll diameter are required for this function.

Parameter Code	Parameter Name	Default	Value Range	Descriptions
PD-22	Pre-drive speed gain	0.0%	100.0 to 200.0%	For pre-charge, the running frequency is automatically calculated based on the linear speed and roll diameter to ensure matching with the linear speed of the material. For small deviation of linear speed, you can increase or decrease the operating frequency through this parameter during pre-drive , ensuring accurate linear speed matching.
PD-23	Pre-charge torque limit source	0	0: F2-09 1: Torque in tension control mode	In the torque control tension mode, the target torque is automatically generated to meet the material tension demand. In the normal operation mode, the target torque can also be set according to F2-32. This parameter provides the preceding options for the source of the target torque in the pre-drive mode. You can set it as required. 0: The target torque is set by F2-32. 1: The target torque is set according to the open-loop torque in the tension control mode (for mode 1 and mode 3 only).
PD-24	Pre-drive torque correction	0.0%	100.0 to 100.0%	The parameter takes effect when PD-23 is set to 1 and is used to correct the tension control torque in pre-drive mode. To avoid excessively slow pre-drive acceleration due to low torque limit when PD-23 is set to 1, the minimum torque limit in pre-drive mode can be limited.
PD-26	Pre-drive acceleration time	20.0s	0.0s to 6000.0s	PD-26, PD-27, and D1-28 are used to set the time as a group, which correspond to the acceleration and deceleration time when the roll diameter is the minimum roll diameter. With the increase of roll diameter, the acceleration and deceleration time increase in proportion to avoid the impact caused by excessive acceleration and deceleration in large winding.
PD-27	Pre-drive deceleration time	20.0s	0.0s to 6000.0s	
PD-28	Minimum torque limit in pre-charge mode	0.0%	0.0 to 100.0%	
PD-29	Pre-charge roll diameter calculation function	0	0: Disabled 1: Enabled	This parameter takes effect only when PD-09 is set to 1. When the winding diameter is calculated by thickness accumulation, the winding diameter increases/decreases with the number of revolutions of the reel. At this time, this parameter can be set to 1 to avoid the cumulative error caused by the failure of winding diameter calculation during pre-driving. You can set this parameter as required.

5.4.7.2.15 Constant Linear Speed Mode

In this mode, the running frequency for winding and unwinding is automatically calculated based on the set target linear speed.

Parameter	Name	Default	Value Range	Descriptions
PD-44	Constant linear speed source selection	0	0: PD-45 1: AI1 2: AI2 4: Pulse reference (DI7) 5: Communication (1000H)	0: Digital setting of D1-45 and non-retentive upon power failure 1 to 2: AI channel 4: Pulse 5: Communication address (1000H); set by percentage
PD-45	Digital setting of constant linear speed input	0 m/min	0.0 m/min to 6500.0 m/min	When digital setting is used as the source for constant linear speed, the constant linear speed is defined by this parameter, which is non-retentive upon power failure.

5.4.7.2.16 Tension Setup at Zero Speed in Closed-Loop Control Mode

Generally, the AC drive can run without the need for additional configuration of closed-loop control.

Configure the following parameters in scenarios demanding accurate tension setup at zero speed or roll diameter auto-tuning during tension setup at zero speed.

Parameter	Name	Default	Value Range	Descriptions
PE-30	Tension establishment	0	0: Disable 1: Enabled	In closed-loop control mode, when PE-30 is set to 0, the pre-speed tensioning function is disabled. When PE-30 is set to 1, the pre-speed tensioning function is enabled.
PE-31	Tension establishment dead zone	2.0%	0.0 to 100.0%	The PID operation stops when the pre-speed tensioning function is enabled and the PID feedback is lower than the value of PE-31.
PE-32	Tension establishment frequency	0.10 Hz	0.00 Hz to F0-10	Used to set the running frequency in scenarios where the tension setup at pre-speed function is enabled but the system is not in the tension setup dead zone.

For details about tension setup at zero speed, see . You can set PE-30 to 1 to enable the tension setup at pre-speed function and set PE-31 to define the tension setup dead zone.

When PID feedback is below the tension setup dead zone, PID calculation stops and the reel runs at a fixed frequency to slowly wind the material.

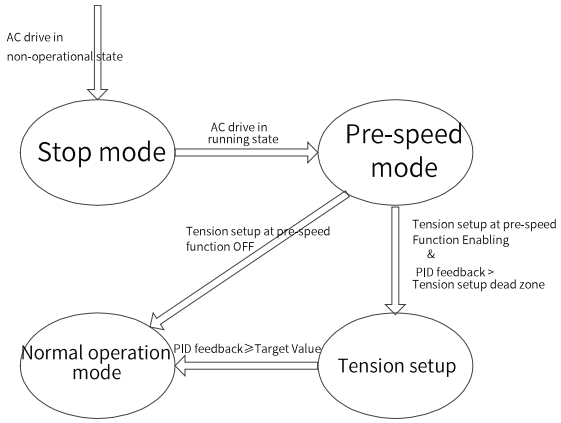


Figure 5-204 Diagram of tension setup at zero speed

5.4.7.2.17 Initial Roll Diameter Auto-tuning

When the pre-speed tension function is enabled, the initial roll diameter auto-tuning function can be configured. During tension setup, the AC drive auto-tunes the initial roll diameter to remove the need for roll diameter reset or initial roll diameter input (for tension setup at zero speed in FVC mode only).

Parameter	Name	Default Value	Value Range	Descriptions
PE-36	Initial roll diameter auto-tuning	0	0: Disabled 1: Enabled	When the pre-speed tension function is enabled, the initial winding diameter auto-tuning function can be configured to realize the auto-tuning of the initial winding diameter, which is only suitable for swing rod control. This function is enabled when PE-36 is set to 1 and disabled when PE-36 is set to 0.
PE-37	Rod length	300 mm	1-65535 mm	Indicates the rod length after initial winding diameter auto-tuning.
PE-38	Rod angle	40°	0.1 degree to 360.0 degrees	Indicates the rod angle after initial winding diameter auto-tuning.

5.4.7.2.18 Closed-loop Tension Torque Mode

You can set the tension in closed-loop torque control mode by using PID alone or main torque + PID.

Param.	Name	Default	Value Range	Descriptions
PD-33	Closed-loop tension torque mode selection	0	0: Torque calculated through pure PID 1: Torque calculated through main + PID	-

The main torque is the torque calculated when PD-00 is set to 1.

In pure PID mode, the set friction and inertia compensation are still valid, but the tension torque is invalid.

When the main + PID mode is used, accurately configure the tension corresponding to 100.0% of PID feedback value, and set parameter PE-02.

5.4.7.2.19 DI Function

The DI function facilitates the implementation and operation of tension control. The DI provides a wide range of functions in conjunction with the setting of related parameters.

The DI function is set through PF-30 to PF-42. Flexible communication functions can be implemented through virtual DIs. The general terminal functions of the drive are not described here.

DI Function

When roll diameter is calculated based on accumulative thickness, set this function for the DI terminal to input revolution count signals from the terminal.

DI function 54: Roll diameter reset

Roll diameter reset during reel replacement is necessary for tension control. It ensures accurate roll diameter at the moment when the system is started after reel replacement, and also ensures normal system startup and proper material tension.

DI functions 55 and 56: Initial roll diameter selection terminals 1 and 2

These functions provide initial roll diameter switchover modes to meet different requirements for different reels or materials. For details of use, see PD-12.

DI Function

When the terminal is activated, the AC drive is switched to the pre-charge speed control mode. After the roll is changed, deactivate this terminal to activate the tension function.

DI function 58: Switchover between winding and unwinding

Winding/unwinding switchover is performed without modifying the parameter, greatly facilitating the operation. For details of use, see PD-01.

DI function 59: Roll diameter calculation stopped

When the terminal is activated, the roll diameter calculation is disabled.

DI terminal function: Exit tension mode

When the terminal is activated, the system exits the tension control mode and the AC drive restores general AC drive functions (the frequency source and torque source are enabled based on the general AC drive functions).

DI terminal function: Terminal tension increases

When the terminal is activated, the tension torque is increased by a certain ratio. After the DI terminal is deactivated, the boost part will be canceled gradually based on time.

DI functions 62 and 63: Thickness selection terminals 1 and 2

These functions provide material thickness switchover modes to meet different requirements for materials with different thickness. In the tension mode, PD-38/39/40/41 is selected as the material thickness through terminal combinations. When these two terminals are inactive, PD-38 is selected as the material thickness. When only the terminal for thickness selection 1 is active, PD-39 is selected as the material thickness. When only the terminal for thickness selection 2 is active, PD-40 is selected as the initial reel diameter. When these two terminals are active, PD-41 is selected as the material thickness.

Passive unwinding (cable drum application)

Defines the winding mode. When the encoder feedback speed is negative or the terminal is set to "Passive unwinding", and the dynamic friction compensation is the current torque reference x PD-50.

Emergency stop - Tension torque compensation enable

In tension mode, when PE-54 is enabled, the PI switches to the emergency stop PI parameter (PE-51 to PE-53). Description:

5.4.7.2.20 AO/Pulse Output Functions

In addition to the AC drive, PLC or actuators also affect the tension control function. The AC drive supports output of variables related to tension control, enriching means to realize the tension control function.

The AO/pulse output is set through E3-00. The general terminal functions of the AC drive are not described here.

Output function 17: External taper output

When the tension taper control is required and the material tension is determined by the external actuator, you can enable this function to output taper.

Output function 18: Roll diameter output

When the roll diameter is calculated in the AC drive and the calculation result needs to be output, you can enable this function to output the result.

Output function 19: Tension output

You can enable this function to output the tension reference of the AC drive. The actual valid tension after taper calculation is calibrated based on the maximum tension (PE-02).

5.4.7.2.21 Monitoring

The following table lists monitoring parameters, which can be monitored through an operating panel or in the background in real time.

Parameters	Parameter Name	Unit	Description
U7-00	Linear speed	0.1 m/min	Indicates the target linear speed of the tension process.
U7-01	Current winding diameter	0.1 mm	This parameter represents the current roll diameter.
U7-02	Linear speed synchronization frequency	0.01 Hz	This parameter represents the motor target frequency that is synchronized with the linear speed.
U7-03	Closed loop speed output	0.01 Hz	Indicates the motor target frequency calculated by the PID output in closed loop tension speed mode.
U7-04	Tension reference (before taper)	1 N	This parameter represents the tension setpoint calculated based on the tension setting source.

Parameters	Parameter Name	Unit	Description
U7-05	Tension reference (after taper)	1 N	This parameter represents the tension setpoint calculated by the taper, which is the actual tension setpoint in effect.
U7-06	Torque reference	0.1%	This parameter represents the target torque of the tension process.
U7-07	Closed loop torque output	0.1%	This parameter represents the target torque calculated by the PID output in closed loop tension torque mode.
U7-08	Tension control state machine	1	This parameter represents the state of the tension process, where: 0 indicates a non-tension control state, and the tension process is invalid; 10 represents an open loop torque control state; 20 to 23 represent the closed loop tension speed control state, and 20 represents the shutdown branch state, 21 represents the pre-speed branch state, 22 represents the tension setup branch state, and 23 represents the normal operation branch state; 30 to 33 represent the closed loop tension torque control state, and 30 represents the shutdown branch state, 31 represents the pre-speed branch state, 32 represents the tension setup branch state, and 33 represents the normal operation branch state; 40 represents constant linear speed control state; 50 represents pre-drive control state.
U7-09	Closed loop tension (speed/torque) PID setting display	0.1%	Indicates the PID reference in closed loop tension (speed/torque) control mode.
U7-10	Closed loop tension (speed/torque) PID feedback display	0.1%	Indicates the PID feedback value in closed loop tension (speed/torque) control mode.
U7-11	Closed loop tension (speed/torque) PID proportional output	1	Indicates the PID calculation proportional output value in closed loop tension (speed/torque) control mode.
U7-12	Closed loop tension (speed/torque) PID integral output	1	This parameter represents the PID calculation integral output value in closed loop tension (speed/torque) control mode.
U7-13	Closed loop tension (speed/torque) PID derivative output	1	This parameter represents the PID calculation derivative output value in closed loop tension (speed/torque) control mode.
U7-14	Tension process execution time	1	Records the actual execution time of tension process in each cycle.
U7-15	Winding mode	1	This parameter indicates the winding/unwinding state when the tension process is valid. 0 indicates winding, and 1 indicates unwinding.

Parameters	Parameter Name	Unit	Description
U7-16	Tension torque setpoint	0.1%	This parameter represents the set torque calculated based on parameters such as tension setpoint, roll diameter, etc.
U7-17	Static friction torque	0.1%	This parameter represents the frictional torque caused by the static friction of the system.
U7-18	Dynamic friction torque	0.1%	This parameter represents the frictional torque caused by the dynamic frictional force during operation.
U7-19	Inertia torque	0.1%	This parameter indicates the torque caused by the system inertia.
U7-20	Terminal lift torque	0.1%	This parameter represents the torque at which the terminal tension is increased and the base value is the tension torque setpoint.
U7-21	Torque upper limit in vertical cable drum application (calculated value)	0.1%	Defines the maximum torque output calculated for vertical cable drum applications based on maximum set tension and empty roll diameter.
U7-22	Torque lower limit in vertical cable drum application (calculated value)	0.1%	Defines the minimum torque output calculated for vertical cable drum applications based on minimum set tension and max. roll diameter.
U7-23	Torque upper limit in vertical cable drum application (actual value)	0.1%	Defines the max. torque calculated for vertical cable drum applications.
U7-24	Torque lower limit in vertical cable drum application (actual value)	0.1%	Defines the min. torque calculated for vertical cable drum applications.
U7-25	Closed loop tension (speed/torque) PID output	0.1%	This parameter represents the PID calculation output (i.e., sum of proportional, integral, derivative) in closed loop tension (speed/ torque) control mode.
U7-26	Linear acceleration	0.1%	This parameter represents the linear acceleration of the material during operation.

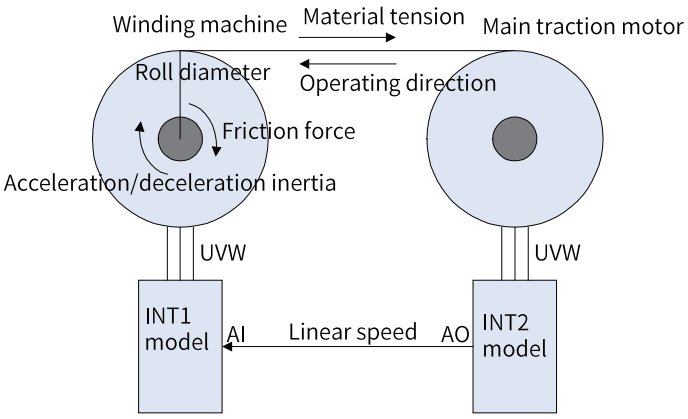
For better control effect, conduct commissioning based on the measurements obtained using a speed measuring device or tape and comparison between such measurements with related monitoring parameters.

5.4.7.3 Typical Applications

This section describes the typical application of each tension control mode (corresponding to the PD-00 selection).

5.4.7.3.1 Tension Open-Loop Torque Control

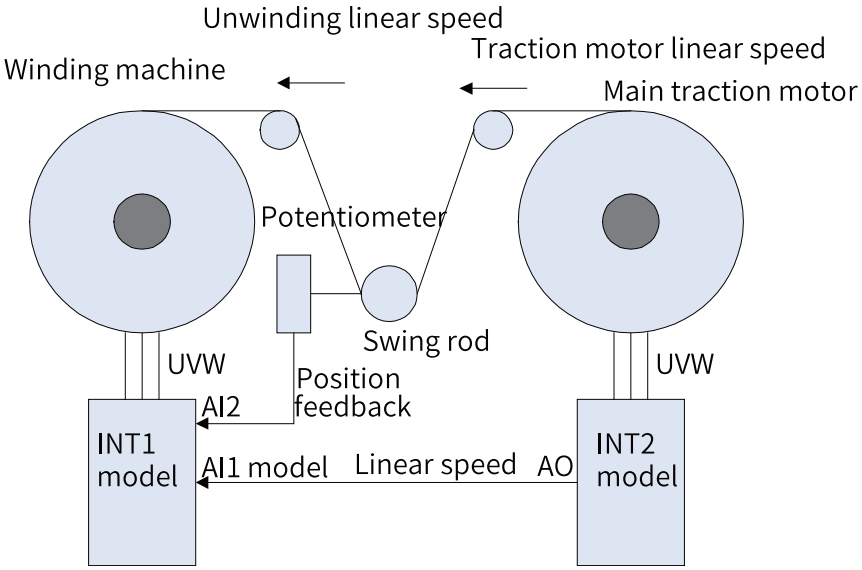
In this mode, no swing rod (floating roller) or tension sensor is required. Tension accuracy is slightly low. This control mode is applicable to scenarios where tension accuracy is not critical.



In the preceding figure, the winding machine runs in tension open-loop torque control mode. The roll diameter is calculated based on the linear speed and the target torque is updated based on the set material tension and current roll diameter. You can set the friction compensation torque and dynamic inertia compensation torque as needed to improve the tension control effect.

5.4.7.3.2 Tension Closed-Loop Speed Control

In this mode, a swing rod (floating roller) or tension sensor is used to feed back material tension. The output frequency of the AC drive is regulated in the closed-loop mode to ensure stable swing rod position or constant tension. The tension is controlled by linear speed synchronous frequency and PID closed-loop frequency. This mode is applicable to scenarios where the speed can be adjusted (the system has an swing rod for pre-charge) or the material can be pulled and stretched.

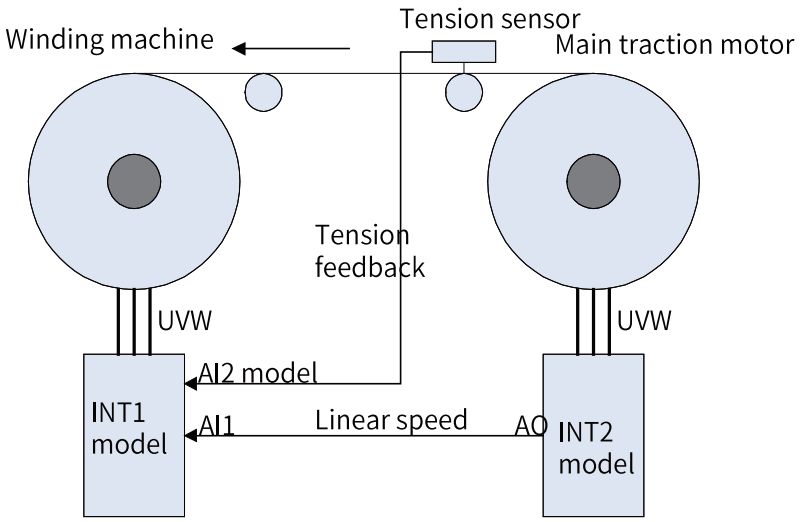


As shown in the preceding figure, when the winding machine works in closed-loop speed control mode, two AI signal channels receive swing rod position potentiometer signals and main traction motor running frequency signals, respectively. The roll diameter is calculated based on linear speed control. The target frequency depends on the main frequency calculated based on linear speed synchronous frequency and the closed-loop regulation based on swing rod position feedback.

The general-purpose AC drive supports main frequency + PID as the frequency source. In tension control mode, the roll diameter is calculated in real time to facilitate matching between the main frequency and linear speed. Therefore, the tension control stability and speed are improved.

5.4.7.3.3 Tension Closed-Loop Torque Control

In this mode, a tension sensor is used to feed back the material tension and the target frequency is regulated in closed-loop mode to ensure constant tension. The main + PID mode or pure PID mode can be configured as needed. The main + PID mode incorporates the operation torque in tension open-loop torque mode, whereas the pure PID mode achieves constant tension control through torque adjustment by pure PID. To optimize dynamic response, enable friction and inertia compensation. This mode is applicable to materials with regular elasticity or applications with small speed adjustment margin.

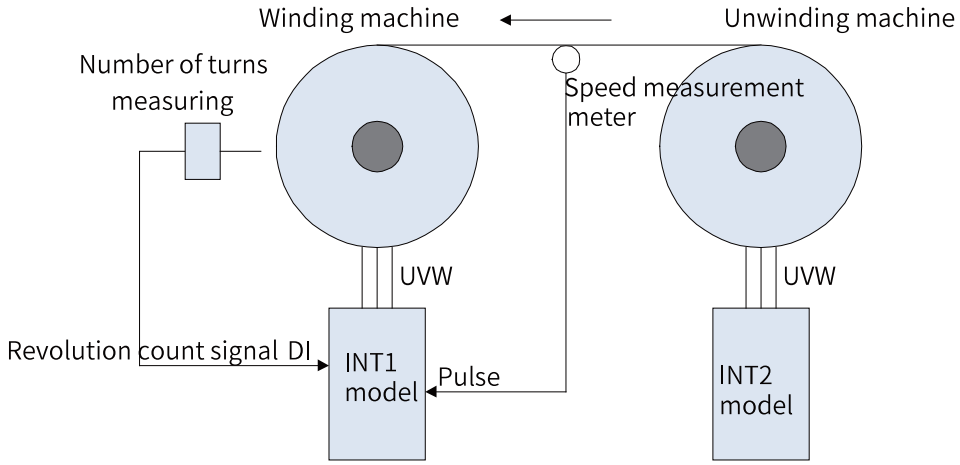


In the preceding figure, when the winding machine works in closed-loop torque control mode, two AI signal channels receive tension sensor signals and main traction motor linear speed signals, respectively. When tension is controlled in the "open-loop tension reference plus tension sensor regulation" mode, the torque of friction and inertia compensation can be set as needed.

For scenarios where elastic materials (speed adjustment margin and tension sensor) and tension sensors are used, the tension closed-loop speed control mode can also be applied.

5.4.7.3.4 Constant linear speed control

Different from preceding modes, this mode is applicable to scenarios where no specific traction is used to directly control the material tension; instead, the winding or unwinding machine runs at a constant linear speed and serves as the traction motor, and the material tension is controlled by the winding/unwinding operation.



In the preceding figure, the winding machine serves as the traction motor. To make the system run at a constant linear speed, the roll diameter must be calculated in either of the following two modes:

- Assign the DI terminal with the revolution count signal function to calculate the roll diameter in thickness overlying mode based on revolution count signals.
- Install a speed measuring device to measure the material linear speed and calculate the roll diameter based on the measured linear speed. Update the target frequency based on the target linear speed and current roll diameter to make the system run at a constant linear speed.

The preceding typical applications only describes the four tension control modes. You can also use other applicable modes. If the basic conditions are met, you can handle them flexibly according to actual conditions.

5.4.7.3.5 Application Restrictions

The preceding section describes four typical tension control applications, which are determined by roll diameter, linear speed, and control feedback.

Table 5–104 Required conditions for tension control modes

Control Mode	Roll Diameter[Note 1]	Linear speed	Control Feedback
Open-Loop Torque Control	Required	Not required	Not required
Closed-loop Speed Control	Required	Required	Required
Closed-Loop Torque Control	Required	Not required	Required
Constant linear speed control	Required	Not required	Not required

Notes:

Note 1: If the roll diameter is calculated based on linear speed control (PD-09 is set to 0), the linear speed is required.

Note 2: Inertia and friction compensation is associated with linear speed, so the linear speed is required in such applications.

5.4.8 Free Function Module

5.4.8.1 Free Function Module

In more complex engineering applications, the MD630-INT can use the free function module to associate multiple status signals and control signals together to achieve project control requirements. The application functions of MD630-INT include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting module. You can set related parameters to achieve simple logic operation.

5.4.8.2 Word-bit Coversion Module

5.4.8.2.1 Word-to-bit Conversion Module

Description

This module enables conversion between 16-bit data and 16-bit bits.

Applicable scenario

Generally, custom status words can be generated for viewing through the word-bit conversion module, or the user-defined control words can be parsed through the word-bit conversion module to meet control requirements.

5.4.8.2.2 Word-to-bit module (A to D)

Function description

The word-to-bit module is used to convert 16-bit data to bit0-bit15, which is a total of 16 bits.

Working principle

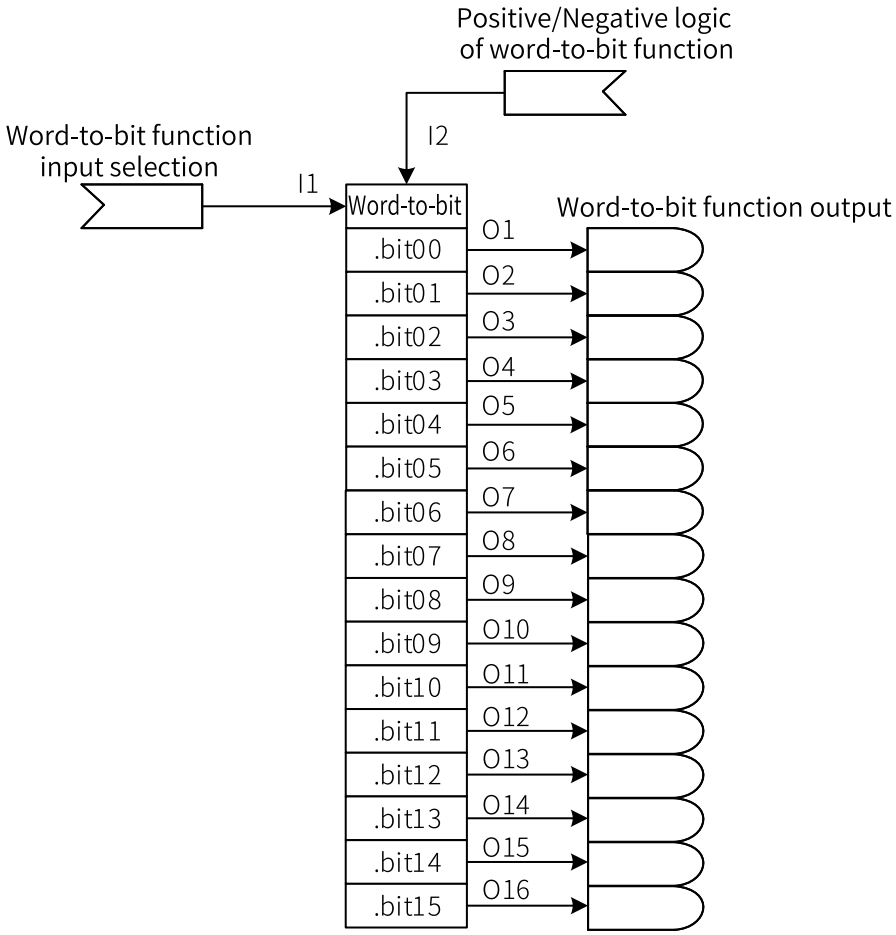


Figure 5-205 Word-to-bit module

When the input I1 is a 16-bit single word, the output O1 to O16 correspond to bit 00 to bit 15 of the input I.

When the input I1 is a 32-bit double word, the output O1 to O16 correspond to high-order 16 bits (bit 00 to bit 15) of the input I1.

Input I2 is used to set the positive and negative logic during conversion. When bit 00–bit 15 of input I2 is 1, the corresponding output of input I1, O1–O16, is inverted.

Connection parameters

MD630-INT has four word-to-bit module modules (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: Single -word connector, double-word connector.

Parameter value source of input I2 : Unsigned number.

Storage position of output O1 to O16: Bit connector.

The parameters corresponding to the input and output of word-to-bit module are shown in the following table.

Word-to-bit module		A	B	C	D
Input	I1	o3-00	o3-01	o3-02	o3-03
	I2	o3-04	o3-05	o3-06	o3-07
Output	O1 (bit 00)	L0304	L0320	L0336	L0352
	O2 (bit01)	L0305	L0321	L0337	L0353
	O3 (bit02)	L0306	L0322	L0338	L0354
	O4 (bit03)	L0307	L0323	L0339	L0355
	O5 (bit04)	L0308	L0324	L0340	L0356
	O6 (bit05)	L0309	L0325	L0341	L0357
	O7 (bit06)	L0310	L0326	L0342	L0358
	O8 (bit07)	L0311	L0327	L0343	L0359
	O9 (bit08)	L0312	L0328	L0344	L0360
	O10 (bit09)	L0313	L0329	L0345	L0361
	O11 (bit 10)	L0314	L0330	L0346	L0362
	O12 (bit11)	L0315	L0331	L0347	L0363
	O13 (bit12)	L0316	L0332	L0348	L0364
	O14 (bit13)	L0317	L0333	L0349	L0365
	O15 (bit14)	L0318	L0334	L0350	L0366
	O16 (bit15)	L0319	L0335	L0351	L0367

Instances

You can convert the received custom control word to bit data through the word-to-bit module , and read the control commands issued by the user. For example, you can convert a custom command word of control channel 1 to bit data through word-to-bit module A.

Control word bit	Meaning	Description
bit0	ON_OFF1 (start/stop)	The AC drive starts when the bit value changes from 0 to 1 and stops when the bit value is 0.
bit1	OFF2 (coast to stop)	Coast to stop command is active when the bit value is 1.
bit2	OFF3 (quick stop)	Quick stop command is active when the bit value is 1.
bit3	Operation permission	Bit value 1 indicates that operation is allowed.
bit4	Reset command	Reset command is active when the bit value changes from 0 to 1.
bit5	JOG1	Bit value 1 indicates that the jog 1 command is valid.
bit6	JOG2	Bit value 1 indicates that the jog 2 command is valid.
bit7	Speed inversion	Bit value 1 indicates that the speed is reversed.
Bit 8 to bit 15	Reserved	-

The parameters to be set are described in the following table.

Parameters	Description	Setting value	Description
o3-00	Input of word-to-bit function A	L1044 (Custom command word of control channel 1)	The input of word-to-bit module A is custom control word.
o3-04	Positive and negative logic of word-to-bit function A	0x0000	The bit output of word-to-bit module A remains unchanged for the output value

At this time, you can check whether the coast to stop instruction is valid by L0305 [word-to-bit module A output Bit01], and L0308 [word-to-bit module A output Bit04] to check whether the fault reset instruction is valid.

5.4.8.2.3 Bit-to word Module (A to D)

Function description

The bit-to word module is used to combine 16 bits from bit 0 to bit 15 into a single 16-bit data.

Working principle

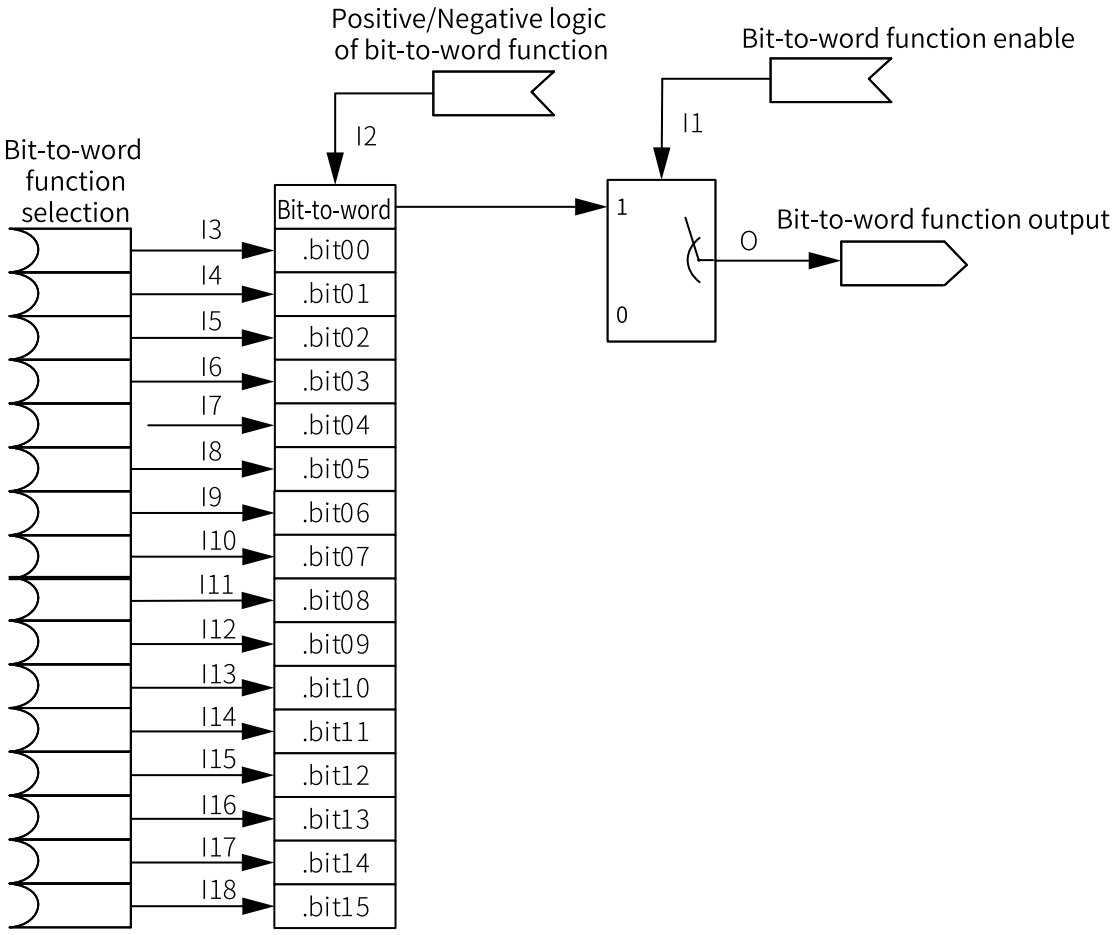


Figure 5-206 Bit-to-word module

Bit-to-word modules input I3–I18 as bit 00–bit 15 of hexadecimal numbers, and output 16-bit single-word data to O.

Input I1 of the bit-to-word module is the enable control bit. When input I1 is 1, the function of the module is valid. When input I1 is 0, output O is 0.

Input I2 is used to set the positive and negative logic during conversion. When bit 00–bit 15 of input I2 is 1, the corresponding bit 00–bit 15 of output O are inverted.

Connection Parameter

MD630-INT has bit-to-word module (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1 : Binary number.

Parameter value source of input I2 : Unsigned number.

Parameter value source of inputs I3 to I18: 0, 1, DI input, and bit connector.

The storage position of the output O: Word connector.

The parameters corresponding to the input and output of bit-to-word module are shown in the following table.

Bit-to-word module		A	B	C	D
Input	I1	o3-08	o3-26	o3-44	o3-62
	I2	o3-09	o3-27	o3-45	o3-63
	I3 (bit00)	o3-10	o3-28	o3-46	o3-64
	I4 (bit01)	o3-11	o3-29	o3-47	o3-65
	I5 (bit02)	o3-12	o3-30	o3-48	o3-66
	I6 (bit03)	o3-13	o3-31	o3-49	o3-67
	I7 (bit04)	o3-14	o3-32	o3-50	o3-68
	I8 (bit05)	o3-15	o3-33	o3-51	o3-69
	I9 (bit06)	o3-16	o3-34	o3-52	o3-70
	I10 (bit07)	o3-17	o3-35	o3-53	o3-71
	I11 (bit08)	o3-18	o3-36	o3-54	o3-72
	I12 (bit09)	o3-19	o3-37	o3-55	o3-73
	I13 (bit 10)	o3-20	o3-38	o3-56	o3-74
	I14 (bit 11)	o3-21	o3-39	o3-57	o3-75
	I15 (bit 12)	o3-22	o3-40	o3-58	o3-76
	I16 (bit 13)	o3-23	o3-41	o3-59	o3-77
	I17 (bit 14)	o3-24	o3-42	o3-60	o3-78
	I18 (bit15)	o3-25	o3-43	o3-61	o3-79
Output	O	L1208	L1209	L1210	L1211

Instances

You can customize the control word to be sent to the user through the bit-to-word module to meet the control requirements. For example, the status word can be defined through bit-to word Module module A as follows.

Param.	Name	Value Range	Description
o3-08	B2W module A enable	1: Enable	Sets whether to enable bit-to-word module A.
o3-09	Positive and negative logic selection for bit-to-word module A	0x0000	Each bit of the bit-to-word module A is positive logic
o3-10	Bit-to-word module A - Bit00 selection	L0100: Ready to switch on	The value 1 indicates that it is ready to switch on.
o3-11	Bit-to-word module A - Bit01 selection	L0102: During operation	The value 1 indicates that the AC drive is running.
o3-12	Bit-to-word module A - Bit02 selection	L0103: Fault active	The value 1 indicates a fault occurs.

Param.	Name	Value Range	Description
o3-13	Bit-to-word module A - Bit03 selection	L0106: Switch-on blocking	The value 1 indicates that it is blocked from running.
o3-14	Bit-to-word module A - Bit04 selection	L0118: Current control channel	0 indicates that channel 1 is active, and 1 indicates that channel 2 is active.
o3-15	Bit-to-word module A - Bit05 selection	L0119: Current set channel	0 indicates that channel 1 is active, and 1 indicates that channel 2 is active.
L1208:	Output of bit-to-word module A	-	Bit-to-word module A output value

In this case, you can send the output value of the bit-to-word module A (L1208) to the user to enable custom status word transmission.

5.4.8.3 Data Conversion Module

5.4.8.3.1 Introduction to Data Conversion Module

Function description

This module enables conversion between different types of data, such as 16-bit single word data and 32-bit double word data.

Applicable scenario

You can convert data to the type of data required by the user to facilitate data query and processing.

5.4.8.3.2 Word to double-word conversion module (A to D)

Function description

The word to double-word module (W-DW module) combines two 16-bit single-word data into a single 32-bit data, then divides the 32-bit data by a user-defined 32-bit base value, to obtain the converted 32-bit double-word data.

Working principle

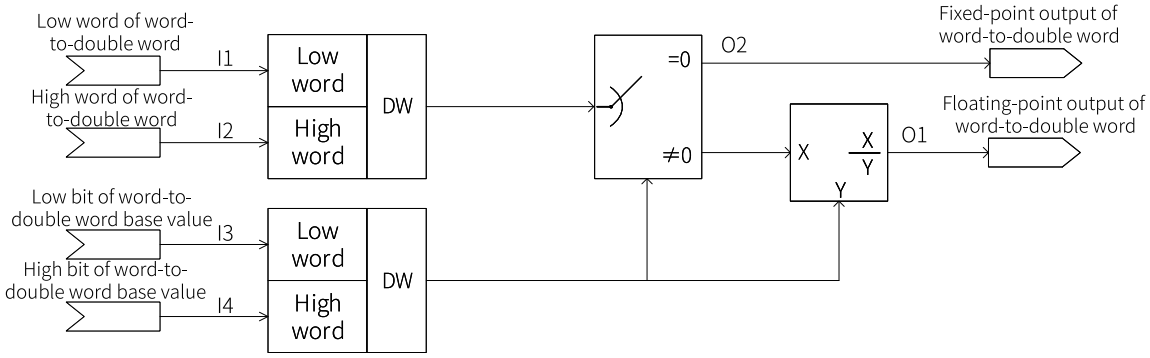


Figure 5-207 W-DW module

The conversion formula for the input and output of W-DW module is as follows:

$$O=\begin{cases} O1:\ \dfrac{I1+I2\times 65536}{I3+I4\times 65536}, & I3+I4\times 65536\neq 0 \\ O2:\ I1+I2\times 65536, & I3+I4\times 65536=0 \end{cases}$$

(1) When the base value with I3 as the low-order 16 bits and I4 as the high-order 16 bits of the W-DW module is not zero, the output (O1) equals the double word divided by the base value with I1 as the low-order 16 bits and I2 as the high-order 16 bits.

(2) When the base value with l3 as the low-order 16 bits and l4 used as the high-order 16 bit is zero, the output equals the double word with l1 as the low-order 16 bits and I2 as the high-order 16 bits. The double word is output directly to O2 without base value conversion.

Connection parameters

MD630-INT has four sets of word to double-word modules (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I2: Word connector, double-word connector.

Parameter value source of input I3 and I4: 16-bit unsigned number.

Storage location of output O1: Floating-point connector.

Storage position of output O2: Double-word connector.

The parameters corresponding to the input and output of the W-DW module are shown in the following table.

Word-to-double word conversion	Input				Output	
	I1	I2	I3	I4	O1	O2
A	o5-00	o5-01	o5-02	o5-03	L2500	L2000
B	o5-04	o5-05	o5-06	o5-07	L2502	L2002
C	o5-08	o5-09	o5-10	o5-11	L2504	L2004
D	o5-12	o5-13	o5-14	o5-15	L2506	L2006

Note: When the input I2 of the word-to-double word conversion module is set to 0 [Disable], this module is disabled and the output is 0. The module functions normally when the input I2 selects others [K connector].

5.4.8.3.3 Double-Word to Word Conversion Module (A to D)

Function description

The double-word to word module (DW-W module) divides the input 32-bit double-word data by the user-defined 32-bit base value to obtain the converted 16-bit single-word data.

Working principle

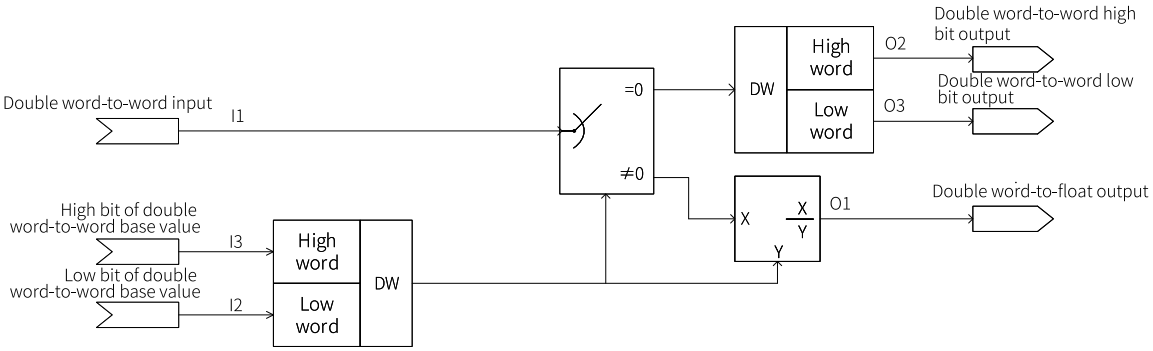


Figure 5-208 DW-W module

The conversion formula for the input and output of the DW-W module is as follows:

$$O=\begin{cases} O1:\ \dfrac{I1}{I2+I3\times 65536}, & I2+I3\times 65536\neq 0 \\ \begin{cases} O2:\ (I1\gg 16)\,\&\,0xFFFF \\ O3:\ I1\,\&\,0xFFFF \end{cases}, & I2+I3\times 65536=0 \end{cases}$$

(1) When the base value with I2 as the low-order 16 bits and I3 as the high-order 16 bits of the DW-W module is not zero, the output equals the value of I1 divided by the base value. The result is output is to O1.

(2) When the base value with I2 as the low-order 16 bits and I3 as the high-order 16 bits of the DW-W module is zero, the output O2 is the high-order 16 bits of I1 and the output O3 is the low-order 16 bits of I1.

Connection Parameter

MD630-INT has four sets of DW-W modules (A to D). The corresponding inputs and outputs of each module are as follows:

Parameter value source of input I1: Word connector, double-word connector.

Parameter value source of input I2 and I3: 16-bit unsigned number.

Storage location of output O1: Floating-point connector.

Storage position of output O2 and O3: Word connector.

The parameters corresponding to the input and output of the DW-W conversion module are shown in the following table.

DW-W module	Input			Output		
	I1	I2	I3	O1	O2	O3
A	o5-32	o5-33	o5-34	L2508	L1212	L1213
B	o5-35	o5-36	o5-37	L2510	L1214	L1215
C	o5-38	o5-39	o5-40	L2512	L1216	L1217
D	o5-41	o5-42	o5-43	L2514	L1218	L1219

5.4.8.3.4 Floating-point connector-to-monitoring parameter module (A to H)

Function description

The floating-point connector-to-monitoring parameter module converts the input floating-point connector data into monitoring parameters displayed in the U group.

Working principle

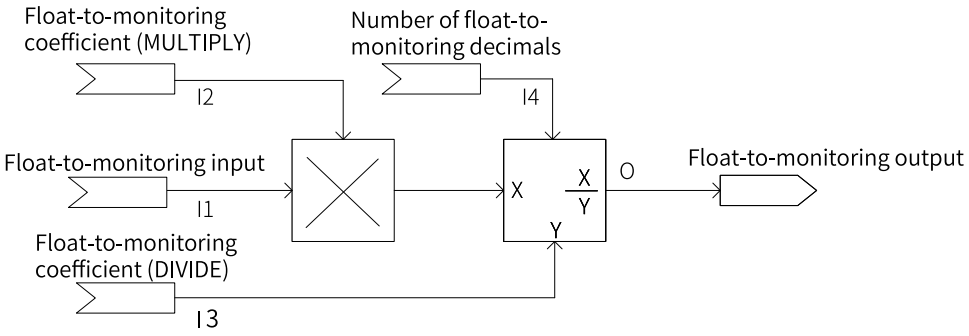


Figure 5-209 Diagram of floating-point connector-to-monitoring parameters

The input I1 of floating-point connector-to-monitoring parameter module is the raw value. Input I2 is the multiplier coefficient, and input I3 is the division coefficient. Final output O = input value (I1) * coefficient (I2) / coefficient (I3).

Input I4 is used to set the number of decimal places of the output value O. You can set the number of decimal places to 0–3. The meaning of the different decimal places is as follows:

(1) When there is no decimal place, the converted monitoring parameter displays the value of the floating-point connector value × 100.

(2) When there is one decimal place, the converted monitoring parameter displays the value of floating-point connector value × 100 × 10.

(3) When there are two decimal places, the converted monitoring parameter displays the value of floating-point value × 100 × 100.

(4) When there are three decimal places, the converted monitoring parameter displays the value of floating-point value × 100 × 1000.

For example, when the floating-point connector value is 40.0%, I2 and I3 are set to 1, and I4 is set to 1 decimal place, the converted monitoring parameter is 40.0% x 100 x 10 = 400.

Connection Parameter

MD630-INT has eight floating-point connector-to-monitoring parameter modules (A to H). The corresponding inputs and outputs of each module are as follows:

Parameter value source of input I1: Floating-point connector.

Parameter value source of input I2 and I3: 16-bit unsigned number (I3 cannot be 0).

Parameter value source of input I4: 0, 1, 2, and 3

The storage position of the output O: Group U3 monitoring parameters

The parameters corresponding to the input and output of the DW-W conversion module are shown in the following table.

Float-to-monitor	Input				Output
	I1	I2	I3	I4	O
A	o5-60	o5-62	o5-63	o5-61	U3-90
B	o5-64	o5-66	o5-67	o5-65	U3-91
C	o5-68	o5-70	o5-71	o5-69	U3-92
D	o5-72	o5-74	o5-75	o5-73	U3-93
E	o5-76	o5-78	o5-79	o5-77	U3-94
F	o5-80	o5-82	o5-83	o5-81	U3-95
G	o5-84	o5-86	o5-87	o5-85	U3-96
H	o5-88	o5-90	o5-91	o5-89	U3-97

Instances

When using HDI input, you can view the input value of the HDI curve in the monitoring parameter group through the floating-point connector-to-monitoring parameters module. The parameters to be set are described in the following table.

Param.	Name	Value Range	Description
o5-60	Floating-point connector-to-monitoring parameter module A input	L2250 (HDI input)	Sets the input value of the module to HDI input.
o5-61	Number of decimal places of floating-point concatenator-to-monitoring parameter module A	0 (No decimal digits)	Set to no decimal place
o5-62	Floating-point connector-to-monitoring parameter module A coefficient (multiply)	1	Sets the multiplier coefficient to 1.
o5-63	Floating-point concatenator-to-monitoring parameter module A coefficient (divide)	1	Sets the division coefficient to 1 during conversion
U3-90	Floating-point concatenator-to-monitoring parameter module A output	-	The monitoring parameter displayed in the U group after conversion

In this case, the value displayed by the monitoring parameter U3-90 is the result of the HDI input value of the floating-point connector × 100. For example, when the HDI value is 20.000%, U3-90 displays 20.

5.4.8.4 Logic Operation

5.4.8.4.1 Logic Operation

Description

This module enables simple logic operations, such as AND, OR, XOR, etc.

Applicable scenario

This module allows simple logic processing of data such as DI signals to enable multiple signal source combined-control of the same module.

5.4.8.4.2 Logic AND/Logic OR Module (A to H)

Function

You can select the logic AND/OR modules to implement logic AND, logic OR function. Up to four inputs can be processed logically. If the logic AND function is selected, the output is 1 when the input is all 1, otherwise the output is 0. If the logic OR function is selected, the output is 0 when the input is all 0, otherwise the output is 1.

Working principle

Logic AND/OR modules A to D support four input values, and Logic AND/OR modules E to H support three input values. This section describes logic AND/OR functions, using modules A to D as the example.

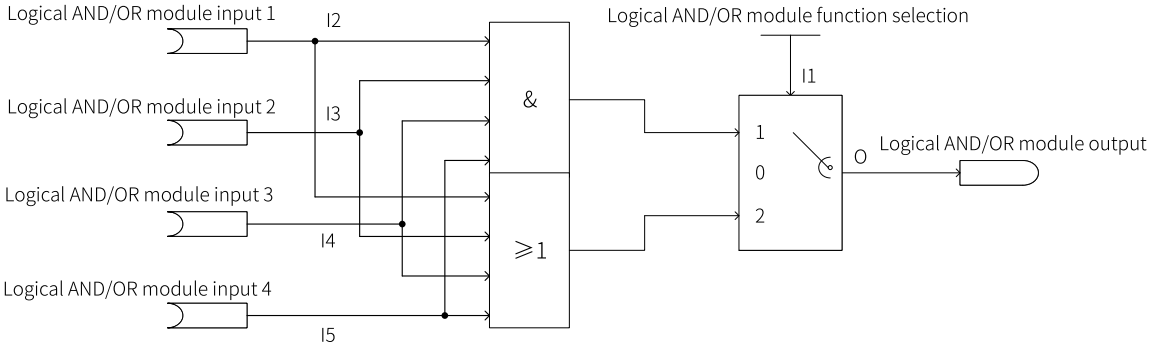


Figure 5-210 Logic AND/OR module

When I1 for enabling logic AND/OR module is set to 0, the module is inactive, and the output (O) is 0.

When I1 for enabling logic AND/OR module is set to 1, the logic AND module is valid and the output (O) is I2 & I3 & I4 & I5. Only when I2, I3, I4 and I5 values are 1, the output (O) is 1; otherwise, the output (O) is 0. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
0	X	X	X	0
X	0	X	X	0
X	X	0	X	0

Input				Output
I2	I3	I4	I5	O
X	X	X	0	0
1	1	1	1	1

When I1 for logic AND/OR module is set to 2, logic OR is valid and the output (O) is I2 | I3 | I4 | I5. Only when I2, I3, I4 and I5 values are 0, the output (O) is 0; otherwise, the output (O) is 1. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
1	X	X	X	1
X	1	X	X	1
X	X	1	X	1
X	X	X	1	1
0	0	0	0	0

Connection Parameter

MD630-INT has eight and logic AND/OR modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: 0 (Disable); 1 (logic AND module); 2 (logic OR module)

Parameter value source of inputs I2, I3, I4, and I5: 0, 1, DI input, or bit connector input

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic AND/OR module are shown in the following table.

Logic AND/OR	Input					Output
	I1	I2	I3	I4	I5	O
A	o6-00	o6-01	o6-02	o6-03	o6-04	L0376
B	o6-05	o6-06	o6-07	o6-08	o6-09	L0377
C	o6-10	o6-11	o6-12	o6-13	o6-14	L0378
D	o6-15	o6-16	o6-17	o6-18	o6-19	L0379
E	o6-20	o6-21	o6-22	o6-23	-	L0380
F	o6-24	o6-25	o6-26	o6-27	-	L0381
G	o6-28	o6-29	o6-30	o6-31	-	L0382
H	o6-32	o6-33	o6-34	o6-35	-	L0383

5.4.8.4.3 Logic NOT Module (A to H)

Function description

Logical NOT function can be implemented through this module. The output value is the inverted value of the input value.

Working principle

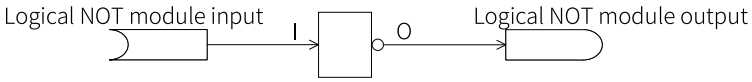


Figure 5-211 Logic NOT module

When the logic NOT module input I is 0 [Disable], the module is disabled and the output is 0.

When the logic NOT module input I is not 0, the output O is the inverted value of the input.

Input	Output
I	O
0	1
1	0

Connection parameters

MD630-INT has eight logic NOT modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I: 0 [Disable], DI input, bit connector.

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic NOT module are shown in the following table.

Logic NOT module	Input	Output
	I	O
A	o6-80	L0384
B	o6-81	L0385
C	o6-82	L0386
D	o6-83	L0387
E	o6-84	L0388
F	o6-85	L0389
G	o6-86	L0390
H	o6-87	L0391

5.4.8.4.4 Logic XOR/XNOR Module (A to H)

Function description

You can select the logic XOR/XNO modules to implement logic XOR/XNO function. Up to two inputs can be processed logically. If the logic XOR function is selected, the output is 1 when the input1 is different with input 2, otherwise the output is 0. If the logic XNOR function is selected, the output is 1 when the input 1 is the same with input 2, otherwise the output is 0.

Working principle

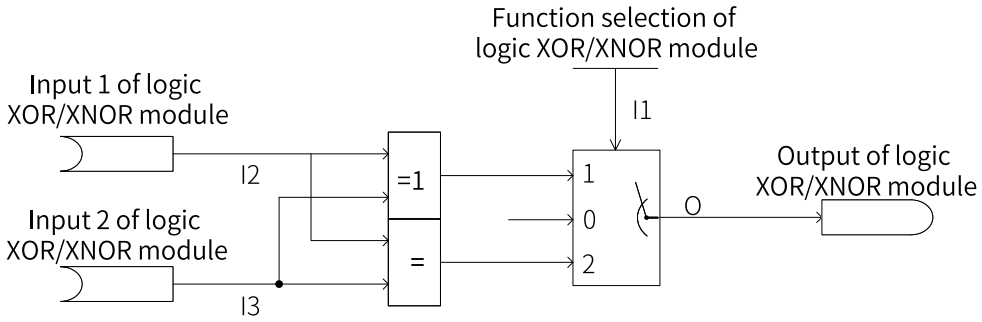


Figure 5-212 Logic XOR/XNOR module

When I1 for enabling logic XOR/XNOR module is set to 0, the module is inactive, and the output (O) is 0.

When I1 for enabling the logic XOR/XNOR module is set to 1, the logic XOR module is active. When I2 and I3 are the same, the output (O) is 0. When I2 and I3 are different, the output (O) is 1. The truth table is as follows.

Input		Output
I2	I3	O
0	0	0
1	0	1
0	1	1
1	1	0

When I1 for enabling the logic XOR/XNOR module is set to 2, the XNOR module is active. When I2 and I3 are the same, the output (O) is 1. When I2 and I3 are different, the output (O) is 0. The truth table is as follows.

Input		Output
I2	I3	O
0	0	1
1	0	0
0	1	0
1	1	1

Connection Parameter

MD630-INT has eight logic XOR/XNOR modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: 0 (Disable); 1 (logic XOR module); 2 (logic XNOR module)

Parameter value source of inputs I2 and I3: 0, 1, DI input, or bit connector.

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic XOR/XNOR module are shown in the following table.

Logic XOR/ XNOR Module	Input			Output
	I1	I2	I3	O
A	o7-00	o7-01	o7-02	L0392
B	o7-03	o7-04	o7-05	L0393
C	o7-06	o7-07	o7-08	L0394
D	o7-09	o7-10	o7-11	L0395
E	o7-12	o7-13	o7-14	L0396
F	o7-15	o7-16	o7-17	L0397
G	o7-18	o7-19	o7-20	L0398
H	o7-21	o7-22	o7-23	L0399

5.4.8.5 Arithmetic Operators

5.4.8.5.1 Introduction to Arithmetic Operations

Function description

This module can perform simple operations on values, such as addition, subtraction, multiplication, division, comparison, absolute values, etc.

Applicable scenario

You can use this module to perform operation on the input value to obtain a value that meets the user's requirements.

5.4.8.5.2 Absolute Value Module (A to H)

Function description

The absolute value module is used to output the absolute value of an input value. The output is equal to the absolute value of the input.

Working principle

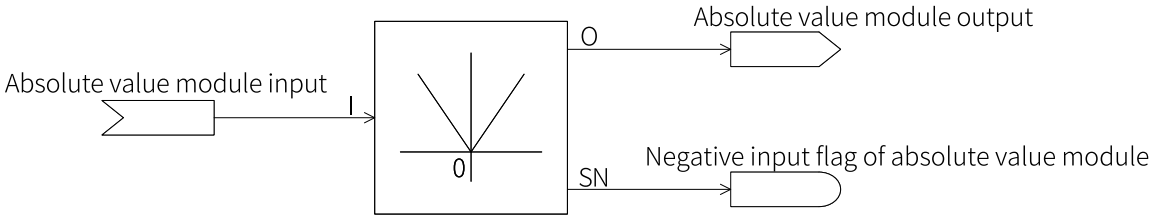


Figure 5-213 Absolute value module Diagram

The calculation formula for absolue value module as follows.

$$O = |I|$$

$$SN = \begin{cases} 1, & I < 0 \\ 0, & I \geqslant 0 \end{cases}$$

(1) When the absolute value module input I is selected as 0 [Disable], the module does not take effect, and the output is 0.

(2) When the absolute value module input I is not 0, the output O is equal to the absolute value of input I. When the input I is negative, the negative input flag SN is 1, otherwise it is 0.

Connection Parameter

MD630-INT has eight absolute value modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I: 0 [Disable], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The storage position of the output SN: Bit connector.

The parameters corresponding to the input and output of the absolute value module are shown in the following table.

Absolute value module	Input	Output	
	I	O	SN
A	o9-00	L2400	L0420
B	o9-01	L2402	L0421
C	o9-02	L2404	L0422
D	o9-03	L2406	L0423
E	o9-04	L2408	L0424
F	o9-05	L2410	L0425
G	o9-06	L2412	L0426
H	o9-07	L2414	L0427

5.4.8.5.3 Addition and subtraction module (A to H)

Function description

The addition and subtraction module is used to add and subtract input values. The addition and subtraction module has four sets of inputs. The first three sets of inputs are performed add operation, and the result is subtracted from the fourth set of inputs to obtain the output value.

Working principle

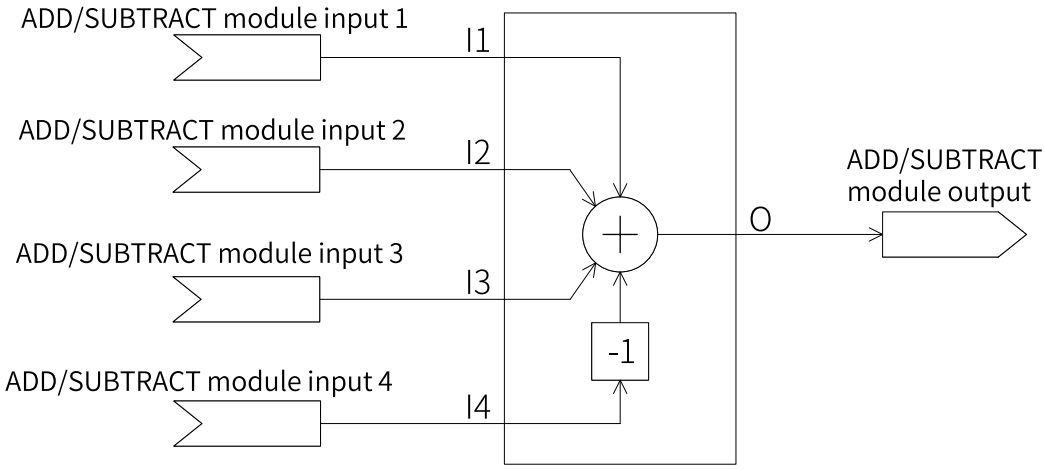


Figure 5-214 Diagram of the addition and subtraction module

The calculation formula for adding and subtracting modules is as follows:

O=I1+I2+I3-I4

(1) When the addition and subtraction module input I is selected as 0 [Disable], the module does not take effect, and the output is 0.

(2) When the module input I1 is set to other values, the value of output O is input I1+I2+I3-I4.

Connection Parameter

MD630-INT has eight addition and subtraction modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 [Disable], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of input I2, I3, and I4: 0, AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the addition and subtraction module is shown in the following table.

Addition and subtraction module	Input				Output
	I1	I2	I3	I4	O
A	o8-00	o8-01	o8-02	o8-03	L2368
B	o8-04	o8-05	o8-06	o8-07	L2370
C	o8-08	o8-09	o8-10	o8-11	L2372
D	o8-12	o8-13	o8-14	o8-15	L2374
E	o8-16	o8-17	o8-18	o8-19	L2376
F	o8-20	o8-21	o8-22	o8-23	L2378
G	o8-24	o8-25	o8-26	o8-27	L2380
H	o8-28	o8-29	o8-30	o8-31	L2382

5.4.8.5.4 Multiplication and Division Module (A to H)

Function description

The multiplication and division module is used to multiply and divide the input value and output it. The multiplication/division module has three sets of inputs. Input 1 and input 2 are multiplied by each other, and the result is divided by input 3 to obtain the output value.

Working principle

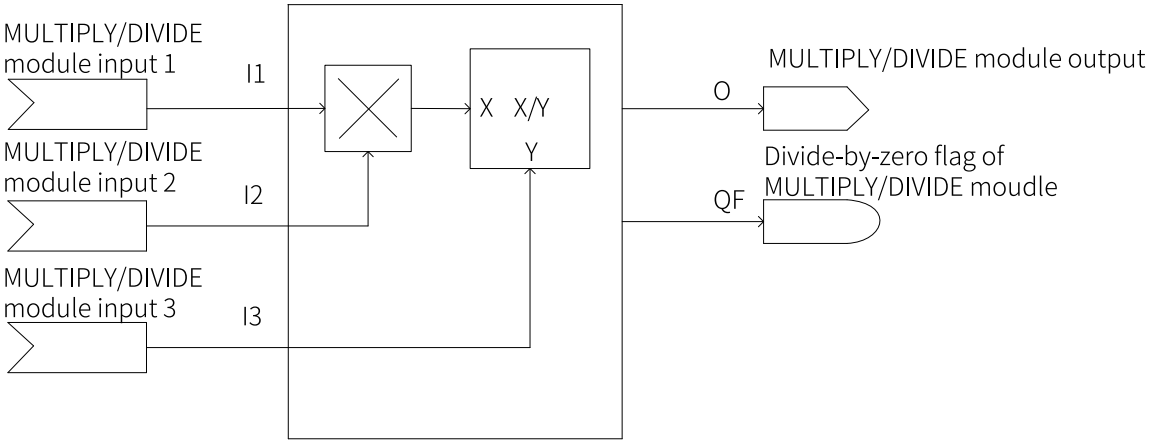


Figure 5-215 Diagram of the multiplication and division module

The multiplication and division module is calculated as follows:

$$\begin{cases} I1 \times I2, & I3 \text{ selection } 0 \text{ [value 1]} \\ \dfrac{I1 \times I2}{I3}, & I3 \neq 0 \\ 0, & I3 = 0 \end{cases}$$

$$QF = \begin{cases} 1, & I3 = 0 \\ 0, & I3 \neq 0 \end{cases}$$

(1) When the multiplication and division module input I is set to 0 [Disable], the module does not take effect, and the output is 0.

(2) When input I3 of the multiplication and division module selects 0 [value 1], output O is the product of input I1 and I2.

(3) When I3 is set to other options, if the input value I3 is 0, the output is 0 and the divisor is the zero flag bit QF which is 1; if the input value I3 is not 0, the output is the product of (I1 x I2)/I3, and the divisor is the zero flag bit QF which is 0.

Connection Parameter

MD630-INT has eight multiplication and division modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 [Disable], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of input I2 and I3: 0 [Value 1], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the multiplication and division module is shown in the following table.

Multiplication and division module	Input			Output	
	I1	I2	I3	O	QF
A	o8-48	o8-49	o8-50	L2384	L0412
B	o8-51	o8-52	o8-53	L2386	L0413
C	o8-54	o8-55	o8-56	L2388	L0414
D	o8-57	o8-58	o8-59	L2390	L0415
E	o8-60	o8-61	o8-62	L2392	L0416
F	o8-63	o8-64	o8-65	L2394	L0417
G	o8-66	o8-67	o8-68	L2396	L0418
H	o8-69	o8-70	o8-71	L2398	L0419

5.4.8.5.5 Comparison Module (A to H)

Function description

The user can set the comparison mode of the input. Three modes are available, input 1> input 2, input 1 = input 2, and input 1 < input 2. The comparison module compares input 1 and input 2 according to the set mode. When the comparison conditions are met, the output is 1, otherwise the output is 0.

Working principle

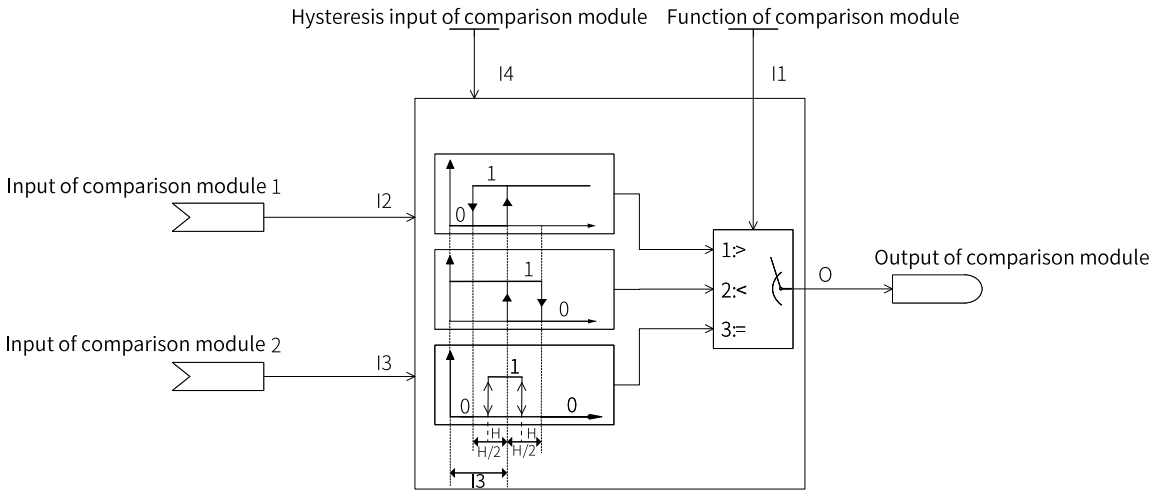


Figure 5-216 Diagram of the comparison module

(1) When the comparison module function selection I1 is set to 0 [Disable], the module is inactive and the output is 0.

(2) When l1 (comparison module function) is set to 1 (input 1> input 2), before I2 increases from 0 to I3 in the forward direction, the output O keeps low level. When I2 increases to a value higher than I3, the output O changes from low level to high level. When I2 keeps increasing, the output O keeps high level. If I2 decreases but keeps higher than or equals to I3 - l4, the output O keeps high level. Only when I2 is lower than I3 - l4, the output O changes from high level to low level.

(3) When l1 (comparison module function) is set to 2 (input 1 < input 2.), before I2 increases from 0 to I3+I4 in the forward direction, the output O keeps high level. When I2 increases to a value higher than I3+I4, the output O changes from high level to low level. When I2 keeps increasing, the output O keeps low level. If I2 decreases but keeps higher than or equals to I3, the output O keeps low level. Only when I2 is lower than I3, the output O changes from low level to high level.

(4) When l1 (comparison module function) is set to 3 (input 1 = input 2), the output keeps high level if I2 is within the range of I3-I4/2 to I3+I4/2; otherwise, the output is low level.

Connection Parameter

MD630-INT has eight comparison modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 (Disable);1: Input 1 > Input 2; 2: Input 1 < Input 2; 3: Input 1 = Input 2

Parameter source of input I2 and I3: 0, AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of I4: Floating point number with two decimal places

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the comparison module is shown in the following table.

Comparison module	Input				Output
	I1	I2	I3	I4	O
A	o9-16	o9-17	o9-18	o9-19	L0400
B	o9-20	o9-21	o9-22	o9-23	L0401
C	o9-24	o9-25	o9-26	o9-27	L0402
D	o9-28	o9-29	o9-30	o9-31	L0403
E	o9-32	o9-33	o9-34	o9-35	L0404
F	o9-36	o9-37	o9-38	o9-39	L0405
G	o9-40	o9-41	o9-42	o9-43	L0406
H	o9-44	o9-45	o9-46	o9-47	L0407

5.4.8.6 Switch Selection

5.4.8.6.1 Switch Selection

Description

Select the signal through the module input to decide control output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Applicable scenario

This module allows parameter setting value to be changed accordingly when the control conditions are changed.

5.4.8.6.2 Binary selector module (A to H)

Description

The binary selector module has two binary inputs. The input is used to determine whether the output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Operation principles

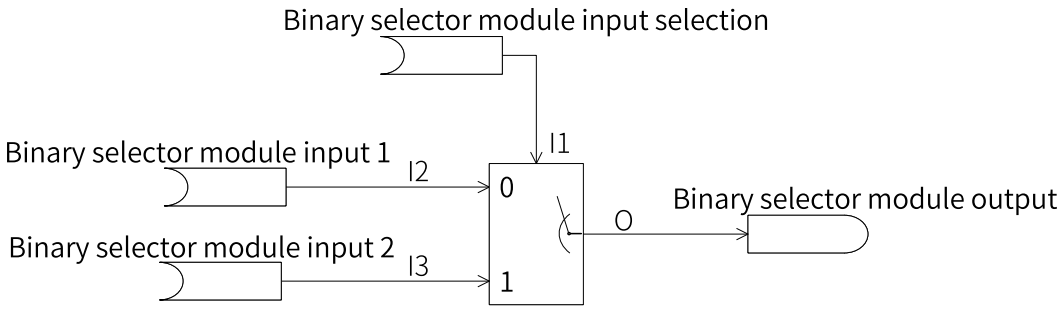


Figure 5-217 Diagram of the binary selector

When input I1 of the binary selector module is set to 0 (invalid), the module is inactive and the output is 0.

Input I1 of the binary selector module Select other options. When I1 is input 0, the output O equals input I2 of the module. When I1 is input 1, the output O equals input I3 of the module.

Connection Parameter

The input and output of binary selector modules (A to H) are as follows:

Input I1 parameter value source: 0 (invalid), DI input, bit connector.

Source of parameter value of input I2, I3: Logic 0, logic 1, DI input, Bit connector.

Output (O): Bit connector

The following table lists the function codes corresponding to input and output of the binary selector module.

Binary Selector Module	Input			Output
	I1	I2	I3	O
A	OA-00	OA-01	OA-02	L0368
B	OA-03	OA-04	OA-05	L0369
C	OA-06	OA-07	OA-08	L0370
D	OA-09	OA-10	OA-11	L0371
E	OA-12	OA-13	OA-14	L0372
F	OA-15	OA-16	OA-17	L0373
G	OA-18	OA-19	OA-20	L0374
H	OA-21	OA-22	OA-23	L0375

Note: Connector L1234 is used to display the selection results of each binary selector module.

Item	Name	Default	Value Range	Descriptions
L1234	Input selection state of binary selector module	-	/	Displays the input selection state for binary selector module. Bit0 to bit7 indicate the selection result of binary selector module A to H. Bit 0 indicates input 1. Bit 1 indicates input 2.

5.4.8.6.3 Digital Selector Module (A to H)

Description

The digital selector module has two floating-point inputs. The input determines whether the output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Operation principles

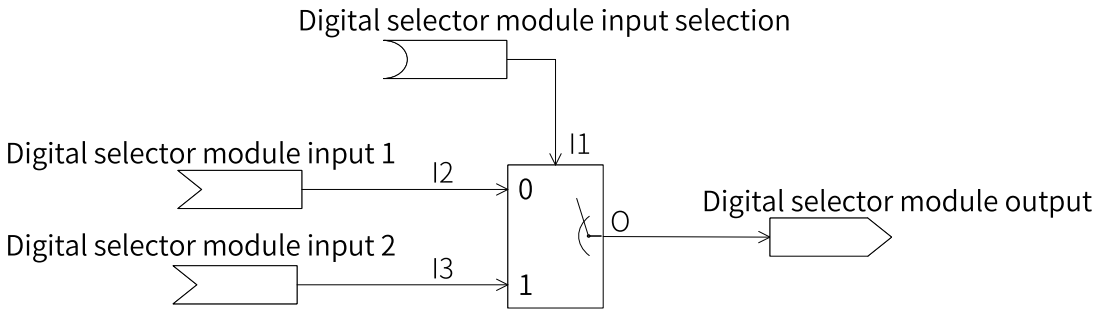


Figure 5-218 Digital selector module

When input I1 of the digital selector module is set to 0 (invalid), the module is inactive and the output is 0.

Input I1 of the digital selector module Select other options. When I1 is entered as 0, the output O is equal to the input I2 of the module. When I1 is entered as 1, the output O is equal to the input I3 of the module.

Connection Parameter

The input and output of the digital selector module (A to H) are as follows:

Input I1 parameter value source: 0 (invalid), DI input, bit connector.

Input I2 and I3 parameter value source: 0, AI1, AI2, HDI, multi-segment value, simple PLC, PID, Communication reference, floating-point connector

Output O: Floating point connector

The following table lists the function codes corresponding to the input and output of the digital selector module.

Digital selector module	Input			Output
	I1	I2	I3	O
A	OA-24	OA-25	OA-26	L2416
B	OA-27	OA-28	OA-29	L2418
C	OA-30	OA-31	OA-32	L2420
D	OA-33	OA-34	OA-35	L2422
E	OA-36	OA-37	OA-38	L2424
F	OA-39	OA-40	OA-41	L2426
G	OA-42	OA-43	OA-44	L2428
H	OA-45	OA-46	OA-47	L2430

Note: Connector L1235 is used to display the selection results of each digital selector module.

Item	Name	Default	Value Range	Descriptions
L1235	Input selection state for digital selector module	-	/	Displays the input selection state for digital selector module. Bit0 to bit7 indicate the selection result of digital selector module A to H. Bit 0 indicates input 1. Bit 1 indicates input 2.

5.4.8.7 Control Function

5.4.8.7.1 Introduction to Control Function

Function description

The input signal can be processed through this module to eliminate signal error.

Applicable scenario

This module is generally used to filter and limit signals such as level and frequency to eliminate signal errors.

5.4.8.7.2 Filter Module (A to D)

Description

The filter module filters the input signal to obtain the output value, which can effectively eliminate the signal error. You can also set the filter time. The longer the filter time, the better the effect, but the output signal lags behind the input signal.

Operation principles

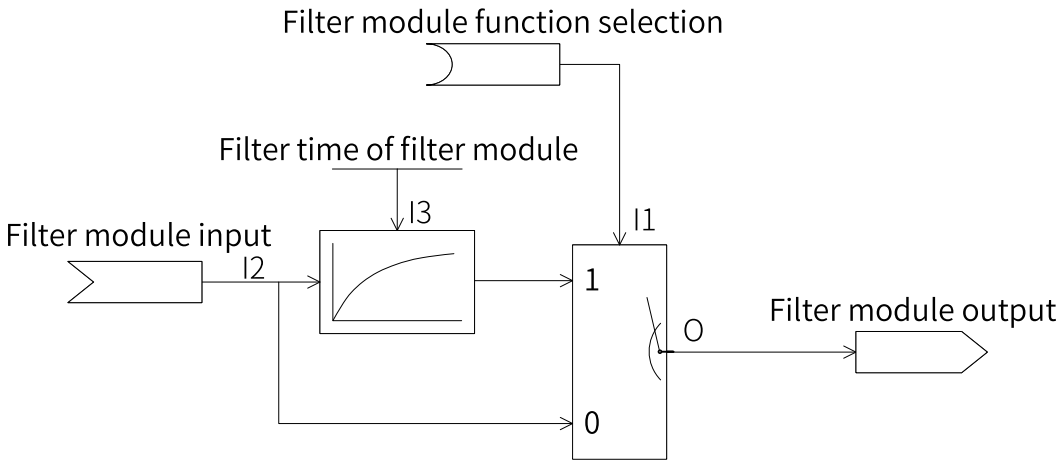


Figure 5-219 Figure 3 Installing the filter module

Connection Parameter

The input and output of the filter module (A to D) are as follows:

Input I1 parameter value source: 0 [invalid], 1 [active], DI input, bit connector.

Input I2 parameter value source: 0, AI1, AI2, HDI, Multi-segment value, simple PLC, PID, communication setting, Floating point connector

Input I3: Floating point number with two decimal places

Output O: Floating point connector

The following table lists the function codes corresponding to input and output of the filter module.

Filter module	Input			Output
	I1	I2	I3	O
A	B-00	OB-01	OB-02	L2440
B	OB-03	OB-04	OB-05	L2442
C	OB-06	Ob-07	OB-08	L2444
D	OB-09	OB-10	B-11	L2446

5.4.8.7.3 Level-to-Pulse Conversion Module (A to D)

Description

The level pulse conversion module enables the mutual conversion of the level signal and pulse signal. When the pulse conversion module function is set to 1, it is used to convert the level signal to a pulse signal. When the function is set to 2, it is used to convert the pulse signal to a level signal.

Operation principles

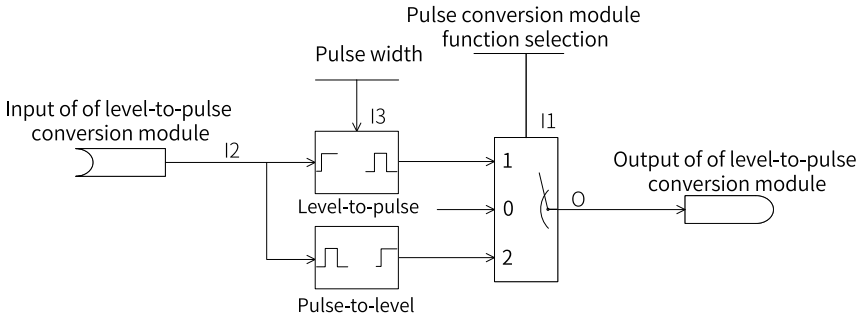
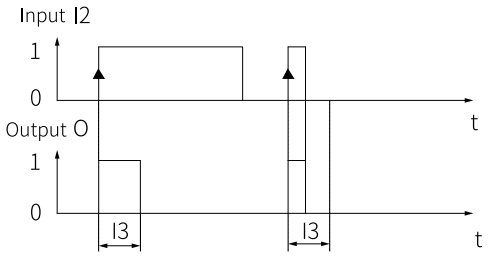


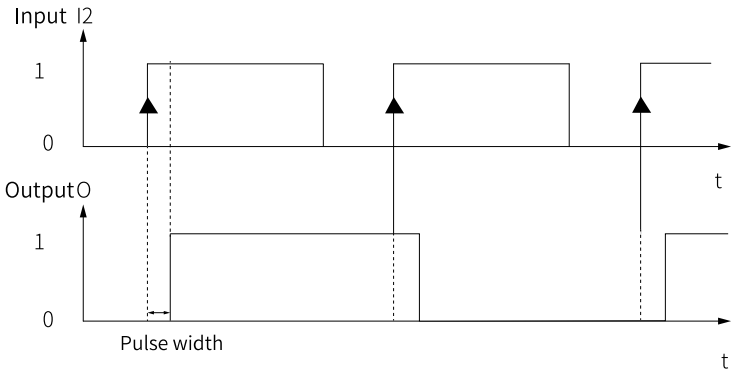
Figure 5-220 Level-to-pulse conversion module

(1) When I1 is set to 0 (Module disabled), the module is inactive and the output is 0.

When I1 is set to 1, level-to-pulse conversion is valid, and the output is set to 1 within the pulse time I3 on the rising edge of input I2. If input I2 is 0, the output is 0 immediately regardless of whether the pulse duration is reached.



(3) When I1 is set to 2 (Pulse change level), the pulse change level is active. The output is set to high after the pulse width I3 of the first rising edge of input I2 and low after the pulse width I3 of the second rising edge of input I2. Each odd rising edge is set to high and the even rising edge is set to low.



Connection Parameter

The corresponding inputs and outputs of the level pulse conversion modules (A to D) are as follows:

Input I1: 0: Module disabled; 1: Level-to-pulse conversion; 2: Pulse-to-level conversion

Input I2: 0, 1, DI input, and bit connector input

Input I3: Floating point number with two decimal places

Output (O): Bit connector

The following table lists the function codes corresponding to the input and output of the level pulse conversion module.

Level-to-pulse conversion module	Input			Output
	I1	I2	I3	O
A	B-24	OB-25	OB-26	L0408
B	OB-27	B-28	B-29	L0409
C	OB-30	OB-31	OB-32	L0410
D	B-33	OB-34	OB-35	L0411

5.4.8.7.4 Limiting Module (A to D)

Function description

The limiting module is used to set the upper and lower limit of the input signal. When the input is within the limit range, the output equals the input. When the input exceeds the upper limit, the output equals the upper limit. When the output is below the lower limit, the output equals the lower limit.

Operation principles

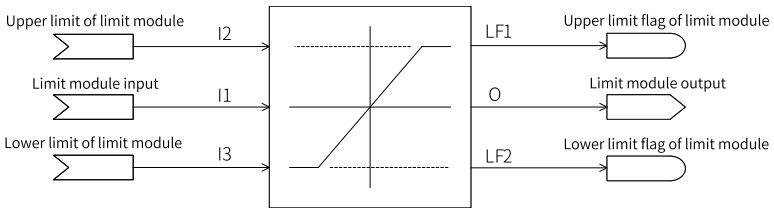


Figure 5-221 Diagram of the limiting module

(1) When input I1 of the limiting module is set to 0 (Disable), the module is inactive and the output is 0.

(2) When the input I1 of the limiting module is larger than the upper limit I2, the output O is equal to the input I2 and the upper limit flag LF1 is set to 1.

(3) When input I1 is smaller than the lower limit I3, the output O is equal to the input I3 and the lower limit flag LF2 is set to 1.

(4) When input I1 is within the upper and lower limits, the output O equals the input value I1.

Connection parameter

The corresponding inputs and outputs of the limit modules (A to D) are as follows:

Input I1 parameter value source: 0 (disabled), AI1, AI2, HDI, Multi-segment value, simple PLC, PID, communication setting, Floating point connector

Input I2 parameter value source: 0 (upper limit invalid), AI1, AI2, HDI, Multi-segment value, simple PLC, PID, communication setting, Floating point connector

Input I3 parameter value source: 0 (lower limit invalid), AI1, AI2, HDI, Multi-segment value, simple PLC, PID, communication setting, Floating point connector

The storage position of output O is the floating-point connector.

The storage position of the output LF1 and LF2 is bit connector.

The following table lists the function codes corresponding to input and output of the limit module.

Limiting Module	Input			Output		
	I1	I2	I3	O	LF1	LF2
A	oC-00	oC-01	oC-02	L2432	L0429	L0428
B	oC-03	oC-04	oC-05	L2434	L0431	L0430
C	oC-06	oC-07	oC-08	L2436	L0433	L0432
D	oC-09	oC-10	oC-11	L2438	L0435	L0434

5.4.8.7.5 Logic Delay Module (A to H)

Function description

The logic delay module is used to delay input signals. After the ON delay is set, the output signal changes from 0 to 1. After the OFF delay is set, the input signal changes from 1 to 0. The output signal changes at a delay.

Operation principles

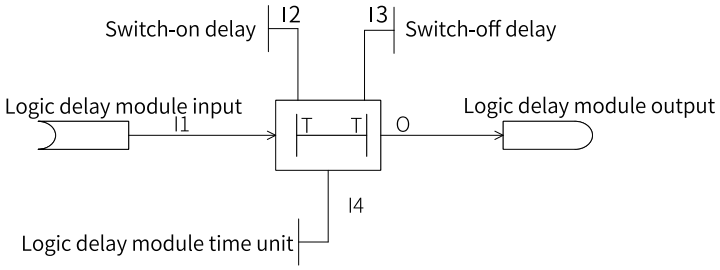


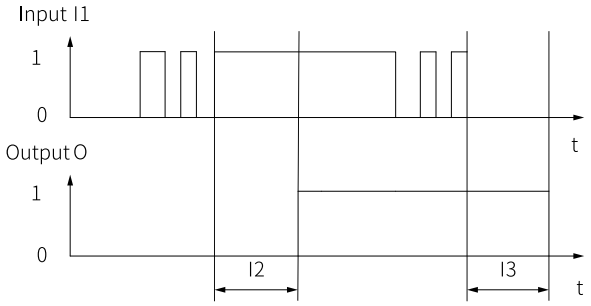
Figure 5-222 Logic delay module diagram

When input I1 of the logic delay module is set to 0 (Disable), the module is inactive and the output is 0.

When input I1 of the logic delay module is used to select other inputs, the output O performs an ON delay when input I1 changes from low to high. The delay time depends on the ON delay time set by I2 and the time unit selected by I4. The switch-off delay is also performed when input I1 changes

from high level to low level. The delay time depends on the switch-off delay time set by I3 and the time unit selected by I4.

Pulse signals smaller than the set delay time are also filtered when the delay is active, as shown in the following figure.



Connection parameter

The corresponding input and output of logic delay modules (A to H) are as follows:

Input I1 parameter value source: 0 (disabled), DI input, bit connector.

Input I2 and I3 parameter value source: Unsigned number.

Input I4 parameter value source: 0 (no delay), 1 (10 ms), 2 (100 ms), 3 (1s), 4 (10s), 5 (1 min), 6 (2 min).

Storage position of output O: Bit connector

The following table lists the function codes corresponding to the input and output of the logic delay module.

Logic delay module	Input				Output
	I1	I2	I3	I4	O
A	oC-28	oC-29	oC-30	oC-31	L0456
B	oC-32	oC-33	oC-34	oC-35	L0457
C	oC-36	oC-37	oC-38	oC-39	L0458
D	oC-40	oC-41	oC-42	oC-43	L0459
E	oC-44	oC-45	oC-46	oC-47	L0460
F	oC-48	oC-49	oC-50	oC-51	L0461
G	oC-52	oC-53	oC-54	oC-55	L0462
H	oC-56	oC-57	oC-58	oC-59	L0463

5.4.8.8 Multi-point curve A

Description

The multi-point curve module can define up to ten curve points. Segments describe the relationship between input and output. After setting the multi-point curve, set the input value of the module. The output value corresponding to the input value will be calculated based on the curve relation.

Applicable scenario

When the change relationship between input and output is complex, the corresponding change between input and output can be achieved through multi-point curves.

Operation principles

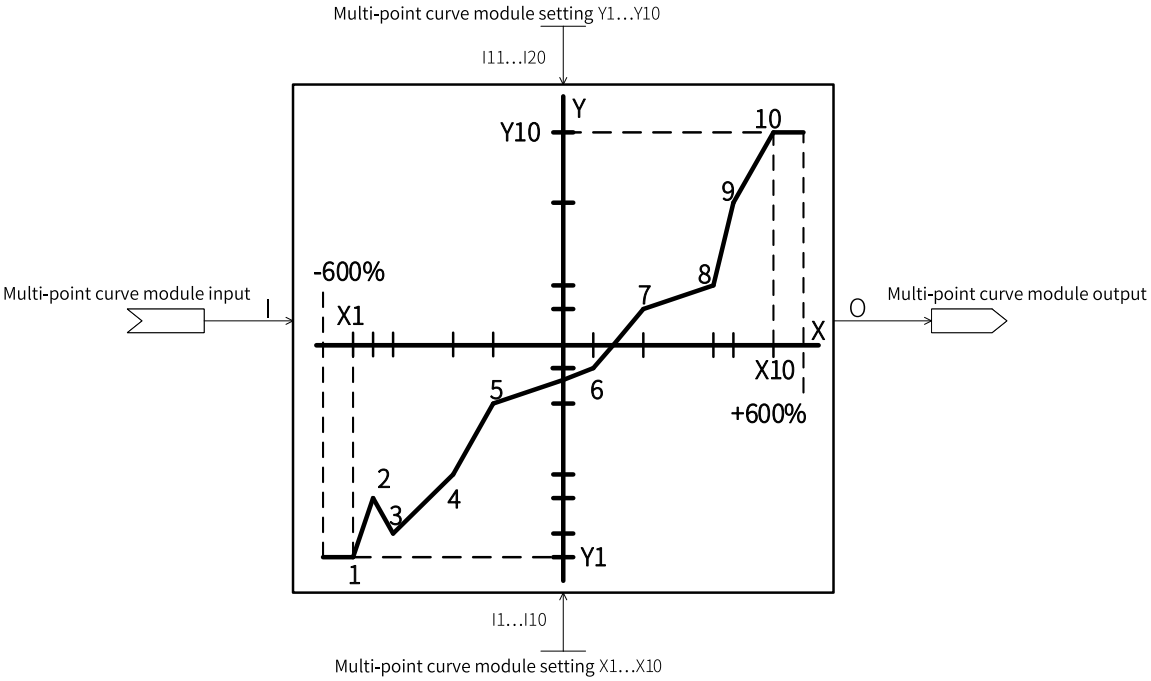


Figure 5-223 HDI four-point curve

The coordinate is valid only when X1 ≤ X2 ≤⋯≤ X10 is satisfied. When the input is outside the active coordinate point, the output is equal to the ordinate value of adjacent valid coordinate point. When the input is within the valid coordinate point, the corresponding ordinate value is calculated based on the curve.

Assume that the coordinate is valid and number of coordinates inputted is lower than 10. If the last abscissa inputted is negative, the abscissa and the following abscissa whose value is 0 are kept, and the subsequent coordinate values are discarded. If the last abscissa inputted is positive, the abscissa is kept, and the subsequent coordinate values are discarded.

When the multi-point curve horizontal coordinate does not meet the setting of X1 ≤ X2 ≤ · · · ≤ X10, U6-74 (Multi-point curve setting error flag) is set to 1, indicating that the curve is set incorrectly.

Connection Parameter

The input and output of multi-point curves (A to B) are as follows:

Input I parameter value source: 0 [Module not enabled], floating-point connector.

The parameter values of the coordinate settings X1 to X10 and Y1 to Y10 are derived from one decimal floating-point number.

Output O: Floating point connector

The following table lists the function codes corresponding to the input and output of the multi-point curve module.

Polyline block		A	B
Input	I	o2-00	o2-21
	I1 (X1)	o2-01	o2-22
	I2 (X2)	o2-02	o2-23
	I3 (X3)	o2-03	o2-24
	I4 (X5)	o2-04	o2-25
	I5 (X5)	o2-05	o2-26
	I6 (X6)	o2-06	o2-27
	I7 (X7)	o2-07	o2-28
	I8 (X8)	o2-08	o2-29
	I9 (X9)	o2-09	o2-30
	I10 (X10)	o2-10	o2-31
	I11 (Y1)	o2-11	o2-32
	I12 (Y2)	o2-12	o2-33
	I13 (Y3)	o2-13	o2-34
	I14 (Y5)	o2-14	o2-35
	I15 (Y5)	o2-15	o2-36
	I16 (Y6)	o2-16	o2-37
	I17 (Y7)	o2-17	o2-38
	I18 (Y8)	o2-18	o2-39
	I19 (Y9)	o2-19	o2-40
	I20 (Y10)	o2-20	o2-41
Output	O	L2448	L2450
	U6-74	U6-74_bit0	U6-74_bit1

Instances

If you need to adjust the frequency based on AI input, but the relationship is complicated. If the AI curve cannot meet the requirement, you can set it through the multi-point curve module. For example, the AI input and frequency setting meet the following correspondence:

(1) When the AI input is 0, the frequency is set to 10%.

(2) When the AI input is 30%, the frequency is set to 25%.

(3) When the AI input is 50%, the frequency is set to 60%.

(4) When the AI input is 70%, the frequency is set to 85%.

(5) When the AI input is 100%, the frequency is set to 100%.

In this case, you can set the multi-point curve parameters as follows to set the relationship between AI and frequency. Set F0-29 (Main frequency source) to L2448 (Multi-point curve A output) to modify the frequency setting through the multi-point curve.

Item	Name	Value range:	Description
o2-00	Input of multi-point curve module A	<I/O module 1> DIO1 input	Multi-point curve input is set to AI1
o2-01	Setpoint X1 of multi-point curve module A	0.0%	Defines the horizontal coordinate of the first point of the multi-point curve

Item	Name	Value range:	Description
o2-02	Setpoint X1 of multi-point curve module A	30.0%	Defines the horizontal coordinate of the second point of the multi-point curve
o2-03	Setpoint X1 of multi-point curve module A	50.0%	Defines the horizontal coordinate of the third point of the multi-point curve
o2-04	Setpoint X1 of multi-point curve module A	70.0%	Defines the horizontal coordinate of the fourth point of the multi-point curve
o2-05	Setpoint X1 of multi-point curve module A	100.0%	Defines the horizontal coordinate of the fifth point of the multi-point curve
o2-11	Setpoint Y1 of multi-point curve module A	10.0%	Defines the vertical coordinate of the first point of the multi-point curve
o2-12	Setpoint X1 of multi-point curve module A	25.0%	Defines the vertical coordinate of the second point of the multi-point curve
o2-13	Setpoint X1 of multi-point curve module A	60.0%	Defines the vertical coordinate of the third point of the multi-point curve
o2-14	Setpoint X1 of multi-point curve module A	85.0%	Defines the vertical coordinate of the fourth point of the multi-point curve
o2-15	Setpoint X1 of multi-point curve module A	100.0%	Defines the vertical coordinate of the fifth point of the multi-point curve
F0-29	Main frequency source	Output of multi-point curve A	The main frequency source is set to multi-point curve A output

When AI1 input is 30.0%, the output of the multi-point curve module is 25.000% and the frequency setting is 25%.

When AI1 input is 40.0%, the value is between X2 and X3 of the multi-point curve. The multi-point curve output is calculated based on the linear relationship between the second and third points of the multi-point curve. The output is (Y3-Y2) ÷ (X3-X2) x (40.0%-X2) + Y2 = 42.5%, that is, the frequency setpoint is 42.5%.

5.4.8.9 Constant Value

Function description

The output value of the constant value module always equals the input value.

Applicable scenario

To select a fixed value as the input source, you can set the value through the constant value module, and set the input source to output from the constant value module.

Working principle

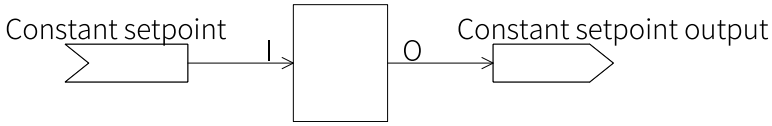


Figure 5-224 Diagram of constant value module

The output O of the constant value module equals to the set value I. There are two constant value settings:

(1) Floating-point with one decimal place number, ranging from -3000.0 to 3000.0%.

(2) Signed number, ranging from -32768 to 32767.

Connection Parameter

MD630-INT has sixteen constant value modules. The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I: Floating-point number or signed number.

The storage position of output O: Word connector and floating-point connector

The parameters corresponding to the input and output of the constant value module are shown in the following table.

Constant value setting module	Input	Output
	I	O
Floating point 1	o1-00	L2352
Floating point 2	o1-01	L2354
Floating point 3	o1-02	L2356
Floating point 4	o1-03	L2358
Floating point 5	o1-04	L2360
Floating point 6	o1-05	L2362
Floating point 7	o1-06	L2364
Floating point 8	o1-07	L2366
Single-word 1	o1-08	L1200
Single-word 2	o1-09	L1201
Single-word 3	o1-10	L1202
Single-word 4	o1-11	L1203
Single-word 5	o1-12	L1204
Single-word 6	o1-13	L1205
Single-word 7	o1-14	L1206
Single-word 8	o1-15	L1207

5.4.9 Fire Mode

5.4.9.1 Fire mode

Scenarios

In case of emergency situations such as a fire, the MD630-INT AC drive can enter fire mode. In this mode, the AC drive will ignore some non-critical faults and continue to operate to ensure the safe evacuation of personnel and timely response to firefighting efforts in buildings, elevators, tunnels, etc. Additionally, fire mode supports bypass operation, allowing the motor to run directly from the power grid. The logical conditions for fire mode can be set through group J6 parameters.

Note

When operating in the fire mode, the AC drive is in an extremely abnormal operating environment, and may be damaged. Damage in this case may not be included in the warranty.

Function description

You can set the function status of the fire mode through parameter J6-02 [Fire mode enable].

- J6-02 = 1 [Enable]: The fire mode is activated according to the input signal of J6-03 [Fire mode operation source]. Once the fire mode is activated, the AC drive will operate in abnormal extreme conditions, which may affect the product warranty.
- J6-02=2 [Fire mode test]: Meet the testing requirements. When set to 2 [Test mode], the AC drive will still enter the fire mode activation state based on the input signal of J6-03, but it differs from option 1 [Enable] in that: Test mode is only used for a one-time test, and during the test, the input signal of J6-03 will no longer take effect. Furthermore, if the AC drive is powered on with J6-02 set to 2 [Test mode], the system will automatically force J6-02 to 0 [Disable].
  Test mode is only used for fire mode function verification after factory shipment. The use of this mode is recorded and recognized by the system, but it does not affect the AC drive's warranty.



If the test mode is selected during use, the fire mode may not be activated in critical situations.

Related parameters

Param.	Name	Default	Value Range	Description
J6-02	Fire mode enable	0	0: Disable fire mode 1: Enable fire mode 2: Fire mode test	Set whether to enable the fire mode. **Value description:** 0: Disable 1: Enable 2: Fire mode test: Use this mode for fire function testing after factory release. Otherwise, the AC drive will consider a real fire has occurred, affecting warranty. Note: Do not select this mode for actual use, as the fire function may not activate.
J6-03	Fire mode operation source	0	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 Others: B connector	When the fire mode enable is active, this source can activate the fire mode. When the fire mode is running, this source can deactivate the fire mode if it becomes invalid.

5.4.9.2 Operating Frequency and Direction

Function description

The frequency source in the fire mode is given by the following independent channels:

1. Main frequency source (given by J6-11 [fire mode frequency source]): Optional digital setting (set by J6-13), operating frequency before the fire, AI input, PID, or communication;
2. Backup frequency source (given by J6-12 [Fire mode backup frequency source]): Optional digital setting value, operating frequency before the fire or maximum operating frequency (based on the per unit value of the C4-10).

The user can select the main/backup frequency source based on the actual scene.

Working principle

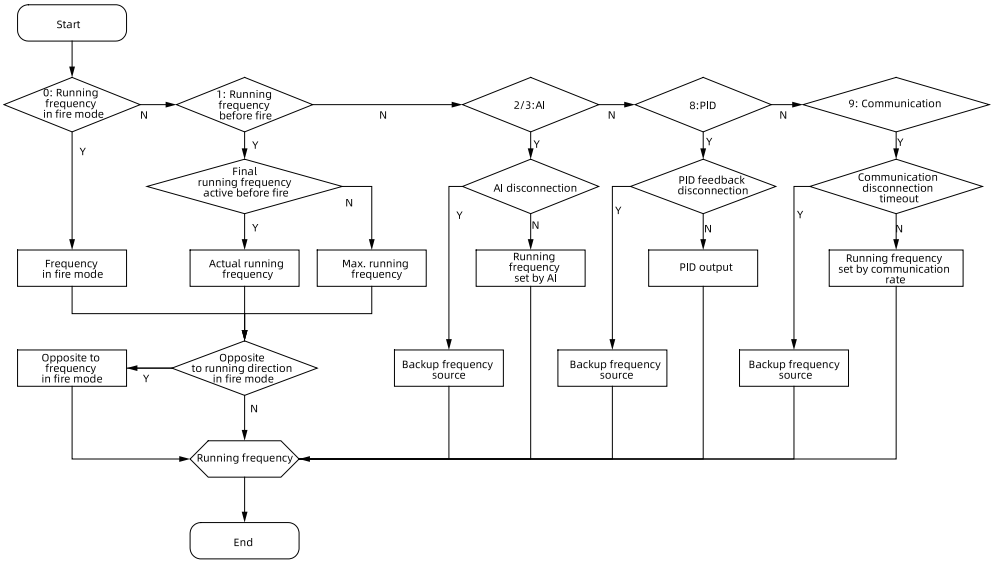


Figure 5-225 Flow diagram of the main frequency source

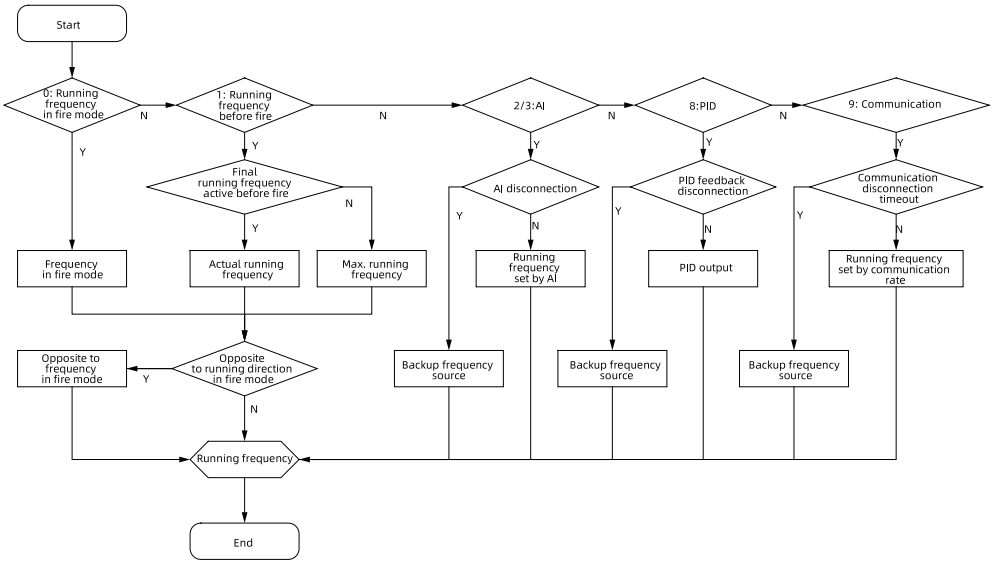


Figure 5-226 Flow diagram of the backup frequency source

J6-12 [fire mode backup frequency source] is used as a supplement to J6-11 [fire mode frequency source], and the following rules are followed:

1. **Normal situation**: The frequency source set by J6-11 [fire mode frequency source] is preferred.
2. **Upon fault**: Automatically switch to J6-12 [fire mode backup frequency source] when any of the following condition is met:

- When the frequency source of J6-11 is AI1 and AI2, AI disconnection detection is enabled, and AI disconnection occurs;
- When the frequency source of J6-11 is PID, PID feedback loss detection is enabled and the PID feedback is disconnected;
- When the frequency source of J6-11 is communication, and communication is disconnected;

3. **Special scenario**: When J6-11 = 1 [Operating frequency filter value before the fire], the AC drive will run at the maximum frequency in the following conditions.
   - The AC drive is in the stop state when the fire occurs.
   - The running time of the AC drive after startup does not exceed the J6-17, that is, when the running frequency is not stable;
   - The AC drive coasts to stop when the fire occurs.

Note

1. The frequency setting in the fire mode is determined by the motor maximum frequency, digital setting of forward upper frequency 1, digital setting of reverse upper frequency 1, forward upper frequency 2 selection, and reverse upper frequency 2 selection in the motor parameter group.
2. The operating frequency in the fire mode is not affected by H1-60 (restricted speed mode), H1-61 (safe operating frequency), H1-62 (maximum forward frequency limit), and H1-63 (maximum negative frequency limit).

Related parameters

Parameter	Name	Default	Value Range	Descriptions
J6-06	Operating direction in fire mode	0	0: Default direction 1: Opposite to the default direction	Sets the operating direction in fire mode. 0: Default direction 1: Opposite to the default direction **Note:** Active when [frequency set by digital setting] or [operating frequency filter value before the fire] is selected.
J6-07	Acceleration time in fire mode	20.0	0 to 6500.0	Sets the acceleration time in fire mode. **Note:** Active when the fire mode is activated, and the acceleration/deceleration time set by other sources is invalid.
J6-08	Deceleration time in fire mode	20.0	0 to 6500.0	Sets the deceleration time in fire mode. **Note:** Active when the fire mode is activated, and the acceleration/deceleration time set by other sources is invalid.

Parameter	Name	Default	Value Range	Descriptions
J6-11	Fire mode frequency source	0	0: Frequency set by digital setting 1: Operating frequency filter value before the fire 2: AI1 3: AI2 8: PID 9: Communication	Sets the frequency source in the fire mode. **Description** : 0: Frequency set by digital setting - the fire mode frequency is given by J6-13. 1: Operating frequency filter value before the fire - The target frequency in the fire mode depends on the operating frequency of the AC drive before the fire mode is activated. (1) If the AC drive is not running before the fire mode is activated or the running time is less than the value set by J6-17, the AC drive operates at the maximum frequency. (2) If the AC drive is running before the fire mode is activated and the continuous operation duration exceeds J6-17, and when in the fire mode, the AC drive continues to run at the frequency before the fire. 2: AI1 The target frequency in the fire mode is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 The target frequency in the fire mode is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 8: PID - The target frequency in the fire mode is determined by the output of the PID controller. 9: Communication - The target frequency in the mode is given by communication. The frequency can be set through remote communication. **Additional information:** Active when the fire mode is activated, and frequency sources set by other means are invalid when the fire mode is activated.

Parameter	Name	Default	Value Range	Descriptions
J6-12	Fire mode backup frequency source	0	0: Frequency set by digital setting 1: Operating frequency filter value before the fire 2: Maximum running frequency	Set the backup frequency source for fire mode. When the J6-11 (fire mode frequency source) selects AI1, AI2, PID, and communication, and the AI disconnection, abnormal communication, and the PID feedback disconnection occur, the backup frequency source is enabled **Description:** 0: Frequency set by digital setting - When the back frequency source is enabled, the value of J6-13 is directly used as the target frequency. 1: Operating frequency filter value before the fire - When the backup frequency source is enabled, the target frequency in the fire mode depends on the operating frequency of the AC drive before the fire mode is activated. (1) If the AC drive is not running before the fire mode is activated or the running time is less than the value set by J6-17, the AC drive operates at the maximum frequency. (2) If the AC drive is running before the fire mode is activated and the continuous operation duration exceeds J6-17, and when in the fire mode, the AC drive continues to run at the frequency before the fire. 2: Maximum running frequency - When the backup frequency source is enabled, the maximum frequency is directly used as the target frequency. **Additional information:** • When the frequency source of J6-11 is AI1 and AI2, and AI disconnection occurs; • When the frequency source of J6-11 is PID, and the PID feedback is disconnected; • When the frequency source of J6-11 is communication, and communication is disconnected; the fire mode backup frequency source is enabled.
J6-13	Frequency set by digital setting	50.00	0.00 to A2-17	Sets the frequency digital setting in the fire mode.
J6-16	Operating frequency filter time before the fire	1.0	0.0 to 300.0	Sets the filter time of the running frequency before the fire. If the AC drive is running before the fire mode is activated, filter the running frequency of the AC drive by setting this parameter. **Note:** Normally used with J6-17, providing the operating frequency before the fire for J6-11 and J6-12.
J6-17	Time for determining effective operating frequency before the fire	30.0	0.0 to 6000.0	Set the effective time of the running frequency before the fire. If the AC drive is running before the fire mode is activated, the operating frequency before the fire is considered valid when the AC drive runs continuously for longer than this parameter setting. **Note:** Normally used with J6-16, providing the operating frequency before the fire for J6-11 and J6-12.

5.4.9.3 Troubleshooting in Fire Mode

Function description

The fire mode function classifies existing faults into five levels: ignored fault, resettable fault, fault preventing operation, and two kinds of faults waiting to be reset (fault waiting to be reset 1, fault waiting to reset 2).

Fault Level		Impact	Reset
Ignored fault		It does not affect the operation of the AC drive.	Do not reset.
Resettable fault		Stop when this kind of fault is triggered	Try automatic reset after waiting for the time set by J6-21. • Reset succeeded: The AC drive automatically restarts. • Reset failed: Wait for the time set by J6-21 to continue with the next fault reset.
Fault preventing operation		Forced termination of operation	/
Fault waiting to be reset	Fault waiting to be reset 1	Stop when this kind of fault is triggered	Wait for the time set by J6-22 [Waiting time for fault waiting to be reset 1]/J6-23 [Waiting time for fault waiting to be reset 2] and J6-21[Delay for automatic fault reset in fire mode] before the automatic reset. • Reset succeeded: The AC drive automatically restarts. • Reset failed: Wait for the time set by J6-21 to continue with the next fault reset.
	Fault waiting to be reset 2		

Automatic fault reset function in fire mode: In the absence of faults preventing operation, the AC drive restarts after successful reset of resettable faults and faults waiting to be reset.

The priority of multi-fault response is as follows.

Fault co-existence		Response	Response priority
There is a fault preventing operation.		Immediate stop	High
No fault preventing operation, but there are:	Resettable fault	Stop→Auto reset→Restart Note: Takes the maximum wait time as reset time.	Medium
	Fault waiting to be reset		
There are only ignored faults/no faults.		Continuous operation	Low

Related parameters

Param.	Name	Default	Value Range	Descriptions
J6-20	Number of automatic fault reset times in fire mode	80	0 to 100	Sets the number of automatic fault reset times in fire mode. When the fire mode is active, most faults can be ignored and the AC drive continues to run directly. For some faults, reset is required. The number of automatic fault resets is set through this parameter. The AC drive can start directly after the fault is automatically reset. **Note:** Active when the fire mode is activated, and then the H3 group automatic fault reset and restart is invalid.
J6-21	Delay for automatic fault reset in fire mode	1.0	0 to 300.0	Sets the time delay for automatic failure reset in fire mode. When a fault occurs in fire mode that requires automatic reset, the reset command is generated after the delay time. **Note:** Active when the fire mode is activated, and then the H3 group automatic fault reset and restart is invalid.
J6-22	Waiting time for fault waiting to be reset 1	10	0 to J6-23	Sets the waiting time for fault waiting to be reset 1. When the fire mode is active, most faults can be ignored and the AC drive continues to run directly. For some faults, a waiting time is required before the automatic fault reset processing is executed. **Note:** When the fire mode is activated and such a fault occurs, the AC drive stops and waits for the set time of J6-22, and then the AC drive performs automatic fault reset processing. After the set time of of J6-21, the automatic fault reset instruction is issued.
J6-23	Waiting time for fault waiting to be reset 2	30	J6-22 to 3600	Sets the waiting time for fault waiting to be reset 2. When the fire mode is active, most faults can be ignored and the AC drive continues to run directly. For some faults, a waiting time is required before the automatic fault reset processing is executed. **Note:** When the fire mode is activated and such a fault occurs, the AC drive stops and waits for the set time of J6-23, and then the AC drive performs automatic fault reset processing. After the set time of of J6-21, the automatic fault reset instruction is issued.

5.4.9.4 Bypass

Scenarios

The bypass function allows the motor to switch to the mains frequency operation through a bypass switch (such as a contactor or circuit breaker) when the AC drive fails or needs to be switched urgently, bypassing the AC drive control to ensure motor continuous operation.

Function description

The bypass function of MD630-INT fire mode is controlled by parameter J6-27 [Enable bypass function in fire mode]. After the function is enabled, the AC drive stops running when it fails to operate or the preset fault reset times is exhausted. After waiting for the time set by J6-28 [Fire

bypass delay], a bypass signal outputs to the L0802 [fire mode bypass flag] connector (the user can bind the connector to the DO output to control the bypass switch). The purpose of the bypass delay is to wait for the motor to decelerate.

Related parameters

Param.	Name	Default	Value Range	Descriptions
J6-27	Enable bypass function in fire mode	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	Sets whether to enable the fire bypass function. When the AC drive is abnormal in fire mode and cannot operate normally, the motor can switch to mains frequency operation through the bypass function. **Description:** 0: Disable - When the AC drive is abnormal in fire mode, the motor stops running without the bypass signal. 1: Enable - When the AC drive is abnormal in the fire mode, DO/RO outputs a bypass signal and makes the motor switch to mains frequency operation through external electrical lines. 3 to 9: DI1 to DI7 - Whether the bypass function is enabled depends on the terminal state of the DI. Others: B connector **Note:** You can control the bypass switch by selecting "L0802" in "Others: B Connector" on the DO/RO terminal
J6-28	Fire bypass delay	5.0	0.0 to 300.0	Sets the delay time of bypass function in fire mode. After an AC drive failure, the bypass signal is output after this delay time.

5.5 Fault and Protection

5.5.1 Startup Protection

Application scenarios

By setting P0-21 (Start protection selection) to 1 (enable), the AC drive is protected from power-on without knowledge. Danger caused by the motor responding to a running command.

The following conditions can be protected:

If the running command is valid when the AC drive is powered on (for example, an input terminal is ON before power-on), the AC drive does not respond to the command. The AC drive responds only after the running command is canceled and becomes valid again.

Related parameters

Table 5–105 Parameters related to startup protection

Specification	Name	Default value	Value Range	Descriptions
P0-21	Startup protection	1	0: Disable 1: Enable	It is used to set whether the startup protection function is enabled. Value description 0: Disable This means that the startup protection is not enabled. 1: Enable The startup protection is enabled. Additional information: If it is set to 1, the AC drive does not respond to the run command valid upon AC drive power-on (for example, an input terminal is ON before power-on). The AC drive responds only after the run command is cancelled and becomes valid again. In addition, the AC drive does not respond to the run command valid upon fault reset of the AC drive. The run protection can be disabled only after the run command has been cancelled.

5.5.2 Fault Reset and Restart

5.5.2.1 Fault Reset Mode

MD630-INT supports two fault reset modes, automatic reset and manual reset.

After troubleshooting, you can perform a manual reset through the  on operating panel, or by configuring the DI terminal function, or through communication. For details, see *"5.5.2.2 Manual Fault Reset" on page 703*.

The automatic reset mode takes effect only when configuring parameter group H3. For details, see *"5.5.2.3 Automatic Fault Reset " on page 705*.

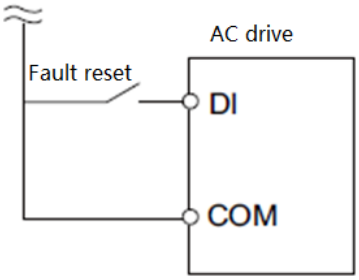
5.5.2.2 Manual Fault Reset

When the AC drive is faulty, users need to perform a manual reset for troubleshooting, preventing negative effects on the equipment.

There are four methods to manually reset a fault:

Method 1: Reset the fault through the DI terminal.

Set the function of any DI terminal to 9 (fault reset). In this way, the faults can be reset when an active signal is sent to the DI terminal.



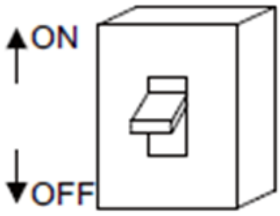
Method 2: Reset the fault through the operating panel.

Press the  key on the operating panel to reset the fault.



Method 3: Automatic fault reset after the AC drive is powered on again.

Disconnect the main circuit power supply. Wait until the fault code disappears, and then connect the power supply again.



Method 4: Reset the fault through communication.

When b1 (command source) is set to 2 (communication control), write "16" (Bit 4 fault reset) to communication address 7321H using the host controller to reset the AC drive after the fault is cleared.



5.5.2.3 Automatic Fault Reset

Scenario

After a fault occurs, the fault is automatically reset if the fault triggering condition does not exist. In this case, you do not need to take any action.

Working principle

The function of automatic fault reset of the MD630-INT drive is invalid by default. The default value of parameter H3-01 (number of automatic fault resets) is 0. To enable the function, you need to configure the relevant parameters. The following figure shows the function of automatic fault reset.

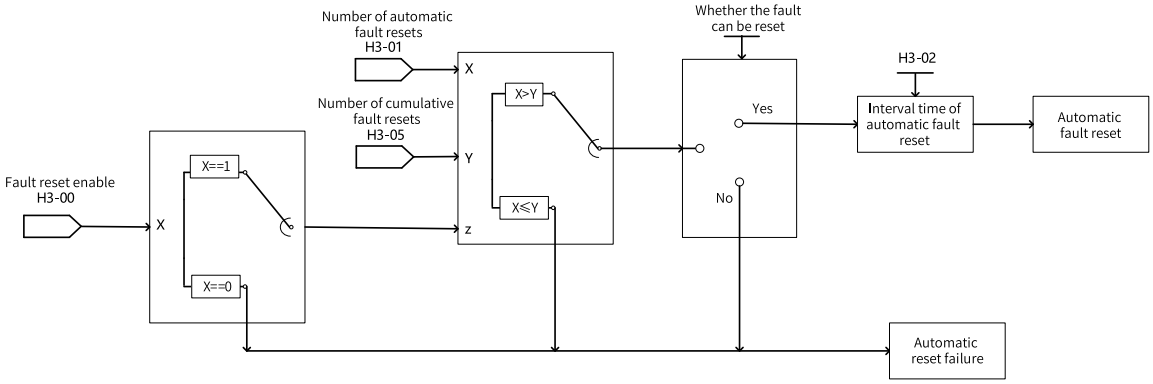


Figure 5-227 Function of automatic fault reset

As shown in the figure above, the parameters to be set are as follows:

(1) Set H3-00 (automatic fault reset) to 1 (enable).

(2) Set H3-01 (number of automatic fault resets).

(3) Set H3-02 (time interval for automatic fault reset), which is the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.

When a fault occurs, you need to ensure that H3-00 (automatic fault reset) is set to 1 (enable), and H3-01 (number of automatic fault resets) is greater than H3-05 (cumulative number of automatic fault resets). The drive will reset the fault every time set by H3-02 (time interval for automatic fault reset) until the problem has been resolved.

Unless the fault can be quickly located and resolved, the value of H3-02 (time interval for automatic fault reset) is not recommended to set to a small value. This is because the drive will reset the fault once every set interval after the fault occurs. If the fault does not meet the reset condition, the number of reset times of the current fault (H3-05) is increased by 1. If the interval is too short and the fault does not reach the reset condition for a long time, the number of automatic fault resets may be exhausted. That is, the value of H3-05 (Cumulative number of automatic fault resets) is greater than the value of H3-01 (number of automatic fault resets).

In addition, when the number of automatic fault resets is exhausted, the number can be resumed through H3-04 (time for restoring the number of automatic fault resets) and H3-06 (action when the number of automatic fault resets reaches).

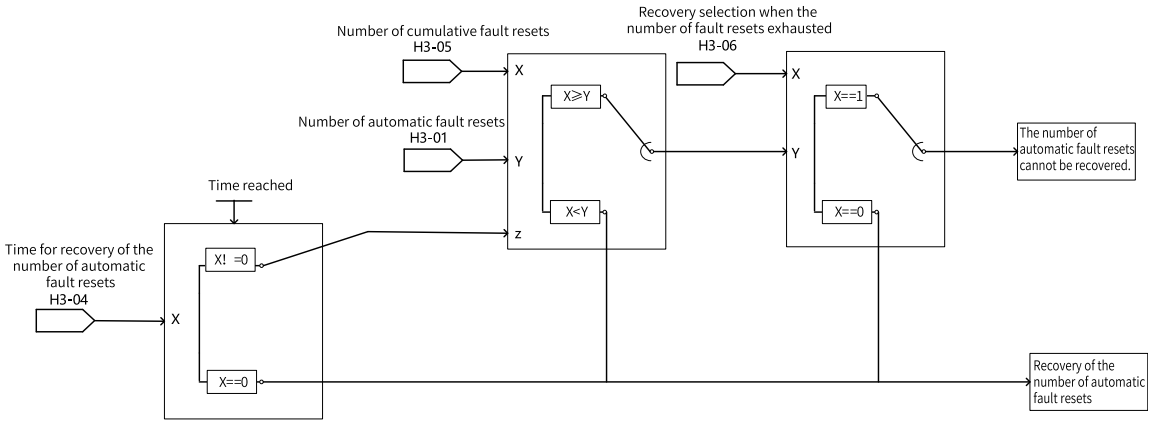


Figure 5-228 Recovery of the automatic fault reset number

As shown in the above figure, if H3-04 (time for restoring the number of automatic fault resets) is not set, H3-01 (number of automatic fault resets) can be restored continuously. If H3-04 is set and the value of H3-05 (cumulative number of automatic fault resets) is smaller than the value of H3-01 (number of automatic fault resets), the number of automatic fault resets can be restored.

When the value of H3-05 (cumulative number of automatic fault resets) is larger than or equal to the value of H3-01 (number of automatic fault resets), whether the number of automatic fault resets can be restored depends on the value of H3-06 (action when the number of automatic fault resets reaches). When H3-06 is set to 1 (number of automatic fault resets not restored), the number of automatic fault resets cannot be restored, that is, the number of automatic fault resets is exhausted. When H3-06 is set to 0 (number of automatic fault resets restored), the number of automatic fault resets is restored.

At the same time, the MD630-INT drive supports ten faults that are inhibited from automatic fault reset, which are set through H3-13 (fault code 1 inhibited from automatic fault reset) to H3-22 (fault code 10 inhibited from automatic fault reset).

Related parameters

Table 5–106 Parameters related to automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-00	Automatic fault reset	1	0: Disable 1: Enable	This parameter sets whether to enable automatic fault reset. Value description 0: Disable. Automatic fault reset is disabled. 1: Enable. Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	This parameter sets the number of automatic fault resets. Remarks: If the number of reset times exceeds the value of this parameter, the AC drive remains in the faulty state.

Parameter code	Parameter name	Default value	Range	Description
H3-02	Time interval for automatic fault reset	1.0s	0.1s to 600.0s	This parameter sets the time interval for automatic fault reset. Remarks: This parameter sets the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.
H3-03	Automatic reset disabled when manual reset applies	1	0: Automatic reset terminated 1: Automatic reset continues	This parameter sets whether automatic reset can be terminated by manual reset during the automatic reset process. If the fault is terminated, the AC drive no longer resets the fault automatically. Value description 0: Automatic reset is terminated upon manual reset. 1: Automatic reset continues after manual reset.
H3-04	Time for restoring the number of automatic fault reset times	10 min	0 min to 6000 min	This parameter sets the time for restoring the number of automatic reset times. Remarks: When it is not set to 0, the number of automatic fault reset times is restored after the time set by H3-04 elapses; when it is set to 0, the number of automatic fault reset times is restored all the time.
H3-05	Cumulative number of automatic fault resets	0	-	This parameter displays the cumulative number of automatic fault resets, which cannot be modified. When the number of manual resets and automatic resets are reached, the number will be cleared.
H3-06	Action when the number of automatic fault resets reaches	0	0: Number of automatic fault resets restored. 1: Number of automatic fault resets not restored.	This parameter sets whether to restore the number of automatic fault resets after the number is exhausted. Value description: 0: When the number of automatic fault resets is exhausted and time for restoring the number of automatic fault resets reach, the number of automatic fault resets can be restored automatically. 1: When the number of automatic fault resets is exhausted, the number cannot be restored automatically.
H3-07	Fault output selection	0	0: No output during automatic fault reset 1: Output during automatic fault reset	This parameter sets whether there is output during automatic fault reset, which determines whether connector L0134 (fault output) is 1 during fault reset. Value description: 0: No output during automatic fault reset 1: Output during automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-13	Fault code 1 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the fault code 1 that is inhibited from automatic fault reset. You need to enter the main code and subcode of the fault, such as 187.1. Remarks: For example, after the main code and subcode of the fault, such as 187.1, is set, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-15	Fault code 3 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-16	Fault code 4 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-17	Fault code 5 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-18	Fault code 6 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-19	Fault code 7 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-20	Fault code 8 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-21	Fault code 9 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-22	Fault code 10 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13

5.5.2.4 Automatic fault reset/restart

Scenarios

When the AC drive reports a fault during operation, the automatic reset upon a fault and automatic restart upon a fault functions enable the AC drive to restart after the AC drive resets upon the fault and after the waiting time for automatic restart upon a fault expires.

Operation principles

During restart, if the AC drive receives a stop/manual reset command, it will stop and not restart. You can set a white list containing up to six faults, upon which the AC drive will reset and then restart. Or you can also set a black list containing up to six faults, upon which the AC drive is not allowed to reset or restart.

When H3-31 (Restart after automatic fault reset) is 0 (white list), H3-34 (designated fault code 1) to H3-39 (specified fault code 6) can set six groups of fault numbers for automatic restart. When H3-31 is set to 1 (black list), all fault numbers except H3-34 to H3-39 are allowed to restart automatically. The following figure shows details.

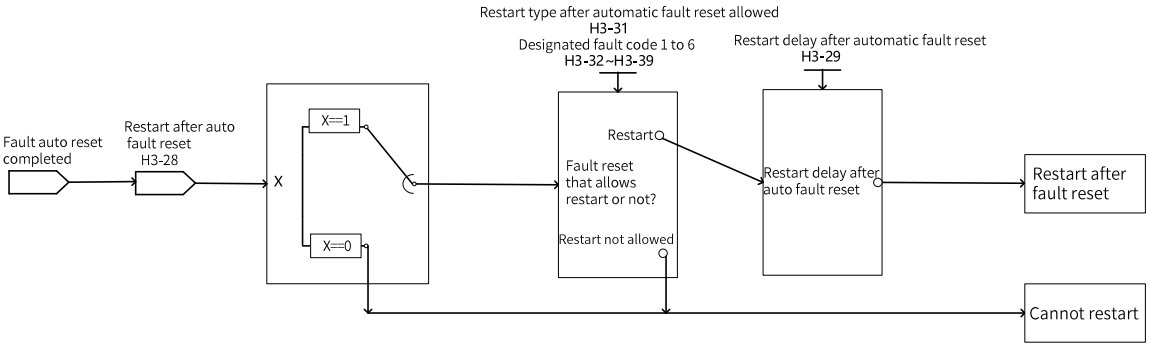


Figure 5-229 Automatic fault reset/restart

For example, set H3-00 to 1, H3-01 to 10, and H3-02 to 5s. H3-28 (Restart after automatic fault reset) is 1 (Enable) and H3-29 (Restart delay after automatic fault reset) is 5s.

When the AC drive is running, a fault is created and H2-00 (External fault 1 (NO) source) is set to 1 (Active). In this case, the AC drive reports the fault E015.1. Then set H2-00 to 0 to turn off the fault occurrence condition. After the fault is reset automatically, after the 5s restart delay, The AC drive starts automatically.

Related parameters:

Table 5–107 Automatic fault reset/restart

Item	Name	De fault	Value Range	Descriptions
H3-28	Restart after automatic fault reset	0	0: Disable 1: Enable	This parameter is used to define whether the AC drive restarts. Value description 0: Disable - Restart is not performed after automatic fault reset. 1: Enable - Restart is performed after automatic fault reset.
H3-29	Restart interval upon automatic fault reset	0.5s	0.0–600.0s	This parameter sets the waiting time from automatic fault reset to automatic restart.
H3-30	Adopt flying start after automatic fault reset	0	0: Disable Flying start is not adopted after automatic fault reset. 1: Enable Flying start is adopted after automatic fault reset.	This parameter determines whether to enable flying start for automatic restart upon a fault. Flying start prevents the motor from being restarted when motor speed is not reduced to 0 upon fault, thus avoiding overcurrent fault caused by inrush current upon start. Description 0: Disable Flying start is not adopted after automatic fault reset. 1: Enable Flying start is adopted after automatic fault reset.
H3-31	List that allows restart after automatic fault reset	1	0: White list 1: Black list	Sets the method of allowing restart after automatic fault reset. Value description 0: Whitelist Automatic restart is allowed for the faults set by H3-34 to H3-39 after the faults are reset. 1: Blacklist Automatic restart is allowed for the faults set by parameters other than H3-34 to H3-39 after the faults are reset.
H3-34	Designated fault code 1	0.0	0.0 to 255.9	To set fault code 1, which allows restart after automatic fault reset, enter the fault code and subcode, such as 187.1. Additional information: For example, enter the master code and subcode of the fault, such as 187.1, the EEPROM junction temperature parameter storage error (E187.1) is performed according to the black and white list set by H3-31.
H3-35	Designated fault code 2	0.0	0.0 to 255.9	This parameter sets the fault group that automatic restart is allowed for after the faults are reset.

Item	Name	De fault	Value Range	Descriptions
H3-36	Designated fault code 3	0.0	0.0 to 255.9	This parameter sets the fault group that automatic restart is allowed for after the faults are reset.
H3-37	Designated fault code 4	0.0	0.0 to 255.9	This parameter sets the fault group that automatic restart is allowed for after the faults are reset.
H3-38	Designated fault code 5	0.0	0.0 to 255.9	This parameter sets the fault group that automatic restart is allowed for after the faults are reset.
H3-39	Designated fault code 6	0.0	0.0 to 255.9	This parameter sets the fault group that automatic restart is allowed for after the faults are reset.

5.5.3 Fault Protection Action Selection

5.5.3.1 Setting Actions to Faults

Scenarios

The fault action indicates the corresponding measures taken by the drive in response to a fault. You can set the fault action according to actual requirements to keep the drive in the corresponding state after the fault occurs.

Function description

The MD630-INT AC drive can be set with 11 types of fault actions. Ranked from most severe to least severe, the fault levels can be divided into: coast-to-stop > maximum-capacity stop > quick stop > decelerate-to-stop > limited operation (with limited speed, power, current, and torque) > alarm > notification > No detection.

When "No detection" is selected as the protective action against fault, no prompt will be displayed when a fault occurs. Select this option only when necessary.

Different fault actions can be set for faults so that the drive takes corresponding measures when a fault occurs. See the table below.

Table 5–108 Fault action description

Action	**Description**	Related parameters
Coast to stop	After a fault occurs, the AC drive stops output and the load coasts to stop due to its inertia.	-
Maximum-capacity stop	After a fault occurs, the AC drive outputs at maximum capacity to stop the load in the shortest time.	The fixed deceleration time for maximum-capacity stop is 50 ms.
Quick stop	After a fault occurs, the AC drive stops according to the specified quick stop time.	b7-34 (Deceleration time for quick stop)

Action	**Description**	Related parameters
Decelerate to stop	After a fault occurs, the AC drive stops according to the specified deceleration time.	Take the first group of acceleration/ deceleration time as an example: b7-04 (Ramp 1 acceleration time) b7-05 (Ramp 1 deceleration time)
Run with speed restriction	After a fault occurs, the AC drive keeps running in the mode set by H1-60.	H1-60 (Run with speed restriction) H1-61 (Designated safe running frequency) H1-62 (Maximum forward frequency limit) H1-63 (Maximum reverse frequency limit)
Run with power restriction	After a fault occurs, the AC drive keeps running with a power not exceeding the power limited by H1-64 and H1-65.	H1-64 (Maximum motoring power limit) H1-65 (Maximum regenerative power limit)
Run with current restriction	After a fault occurs, the AC drive keeps running with a current not exceeding the current limited by H1-68.	H1-68 (Maximum current limit)
Run with torque restriction	After a fault occurs, the AC drive keeps running with a torque not exceeding the torque limited by H1-66 and H1-67.	H1-66 (Maximum forward torque limit) H1-67 (Maximum reverse torque limit)
Alarm	After a fault occurs, the AC drive displays the alarm code, which has no effect on running.	-
Notification	After a fault occurs, the AC drive displays the notification code, which has no effect on running.	-
Ignorable fault	A fault that is ignored by the AC drive	-

There are multiple modes and parameters for the "Run with speed restriction" action. When a fault occurs and the fault action is set to "Run with speed restriction", the drive continues to run in the mode defined by H1-60 (Run with speed restriction). The following six options are available for H1-60: The following six options are available for H1-60:

0: Run at limit frequency. In this mode, the drive continues to run after a fault occurs, but the speed is limited by H1-62 and H1-63. The drive cannot run at a speed higher than the speed limit. H1-62 and H1-63 indicate the frequency reference in percentages. The base value (100%) is determined by A2-04 (Per unit frequency base value).

1: Run at the running frequency upon fault. In this mode, after a fault occurs, the drive continues to run according to the running frequency upon fault.

2: Designated safe running frequency. In this mode, after a fault occurs, the drive continues to run according to H1-61. H1-61 indicates the frequency reference in percentages. The base value (100%) is determined by A2-04 (Per unit frequency base value).

3: Run at set frequency. In this mode, the drive continues to run at the set frequency after a fault occurs.

4: Run at the upper frequency limit in the current direction. In this mode, the drive runs at the upper frequency in the current direction after a fault occurs.

5: Run at the lower frequency limit in the current direction. In this mode, the drive runs at the lower limit frequency in the current direction after a fault occurs

The MD630-INT can be configured with output terminals that provide a valid signal when a fault occurs.

For example, parameter E1-04 [DO output function selection] is configured as option 2 [Fault output], option 38 [Abnormal output (Fault/Minor fault/Warning)], option 41 [Fault (excluding undervoltage) output], and option 43 [Output on minor fault or warning]:

2: Fault - When the AC drive stops due to a fault (coast to stop, stop at maximum capability, quick stop, or decelerate to stop), the terminal outputs an active signal.

38: Exception (fault/minor fault/alarm) - When the AC drive encounters a fault, a minor fault, or an alarm, the terminal outputs an active signal.

41: Fault (excluding undervoltage) - When the AC drive encounters a fault (excluding undervoltage), the terminal outputs an active signal.

43: Minor fault or alarm - When the AC drive encounters a minor fault or an alarm, the terminal outputs an active signal.

For the fault protection action selection, see the fault action range set in H1-00 to H1-18. For details, see "Setting Main Fault Code Actions".

When the fault level is a notification, the output terminals cannot be configured as fault output signals.

Related parameters

Table 5–109 Fault operation mode related parameters

Param.	Name	Default	Setting range	Description
H1-60	Run with speed restriction	1	0: Run at limit frequency 1: Run at the running frequency upon fault 2: Run at designated safe running frequency 3: Run at set frequency 4: Run at the upper frequency limit in the current direction 5: Run at the lower frequency limit in the current direction	This parameter is used to select the mode in which the AC drive runs with speed restrictions upon a minor fault. Value description: 0: When the limit occurs, the maximum running frequency is limited by H1-62 and H1-63. 1: When the limit occurs, the drive continues to run at the running frequency upon fault. 2: When the limit occurs, the drive runs at the the safe running frequency specified by H1-61. 3: When the limit occurs, the drive runs at the set frequency. 4: When the limit occurs, the drive runs at the upper frequency limit in the current direction. 5: When the limit occurs, the drive runs at the lower frequency limit in the current direction.
H1-61	Designated safe running frequency	0.0%	0.0% to 800.0%	This parameter sets the designated safe running frequency under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 2, the AC drive runs at the designated safe operation frequency upon a minor fault.

Param.	Name	Default	Setting range	Description
H1-62	Maximum forward frequency limit	100.0%	0.0% to 800.0%	This parameter sets the maximum frequency in the forward direction under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the forward direction upon a minor fault.
H1-63	Maximum reverse frequency limit	100.0%	0.0% to 800.0%	This parameter sets the maximum frequency in the reverse direction under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the reverse direction upon a minor fault.
H1-64	Maximum motoring power limit	50.0%	0.0% to 400.0%	This parameter sets the maximum frequency in the reverse direction under restricted operation conditions. Note: This parameter is used to set the maximum motoring power for occurrence of minor faults.
H1-65	Maximum regenerative power limit	50.0%	0.0% to 400.0%	This parameter sets the maximum regenerative power under restricted running conditions. Note: This parameter is used to set the maximum regenerative power for occurrence of minor faults.
H1-66	Maximum forward torque limit	50.0%	0.0% to 400.0%	This parameter sets the maximum torque in the forward direction under restricted running conditions. Note: This parameter is used to set the maximum positive torque for occurrence of minor faults.
H1-67	Maximum reverse torque limit	50.0%	0.0% to 400.0%	This parameter sets the maximum torque in the reverse direction under restricted running conditions. Note: This parameter is used to set the maximum reverse torque for occurrence of minor faults.
H1-68	Maximum current limit	50.0%	0.0% to 400.0%	This parameter sets the maximum current under restricted running conditions. Note: This parameter is used to set the maximum current for occurrence of minor faults.

5.5.3.2 Set Protection Actions upon Faults

Scenarios

The fault protection action setting is used to set the action of all fault subcodes of the fault code, ensuring that the fault protection action of the subcodes is consistent.

Function description

MD630-INT supports setting fault actions for 76 fault codes. The corresponding fault actions are set through the parameters H1-00 to H1-18. The fault action is set by the ones, tens, hundred, and thousands place of each parameter. As shown in the following table, the ones, tens, hundred, and thousands place of H1-00 stand for the fault actions of overcurrent, overvoltage, pre-charge fault, and undervoltage, respectively.

Table 5–110 Parameter setting for fault protection action

Parameter	Fault Name	Subcode		
H1-00	Protection action 0 upon fault	Ones place	Overcurrent (E002)	0: Coast to stop
		Tens place	Overvoltage (E005)	0: Coast to stop
		Hundreds place	Pre-charge fault (E008)	0: Coast to stop
		Thousands place	Undervoltage (E009)	0: Coast to stop

It should be noted that not every fault code can set 11 fault actions; only the fault actions provided of the parameter can be set. For example, for the ones place of H1-00, only one option (coast to stop) is available for an overcurrent fault (E002). This indicates that the corresponding fault code only supports one fault action and other fault actions are not supported.

When the fault action of the fault code is set, all the subcodes of the fault code maintain the same fault action as the fault code. You can modify the fault actions as needed. For details, see *"5.5.3.3 Action Modification of a Single Fault" on page 751*.

For example, if you set the value at the thousands place of H1-03 to 3, that is, the fault protection action of the fault code E186 (Power EEPROM fault) is to decelerate to stop, then the fault action for all the subcodes under this fault code is to decelerate to stop, including E186.1, E186.2 , and E186.3.

Related parameters

Table 5–111 Parameter setting for protection action of fault codes

Param.	Name	Default	Value Range	Descriptions
H1-00	Protection action 0 upon fault	0	Ones position: Overcurrent (E002) 0: Coast to stop Tens position: Overvoltage (E005) 0: Coast to stop Hundreds position: Pre-charge fault (E008) 0: Coast to stop Thousands position: Undervoltage (E009) 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Overcurrent (E002) 0: Coast to stop - When the AC drive encounters overcurrent due to certain reasons, the operating panel displays E002 and the motor coasts to stop. Tens position: Overvoltage (E005) 0: Coast to stop - When the AC drive encounters overvoltage due to certain reasons, the operating panel displays E005 and the motor coasts to stop. Hundreds position: Pre-charge fault (E008) 0: Coast to stop When the AC drive encounters a pre-charge fault due to certain reasons, the operating panel displays E008 and the motor coasts to stop. Thousands position: Undervoltage (E009) 0: Coast to stop When the AC drive encounters undervoltage for some reason, the operating panel displays E009 and the motor coasts to stop. Remarks: Fault protection actions for overcurrent, overvoltage, pre-charge fault, and undervoltage set by this parameter cannot be changed. If preceding faults occur, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-01	Protection action 1 upon fault	0	Ones position: Inverter overload (E010) 0: Coast to stop Tens position: Motor overload (E011) 0: Coast to stop Hundreds position: Input phase loss (E012) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque (Continued)	Sets the protection action for different faults. Value description: Ones position: Inverter overload (E010) 0: Coast to stop - When the AC drive encounters overload due to certain reasons, the operating panel displays E010 and the motor coasts to stop. Tens position: Motor overload (E011) 0: Coast to stop - When the AC drive encounters motor overload due to certain reasons, the operating panel displays E011 and the motor coasts to stop. Hundreds position: Input phase loss (E012) 0: Coast to stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor coasts to stop. 1: Stop at maximum capability - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor stops at the maximum capability. 2: Quick stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor performs quick stop. 3: Decelerate to stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor decelerates to stop. 9: Run at limited speed - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the speed limited to a certain range. 00AH: Run at restricted power - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the power limited to a certain range. 000BH: Run with limited current - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the torque limited to a certain range. (Continued)

Param.	Name	Default	Value Range	Descriptions
H1-01	Protection action 1 upon fault	0	(Continued) D: Alarm E: Prompt F: No detection Thousands position: Output phase loss (E013) 0: Coast to stop	(Continued) 00DH: Alarm - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays A012 and the AC drive operates normally. 00EH: Prompt - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays N012 and the AC drive operates normally. 00FH: Ignore - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Thousands position: Output phase loss (E013) 0: Coast to stop - When the AC drive encounters phase loss on the output side due to certain reasons, the operating panel displays E013 and the motor coasts to stop. Remarks: Fault protection actions for inverter overload, motor overload, and phase loss on the output side set by this parameter cannot be changed. If preceding faults occur, the AC drive stops output and the motor coasts to stop. If a phase loss fault occurs on the input side, you can modify the fault protection action to make the AC drive act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-02	Protection action 2 upon fault	0	Ones position: Module overtemperature (E014) 0: Coast to stop Tens position: External fault (E015) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt (Continued)	The ones, tens, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Module overtemperature (E014) 0: Coast to stop - When the AC drive encounters the drive overtemperature threshold reach fault due to certain reasons, the operating panel displays E014 and the motor coasts to stop. Tens position: External fault (E015) 0: Coast to stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor coasts to stop. 1: Stop at maximum capability - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor stops at the maximum capability. 2: Quick stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor performs quick stop. 3: Decelerate to stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor decelerates to stop. 9: Run with speed restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the speed limited to a certain range. 10: Run with power restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the power limited to a certain range. 11: Run with current restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the current limited to a certain range. 12: Run with torque restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the torque limited to a certain range. 13: Alarm - When the AC drive encounters an external fault due to certain reasons, the operating panel displays A015 and the AC drive operates normally. 14: Prompt - When the AC drive encounters an external fault due to certain reasons, the operating panel displays N015 and the AC drive operates normally. (Continued)

Param.	Name	Default	Value Range	Descriptions
H1-02	Protection action 2 upon fault	0	(Continued) F: No detection Hundreds position: Reserved 0: Coast to stop Thousands position: Current sampling error (E018) 0: Coast to stop	(Continued) 15: Ignore - When the AC drive encounters an external fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Thousands position: Current sampling error (E018) 0: Coast to stop - When the AC drive encounters a current sampling fault due to certain reasons, the operating panel displays E018 and the motor coasts to stop. Remarks: Fault protection actions for drive overtemperature threshold reach and current sampling faults set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop. If an external fault occurs, you can modify the fault protection action to make the AC drive act accordingly.
H1-03	Protection action 3 upon fault	0	Ones position: Parameter auto-tuning error (E019) 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: EEPROM fault (E021) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop F: No detection	Same as H1-00

Param.	Name	Default	Value Range	Descriptions
H1-04	Protection action 4 upon fault	0	Ones position: Output short-circuited to ground (E023) 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: Cumulative running time reached (E026) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: User-defined fault (E027) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	The ones, tens, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Output short-circuited to ground (E023) 0000H: Coast to stop - When the AC drive encounters an output short-circuited to ground fault due to certain reasons, the operating panel displays E023 and the motor coasts to stop. Hundreds position: Cumulative running time reached (E026) 0000H: Coast to stop - When the AC drive encounters a cumulative running time reach fault due to certain reasons, the operating panel displays E026 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays A026 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays N026 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands position: User-defined fault (E027) 0000H: Coast to stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor decelerates to stop. 000FH: Ignore - When the AC drive encounters a custom fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for output short-circuited to ground faults set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop. If the cumulative running time reach fault and user-defined fault occur, you can modify the fault protection action to make the AC drive act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-05	Protection action 5 upon fault	0x00DD	Ones position: User-defined alarm (E028) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Accumulative power-on time reached (E029) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: User-defined alarm (E028) 0000H: Coast to stop - When the AC drive encounters a user-defined alarm due to certain reasons, the operating panel displays E028 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays A028 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays N028 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a custom alarm due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Hundreds position: Three phase loss (E030) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: PID fault feedback loss (E031) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: Accumulative power-on time reached (E029) 0000H: Decelerate to stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor decelerates to stop. 0001H: Stop at maximum capability - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays A029 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays N029 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Hundreds position: Three phase loss (E030) 0000H: Coast to stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays A030 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays N030 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters hree-phase loss due to certain reasons, the operating panel does not display any fault and the AC drive operates normally.

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands position: PID fault feedback loss (E031) 0000H: Coast to stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays A031 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays N031 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the PID fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions, including actions for custom fault, cumulative power-on time reached, three-phase loss fault, and PID feedback loss fault can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-06	Protection action 6 upon fault	0x0D0D	Ones position: Parameter reset error (E032) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Reserved 0: Coast to stop (Continued)	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: Parameter reset error (E032) 0000H: Coast to stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays A032 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays N032 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a parameter exception due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Tens position: Reserved (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Hundreds position: Excessive speed deviation (E042) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (Continued)	(Continued) Hundreds position: Excessive speed deviation (E042) 0000H: Coast to stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays A042 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays N032 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a parameter exception due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Thousands position: Motor speed overlimit (E043) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Thousands position: Motor speed error (E043) 0000H: Coast to stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays A043 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays N043 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor overspeed due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for parameter reset error, excessive speed deviation fault, and motor overspeed error can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-07	Protection action 7 upon fault	0x0	Ones: Reserved 0: Coast to stop Tens position: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Auto-tuned pole position error (E051) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Description: Ones: Reserved 0000H: Coast to stop Tens: Reserved 0000H: Coast to stop Hundreds: Reserved 0000H: Coast to stop Thousands: Auto-tuned pole position error (E051) 0000H: Coast to stop - When the AC drive encounters a magnetic pole position auto-tuning error due to certain reasons, the operating panel displays E051 and the motor coasts to stop. Note: Fault protection actions for the magnetic pole position auto-tuning error set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop.
H1-08	Protection action 8 upon fault	0x0	Ones: Reserved 0: Coast to stop Tens: Self-test fault 1 (E056) 0: Coast to stop Hundreds: Self-test fault 2 (E057) 0: Coast to stop Thousands：Self-test fault 3 (E058) 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Description: Tens: Self-test fault 1 (E056) 0000H: Coast to stop - When the AC drive encounters self-test fault 1 due to certain reasons, the operating panel displays E056 and the motor coasts to stop. Hundreds: Self-test fault 2 (E057) 0000H: Coast to stop - When the AC drive encounters self-test fault 2 due to certain reasons, the operating panel displays E057 and the motor coasts to stop. Thousands: Self-test fault 3 (E058) 0000H: Coast to stop - When the AC drive encounters self-test fault 3 due to certain reasons, the operating panel displays E058 and the motor coasts to stop. Note: Fault protection actions for self-test fault 1 to self-test fault 3 set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-09	Protection action 9 upon fault	0x0	Ones position: Self-test fault 4 (E059) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Description: Tens: Self-test fault 4 (E059) 0000H: Coast to stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor performs quick stop. 0003H: Quick stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor performs quick stop. 0009H: Run with speed limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays A059 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays N059 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Note: Fault protection action for self-test fault 4 cannot be changed. If this fault occurs, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-10	Protection action 10 upon fault	0	Ones position: Fan fault (E080) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Reserved 0: Coast to stop Hundreds position: Reserved 0: Coast to stop Thousands position: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: Fan fault (E080) 0000H: Coast to stop When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor coasts to stop. 0001H: Stop at maximum capability When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays A080 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays N080 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a fan fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for fan fault can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-11	Protection action 11 upon fault	0x0F00	Ones: Reserved 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: Sequence fault (E085) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: Motor control error 1 (E093) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Value description: Hundreds position: Sequence fault (E085) 0000H: Coast to stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays A085 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays N085 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands position: Motor control error 1 (E093) 0000H: Coast to stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays A093 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays N093 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for time sequence fault and motor control exception 1 can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-12	Protection action 12 upon fault	0xDDDD	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: AC drive pre-overload (E110) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Motor control error 2 (E094) 0000H: Coast to stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays A094 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays N094 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Hundreds position: Motor pre-overload (E111) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: Module pre-overheat (E114) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: AC drive pre-overload (E110) 0000H: Coast to stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays A110 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays N110 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Hundreds position: Motor pre-overload (E111) 0000H: Coast to stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays A111 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays N111 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands position: Module pre-overheat (E114) 0000H: Coast to stop - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays A114 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays N114 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for motor control exception 2, AC drive pre-overload, motor pre-overload, and module pre-overtemperature can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-14	Protection action 14 upon fault	0x00DF	Ones: AI/HDI disconnected (E154) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: IO expansion card communication timeout 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Automatic fault rest failure (E159) 0: Coast to stop 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: AI/HDI disconnected (E154) 0000H: Coast to stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays A154 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays N154 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands position: Automatic fault reset failure (E159) 0000H: Coast to stop - When the AC drive encounters an automatic fault reset failure due to certain reasons, the operating panel displays E159 and the motor coasts to stop. Remarks: Fault protection actions for AI/HDI disconnection fault and automatic fault reset failure can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	Ones position: Modbus communication timeout (E160) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Description: Ones: Modbus communication timeout (E160) 0000H: Coast to stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays A160 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays N160 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	(Continued) Tens: CANopen fault (E161) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore (To be continued)	(Continued) Tens: CANopen fault (E161) 0000H: Coast to stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays A161 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays N161 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Hundreds: CANlink fault (E162) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Continued	(Continued) Hundreds: CANlink fault (E162) 0000H: Coast to stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the CAN-link fault due to certain reasons, the operating panel displays A162 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays N162 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued Thousands: Modbus TCP communication timeout (E169) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore	(Continued) Thousands: Modbus TCP communication timeout (E169) 0000H: Coast to stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays A169 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays N169 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Note: Protection action 15 for Modbus communication timeout fault, CANopen fault, and CANlink faults be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-16	Protection action 16 upon fault	0	Ones: EtherNet/IP failure (active only for MD630N) (E165) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Ten position: PROFINET fault (active only for MD630N) (E166) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones: EtherNet/IP fault (E165) 0000H: Coast to stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays A165 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays N165 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Hundreds: EtherCAT fault 1 (active only for MD630N) (E167) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands: EtherCAT fault 2 (active only for MD630N)(E168) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: PROFINET fault (E166) 0000H: Coast to stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays A166 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays N166 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Hundreds: EtherCAT fault 1 (E167) 0000H: Coast to stop - When the AC drive encounters EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays A167 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays N167 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands: EtherCAT fault 2 (E168) 0000H: Coast to stop - When the AC drive encounters EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays A168 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays N168 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for Ethernet/IP, PROFINET, EtherCAT fault 1, and EtherCAT fault 2 can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-17	Protection action 17 upon fault	0	Ones: Inobus extension protocol (E170) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens: Junction temperature fault (E191) 0: Coast to stop Hundreds: flying start fault (E192) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Inobus protocol fault (E170) 0000H: Coast to stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays A170 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays N170 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	(Continued) Thousands: Undervoltage suppression limit reached (E193) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Hundreds: Flying start fault (E192) 0000H: Coast to stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays A192 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays N192 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the flying start fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
Continued	Continued	Continued	Continued	(Continued) Thousands: Undervoltage suppression limit reached (E193) 0000H: Coast to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor coasts to stop. 0001H: Stop at maximum capability - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor stops at the maximum capability. 0002H: Quick stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor performs quick stop. 0003H: Decelerate to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor decelerates to stop. 0009H: Run with speed limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the undervoltage suppression limit is reached, the operating panel displays A193 and the AC drive operates normally. 000EH: Prompt - When the undervoltage suppression limit is reached, the operating panel displays N193 and the AC drive operates normally. 000FH: Ignore - When the undervoltage suppression limit is reached, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for Inobus protocol fault, speed trakcing fault, undervoltage suppression limit reached fault can be changed to enable the AC drive to act accordingly.

5.5.3.3 Action Modification of a Single Fault

Scenario

This function enables you to set the action of a sub-fault under a master fault. It applies to the scenario that actions for the sub-fault and master fault are different.

Function description

The MD630-INT supports setting the fault action of a single fault, which is implemented by H1-30 (setting of the first group fault code) to H1-49 (setting of fault level for fault codes of group 10).

H1-30 and H1-31 are used together to set the fault action of the first fault. H1-30 is used to set the fault code, and H1-31 is used to select the type of fault action. In this case, there are 20 parameters, that is, actions of 10 faults can be set separately.

For example, set H1-30 to 186.1 and H1-31 to 0x0002 (quick stop). The action of E186.1 (model parameter read/write failure) is "quick stop".

Table 5–112 Modifying the fault action

Parameter code	Fault name	Value
H1-30	Settings of fault codes of group 1	186.1
H1-31	Settings of fault level for fault codes of group 1	0x0002 (Quick stop)

Actions that can be set for a fault must be supported by the master fault.

For example, the thousands place of H1-03 (Fault protection action selection 3) indicates power unit EEPROM fault (E186). Options of E186 include only 0 (coast to stop), 1 (stop at maximum capability), 2 (quick stop), 3 (decelerate to stop), and F (No detection). For sub-faults under E186, you can only set one of the five fault actions.

Related parameters

Table 5–113 Parameters for modifying fault actions

Parameter code	Parameter name	Default value	Range	Description
H1-30	Settings of fault codes of group 1	0.0	0.0 to 255.9	This parameter specifies the fault code of group 1 whose fault level is to be edited. Remarks Enter the main code and subcode of the fault. For example, fill in 187.1 and set H1-31 to 000FH. In this case, E187.1 (Power unit EEPROM junction temperature fault) is not displayed, but the AC drive can operate normally.
H1-31	Settings of fault level for fault codes of group 1	0x000F	0000H: Coast to stop 0001H: Stop at maximum capability 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Display warning 000EH: Prompt 000FH: Not detected	This parameter specifies the fault level of fault codes of group 1. Value description 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run at limited speed. The AC drive displays L and continues running with speed restriction. 000AH: Run at limited power. The AC drive displays L and continues running with power restriction. 000BH: Run at limited current. The AC drive displays L and continues running with current restriction. 000CH: Run at limited torque. The AC drive displays L and continues running with torque restriction. 000DH: Display warning The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt The AC drive displays prompt N, which has no effect on operation. 000FH: Not detected This fault is shielded by the AC drive. Remarks After fault codes are set, this parameter represents the action against current fault. The fault level setting adopts a white list, and only allowable levels can be set.
H1-32	Settings of fault codes of group 2	0.0	0.0 to 255.9	This parameter specifies the fault code of group 2 whose fault level is to be edited, which is the same as H1-30.
H1-33	Settings of fault level for fault codes of group 2	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 2, which is the same as H1-31.
H1-34	Settings of fault codes of group 3	0.0	0.0 to 255.9	This parameter specifies the fault code of group 3 whose fault level is to be edited, which is the same as H1-30.

Parameter code	Parameter name	Default value	Range	Description
H1-35	Settings of fault level for fault codes of group 3	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 3, which is the same as H1-31.
H1-36	Settings of fault codes of group 4	0.0	0.0 to 255.9	This parameter specifies the fault code of group 4 whose fault level is to be edited, which is the same as H1-30.
H1-37	Settings of fault level for fault codes of group 4	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 4, which is the same as H1-31.
H1-38	Settings of fault codes of group 5	0.0	0.0 to 255.9	This parameter specifies the fault code of group 5 whose fault level is to be edited, which is the same as H1-30.
H1-39	Settings of fault level for fault codes of group 5	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 5, which is the same as H1-31.
H1-40	Settings of fault codes of group 6	0.0	0.0 to 255.9	This parameter specifies the fault code of group 6 whose fault level is to be edited, which is the same as H1-30.
H1-41	Settings of fault level for fault codes of group 6	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 6, which is the same as H1-31.
H1-42	Settings of fault codes of group 7	0.0	0.0 to 255.9	This parameter specifies the fault code of group 7 whose fault level is to be edited, which is the same as H1-30.
H1-43	Settings of fault level for fault codes of group 7	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 7, which is the same as H1-31.
H1-44	Settings of fault codes of group 8	0.0	0.0 to 255.9	This parameter specifies the fault code of group 8 whose fault level is to be edited, which is the same as H1-30.
H1-45	Settings of fault level for fault codes of group 8	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 8, which is the same as H1-31.
H1-46	Settings of fault codes of group 9	0.0	0.0 to 255.9	This parameter specifies the fault code of group 9 whose fault level is to be edited, which is the same as H1-30.
H1-47	Settings of fault level for fault codes of group 9	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 9, which is the same as H1-31.
H1-48	Settings of fault codes of group 10	0.0	0.0 to 255.9	This parameter specifies the fault code of group 10 whose fault level is to be edited, which is the same as H1-30.
H1-49	Settings of fault level for fault codes of group 10	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 10, which is the same as H1-31.

5.5.4 Custom Faults and Alarms

Scenarios

The AC drive supports custom faults and alarms. You can select the B connector as the trigger condition for faults and alarms as needed to custom faults and alarms through parameter interconnection. For details, see *" Parameter interconnection" on page 769*.

Working principle

Custom faults and alarms include two external fault settings, external fault 1 (NO) source and external fault 2 (NC) source.

The source of external fault 1 (NO) is set by H2-00. When it is set to 0, it is invalid. When it is set to 1, the drive reports E015.1, or you can select B connector as the trigger source to implement custom fault trigger conditions.

The source of external fault 2 (NC) is set by H2-01. When it is set to 0, it is invalid. When it is set to 1, the drive reports E015.2. You can also select the B connector as the trigger source to implement custom fault trigger conditions.

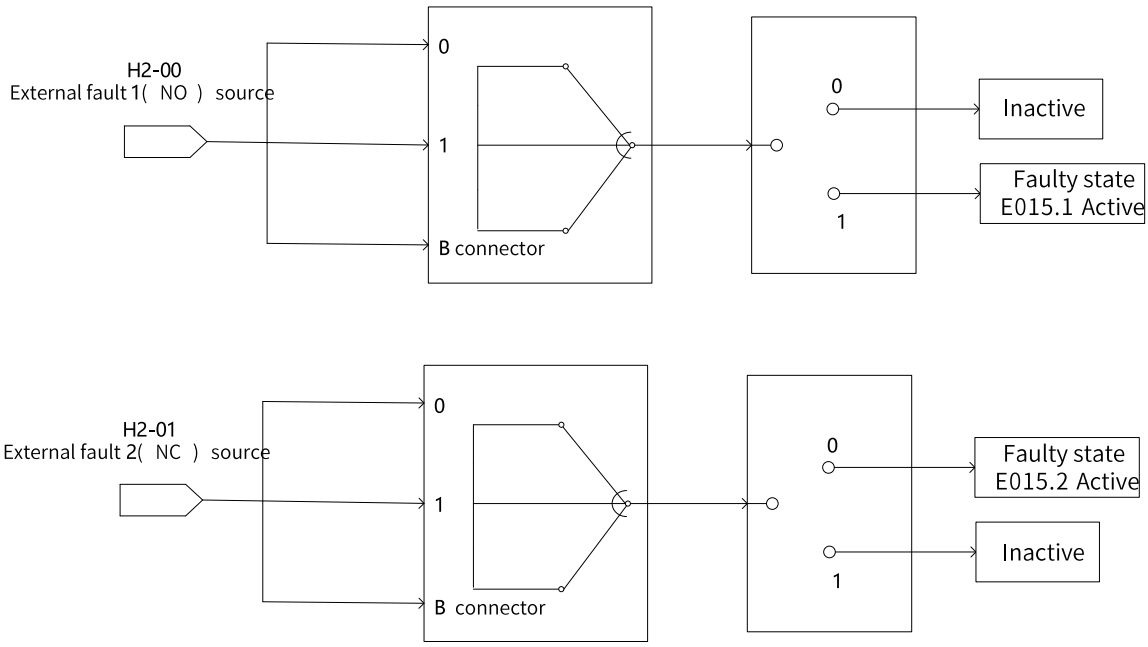


Figure 5-230 External fault diagram

Note that these two faults can also be triggered by the DI terminal function. The DI terminal function numbers are 11 [NO input for external fault] and 33 [NC input for external fault] respectively. When a DI terminal is used to select the corresponding function, the corresponding parameter is read-only. For example, if DI1 is set to 11 [NO input of external fault], H2-00 is read-only.

In addition, the MD630-INT drive provides eight groups of custom faults and alarms. Set the fault trigger source for eight groups of custom faults through H2-02 [Custom fault 1 source] to H2-09 [Custom fault 8 source]. The fault codes are E027.1 to E027.8. The eight groups of custom alarms are set through H2-10 [Custom alarm 1 source] to H2-17 [Custom alarm 8 source). The alarm codes are A28.1 to A28.8.

For example, set H2-02 [Custom fault 1 source] to connector B, select L00 [Bit connector 1] in the pop-up box, and select L0002 [DI1]. Then, when DI1 is valid, the drive reports E027.1.

Note that the function number of the DI terminal is set to 44 [custom fault 1] or 45 [custom fault 2]. The trigger source of faults E027.1 and E027.2 is determined by the status of the DI terminal.

Related parameters

Table 5–114 Parameters related to custom faults and alarms

Param.	Name	Default	Setting range	Description
H2-00	External fault 1 (NO) source	0	0: Invalid 1: Valid Others: B connector	Defines the source of external fault 1 (NO). Value description: 0: Invalid - External fault 1 (NO) is inactive and the drive does not report a fault. 1: Valid - External fault 1 (NO) is valid and the drive reports E015.1. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: 1: Defines the source of external fault 1 (NO). When this parameter is set to 1, the drive reports E015.1 upon receiving external fault 1. If external fault 1 does not need to be reported, set this parameter to 0 and reset the fault. 2: After the DI function is set to 11 (NO input of external fault), the value of H2-00 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-01	External fault 2 (NC) source	1	0: Invalid 1: Valid Others: B connector	Defines the source of external fault 2 (NC). Value description: 0: Invalid - External fault 2 (NC) is invalid and the drive reports E015.2. 1: Valid - External fault 2 (NC) is valid and the drive does not report a fault. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: 1: Defines the source of external fault 2 (NC). When this parameter is set to 1, the drive reports E015.2 upon receiving external fault 2. If external fault 2 does not need to be reported, set this parameter to 0 and reset the fault. 2. After the DI function is set to 33 (NC input of external fault), the value of H2-01 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).

Param.	Name	Default	Setting range	Description
H2-02	Custom fault 1 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 1. Value description: 0: Invalid - The custom fault 1 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 1 is valid and the drive reports E027.1. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 1. When this parameter is set to 1, E027.1 is reported. After the DI function is set to 44 (Custom fault 1), the value of H2-02 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-03	Custom fault 2 source	1	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 2. Value description: 0: Invalid - The custom fault 2 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 2 is valid and the drive reports E27.2. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 2. When this parameter is set to 1, E27.2 is reported. After the DI function is set to 45 (Custom fault 2), the value of H2-03 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-04	Custom fault 3 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 3. Value description: 0: Invalid - The custom fault 3 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 3 is valid and the drive reports E27.3. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 3. When this parameter is set to 1, E27.3 is reported.

Param.	Name	Default	Setting range	Description
H2-05	Custom fault 4 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 4. Value description: 0: Invalid - The custom fault 4 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 4 is valid and the drive reports E27.4. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 4. When this parameter is set to 1, E27.4 is reported.
H2-06	Custom fault 5 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 5. Value description: 0: Invalid - The custom fault 5 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 5 is valid and the drive reports E27.5. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 5. When this parameter is set to 1, E27.5 is reported.
H2-07	Custom fault 6 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 6. Value description: 0: Invalid - The custom fault 6 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 6 is valid and the drive reports E27.6. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 6. When this parameter is set to 1, E27.6 is reported.
H2-08	Custom fault 7 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 7. Value description: 0: Invalid - The custom fault 7 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 7 is valid and the drive reports E27.7. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 7. When this parameter is set to 1, E27.7 is reported.

Param.	Name	Default	Setting range	Description
H2-09	Custom fault 8 source	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 8. Value description: 0: Invalid - The custom fault 8 is inactive and the AC drive does not report a fault. 1: Valid - The custom fault 8 is valid and the drive reports E27.8. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom fault 8. When this parameter is set to 1, E27.8 is reported.
H2-10	Source of custom alarm 1	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 1. Value description: 0: Invalid - The custom alarm 1 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 1 is valid and the drive reports A28.1. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 1. When this parameter is set to 1, A28.1 is reported.
H2-11	Source of custom alarm 2	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 2. Value description: 0: Invalid - The custom alarm 2 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 2 is valid and the drive reports A28.2. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 2. When this parameter is set to 1, A28.2 is reported.
H2-12	Source of custom alarm 3	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 3. Value description: 0: Invalid - The custom alarm 3 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 3 is valid and the drive reports A28.3. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 3. When this parameter is set to 1, A28.3 is reported.

Param.	Name	Default	Setting range	Description
H2-13	Source of custom alarm 4	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 4. Value description: 0: Invalid - The custom alarm 4 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 4 is valid and the drive reports A28.4. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 4. When this parameter is set to 1, A28.4 is reported.
H2-14	Source of custom alarm 5	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 5. Value description: 0: Invalid - The custom alarm 5 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 5 is valid and the drive reports A28.5. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 5. When this parameter is set to 1, A28.5 is reported.
H2-15	Source of custom alarm 6	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 6. Value description: 0: Invalid - The custom alarm 6 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 6 is valid and the drive reports A28.6. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 6. When this parameter is set to 1, A28.6 is reported.

Param.	Name	Default	Setting range	Description
H2-16	Source of custom alarm 7	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 7. Value description: 0: Invalid - The custom alarm 7 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 7 is valid and the drive reports A28.7. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 7. When this parameter is set to 1, A28.7 is reported.
H2-17	Source of custom alarm 8	0	0: Invalid 1: Valid Others: B connector	This parameter sets the source of custom alarm 8. Value description: 0: Invalid - The custom alarm 8 is inactive and the AC drive does not report a fault. 1: Valid - The custom alarm 8 is valid and the drive reports A28.8. Others: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter sets the source of custom alarm 8. When this parameter is set to 1, A28.8 is reported.

5.6 Monitoring

5.6.1 Set Monitoring Parameters Displayed on Operating Panel

Scenarios

The AC drive supports setting the parameters displayed on the operating panel in the stop and running state. The user can display the commonly used parameters or the parameters that need to be reviewed quickly on the operating panel according to actual needs. Use the shift keys  and  on the operating panel and for quick viewing.

Function description

The parameter monitoring function enables you to view the status of the AC drive via the operating panel. Parameters A6-03, A6-04, and A6-05 determine what the operating panel displays and whether to display free mappings. Parameters A6-07, A6-08, A6-09, and A6-10 determine what the free mapping displays.

In the stop or running state, use the shift key  and  on the operating panel to switch the display of different monitoring parameters.

In the running state, 32 operating state parameters are supported. The corresponding parameters can be displayed by setting parameter A6-03 and A6-04. The two parameters can be selected by 32 bits. If the corresponding bit value is set to 1, the parameters are displayed under the run page.

In the stop state, 16 stop status parameters are available. A6-05 determines whether the corresponding parameter is displayed. The corresponding parameter bit is shown in the following table.

Table 5–115 Content displayed in the running and stop states

Param.	Bit	Operating panel display	Bit	Operating panel display
A6-03 Parameter 1 displayed on LED operating panel during operation	bit0	Operating frequency	bit8	DO output state
	bit1	Frequency reference	bit9	AI1 voltage
	bit2	Bus voltage	bit10	AI2 voltage
	bit3	Output voltage	bit11	Reserved
	bit4	Output current	bit12	Reserved
	bit5	Output power	bit13	Reserved
	bit6	Output torque	bit14	Load speed display
	bit7	DI input state	bit15	PID reference
A6-04 Parameter 2 displayed on LED operating panel during operation	bit0	PID feedback	bit8	Motor velocity
	bit1	PLC stage	bit9	Current power-on time
	bit2	HDI input pulse frequency	bit10	Current operating time
	bit3	Running frequency 2 (Hz)	bit11	Reserved
	bit4	Remaining running time	bit12	Communication setpoint
	bit5	AI1 voltage before correction	bit13	Encoder feedback speed
	bit6	Free mapping 0	bit14	Display of main frequency X
	bit7	Free mapping 1	bit15	Display of auxiliary frequency Y
A6-05 Parameter displayed on LED operating panel at stop	bit0	Frequency reference	bit8	Reserved
	bit1	Bus voltage	bit9	PLC stage
	bit2	DI input state	bit10	Reserved
	bit3	DO output state	bit11	PID reference
	bit4	AI1 voltage	bit12	HDI input pulse frequency
	bit5	AI2 voltage	bit13	Reserved
	bit6	Reserved	bit14	Free mapping 0
	bit7	Reserved	bit15	Free mapping 1

For example, when setting parameter A6-05 to 0x003F (the value at bit 0/1/2/3/4/5 is 1), the corresponding display is shown on the operating panel in the shutdown state. The display parameters are switched through the  and  keys on the panel. For example, in the stop state,

the panel displays the frequency reference, press the key, the panel displays the bus voltage, press the key again, and the panel displays the DI input status, as shown in the following figure.

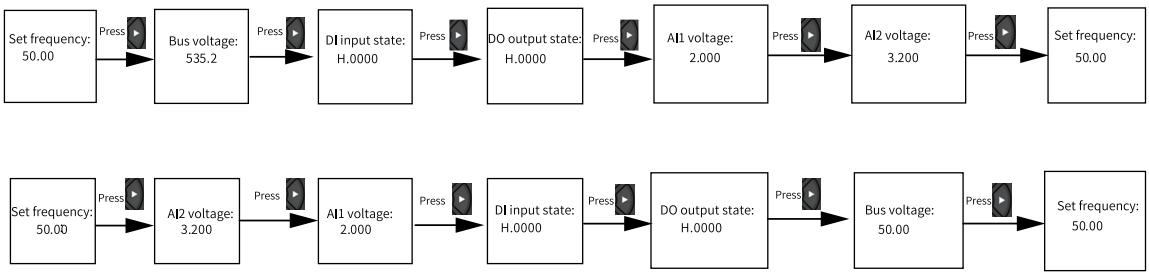


Figure 5-231 Parameter switching in the shutdown state

At the same time, the product supports two free mapping channels. You can select mappings by parameters A6-07 and A6-09. Select the unit and decimal point of the mappings through parameters A6-08 and A6-10.

Free mapping can be set in both the running state and the stop state through bit 6 and bit 7 of A6-04 and bit 14 and bit 15 of A6-05, respectively.

For example, if you want L1002 [system status word 1] to be displayed in the stop stop, follow the steps below.

(1) Set A6-07 by locating L10 [Word connector 1] in the drop-down option, and selecting L1002 [System status word 1].

(2) Set A6-05 to 0x4033, that is, bit value of 0/1/4/5/14 to 1, and the last parameter of the stop parameter display is the content of the free mapping 0 [L1002 (System status word 1)].

(3) Switch the stop parameters through the and keys on the operating panel, as shown in the following figure.

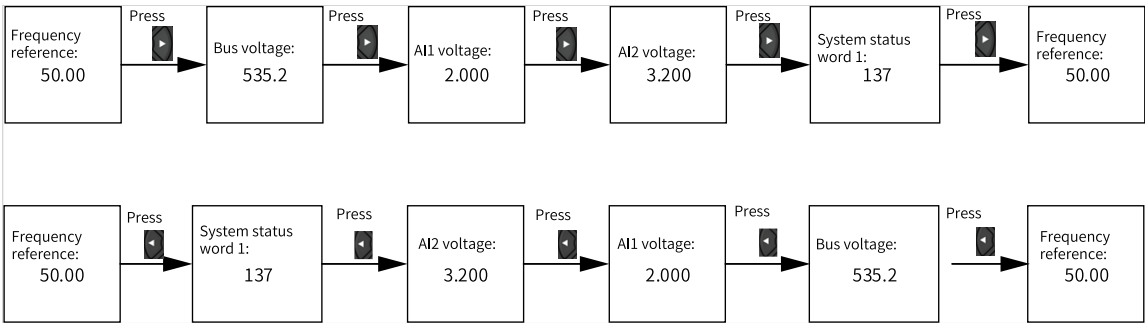


Figure 5-232 Free mapping 0 switching diagram 1

Set the hundreds position of A6-08 and A6-10 to configure whether the unit and decimal place setting (the ones and tens position) is active. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When setting the value at the hundreds position, the unit and decimal place setting is active.

For example, if you want L1101 [base value of frequency per unit value] to be 50.0 Hz, follow the steps below.

(1) Set A6-07 by locating L11 [Word connector 2] in the drop-down option, and selecting L1101 [Base value of frequency per unit value].

(2) Set A6-08 [Format displayed by free mapping 0] to 0x111, that is, the unit is Hz, the decimal place is 1 and the settings are active.

(3) Set A6-05 to 0x4033, that is, bit value of 0/1/4/5/14 to 1, and the last parameter of the stop parameter display is the content of the free mapping 0 [L1101 (Base value of frequency per unit value)].

(4) Switch the stop parameters through the and keys on the operating panel.

The detailed procedure is as follows.

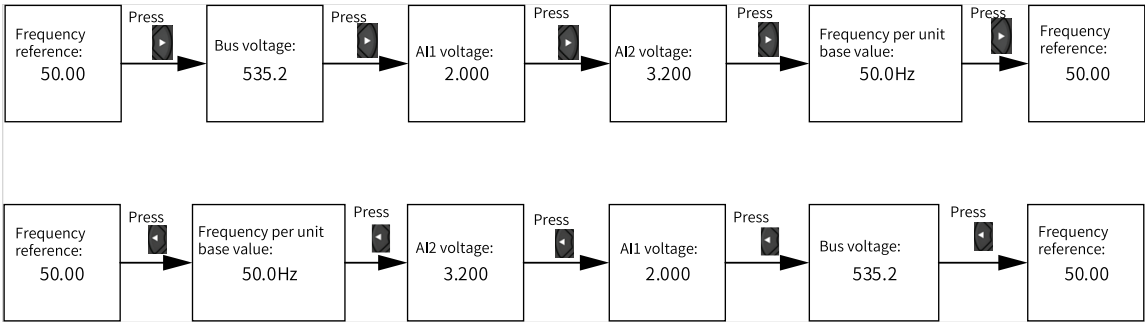


Figure 5-233 Free mapping 0 switching diagram 2

Related parameters

Table 5–116 Display parameter setting

Param.	Name	Default	Value Range	Descriptions
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	Bit 0: Running frequency (Hz) Bit 1: Frequency reference (Hz) Bit 2: Bus voltage (V) Bit 3: Output voltage (V) Bit 4: Output current (A) Bit 5: Output power (kW) Bit 6: Output torque (%) Bit 7: DI input status Bit 8: DO output status Bit 9: AI1 voltage (V) Bit 10: AI2 voltage (V) bit11 to bit13: Reserved Bit 14: Load speed Bit 15: PID reference The bit value description is as follows. 0: Hidden 1: Displayed	Sets the contents of parameter 1 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel when the AC drive is running with the left  and right shift  keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-04	Parameter 2 displayed on LED operating panel during operation	0x0000	Bit 0: PID feedback Bit 1: PLC stage Bit 2: HDI pulse input frequency (kHz) (Only valid for MD630S) Bit 3: Running frequency 2 (Hz) Bit 4: Remaining running time Bit 5: AI1 voltage before correction (V) Bit 6: Free mapping 0 Bit 7: Free mapping 1 Bit 8: Motor speed Bit 9: Current power-on time (min) Bit 10: Current running time (min) bit11: Reserved Bit 12: Communication setting value Bit 13: Encoder feedback speed Bit 14: Main frequency X Bit 15: Auxiliary frequency Y The bit value description is as follows. 0: Hidden 1: Displayed	Sets the contents of parameter 2 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel when the AC drive is running with the left and right shift keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-05	Parameter displayed on LED operating panel at stop	0x0033	Bit 0: Frequency reference (Hz) Bit 1: Bus voltage (V) Bit 2: DI input status Bit 3: DO output status Bit 4: AI1 voltage (V) Bit 5: AI2 voltage (V) Bit 6 to bit 8: Reserved Bit 9: PLC stage Bit 10: Reserved Bit 11: PID reference Bit 12: HDI pulse input frequency (kHz) (Only valid for MD630S) bit13: Reserved Bit 14: Free mapping 0 Bit 15: Free mapping 1 The bit value description is as follows. 0: Hidden 1: Displayed	Sets the parameter displayed on LED operating panel at stop. Note: Defines the parameters displayed on the LED operating panel when the AC drive is in the stop state with the left and right shift keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)
A6-07	Address displayed by free mapping 0	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 0. Note: The parameter is associated with the free mapping 0 of bit 6 of A6-04 and bit 14 of A6-05. When the value at bit 6 of A6-04 is set to 1, the operating panel displays the free mapping 0 in the running state; when the value at bit 14 of A6-05 is set to 1, the operating panel displays the free mapping 0 in the stop state. The display shows the connector value set by A6-07. It is inactive when A6-07 is set to 0.

Param.	Name	Default	Value Range	Descriptions
A6-08	Format displayed by free mapping 0	0x148	Ones position: Unit 0: Disable 1: Hz 2: A 3: RPM 4: V 5: Link 6: % 7: s 8: h 9: kW A: KW/h B: ℃ Tens position: Decimal point 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands position: Reserved	Used to set the format displayed by free mapping 0. Value description Ones position: Defines the display format (unit) of free mapping 0. When free mapping 0 is active, that is, the connector value set by A6-07 is valid, if free mapping 0 is selected for parameter 2 displayed during operation or parameter displayed at stop (A6-04 or A6-05), the unit defined by the ones will be used for display. The tens position is used to set the number of decimal place of the free mapping 0. Similar to the ones position, it indicates how many decimal places the content of the free mapping 0 is displayed. The hundred position is used to set whether the unit and decimal place setting of the free mapping 0 is valid. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When setting the value at the hundreds position, the unit and decimal place setting is active.
A6-09	Address displayed by free mapping 1	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 1. Note: The parameter is associated with the free mapping 1 of bit 7 of A6-04 and bit 15 of A6-05. When the value at bit 7 of A6-04 is set to 1, the operating panel displays the free mapping 0 in the running state; when the value at bit 15 of A6-05 is set to 1, the operating panel displays the free mapping 0 in the stop state. The display shows the connector value set by A6-09. It is inactive when A6-09 is set to 0.

Param.	Name	Default	Value Range	Descriptions
A6-10	Format displayed by free mapping 1	0x148	Ones position: Unit 0: Disable 1: Hz 2: A 3: RPM 4: V 5: Link 6: % 7: s 8: h 9: kW A: KW/h B: ℃ Tens position: Decimal point 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands position: Reserved	Used to set the format displayed by free mapping 1. Value description: Ones position: Defines the display format (unit) of free mapping 1. When free mapping 0 is active, that is, the connector value set by A6-09 is valid, if free mapping 0 is selected for parameter 2 displayed during operation or parameter displayed at stop (A6-04 or A6-05), the unit defined by the ones will be used for display. The tens position is used to set the number of decimal place of the free mapping 1. Similar to the ones position, it indicates how many decimal places the content of the free mapping 1 is displayed. The hundred position is used to set whether the unit and decimal place setting of the free mapping 1 is valid. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When setting the value at the hundreds position, the unit and decimal place setting is active.

5.7 Additional Functions

5.7.1 Parameter interconnection

5.7.1.1 Connector Resource

5.7.1.1.1 Connector

Description

Connectors refer to group L parameters. The connectors are divided into bit connectors (B connector), word connectors (K connector), and floating-point connectors (F connector).

The word connector can be divided into single word (16 bits, corresponding to groups L10 to L12) and double word (32 bits, corresponding to groups L20) types according to the data type.

A double-word connector can indicate more valid digits, improving the numerical value accuracy. To distinguish between two word connectors, this manual is called word connectors for single word connectors and double word connectors.

The product can also enable conversion between bit connectors, word connectors, and double-word connectors through free function blocks. For details, see "Free Function Block".

Scenarios

1. You can monitor the internal status of the system through the connector.
2. Used for parameter interconnection, which is used as the signal source for certain functions, enabling internal resource sharing.
3. As input to free function blocks, perform various mathematical operations to achieve multiple control logic.

5.7.1.1.2 Bit Connector (B Connector)

Scenarios

This connector is used to monitor the digital signal status in the system or as a binary signal source for certain functions.

1. When used to monitor the system status, it can only monitor the state of the system digital signals. For example, it displays the DI input state, DO output state, and a bit of the communication word. A bit of the control word, status word, and fault activation status information are available for user reference.

2. Used for parameter interconnection As the system resource pool, for a parameter with the drop-down menu "Others: B connector", the bit connector (B connector) is used as the binary signal source. You can select any bit connector from L00 to L09 as the input of the parameter. This can be used to implement specific functions (for example, to convert bit connectors to word connectors, see "Free-form Function Block" for details).

Description

The bit connector (B connector) saves information such as the digital signal status in the system, and can be used as the connector signal source for parameters of reference source type. The value of bit connector can only be 0 or 1. Groups L00 to L09 are bit connectors.

Related parameters

Group L00			
Param.	Name	Display range	Description
L0000	Logic 0	0	Constant 0
L0001	Logic 1	1	Constant 1
L0002	DI1	0: DI1 open 1: DI1 closed	Displays the final level state of DI1.
L0003	DI2	0: DI2 open 1: DI2 closed	Displays the final level state of DI2.
L0004	DI3 (valid only for MD630S)	0: DI3 open 1: DI3 closed	Displays the final level state of DI3.
L0005	DI4 (valid only for MD630S)	0: DI4 open 1: DI4 closed	Displays the final level state of DI4.

Group L00			
Param.	Name	Display range	Description
L0006	DI5 (valid only for MD630S)	0: DI5 open 1: DI5 closed	Displays the final level state of DI5.
L0007	DI6 (valid only for MD630S)	0: DI6 open 1: DI6 closed	Displays the final level state of DI6.
L0008	DI7 (valid only for MD630S)	0: DI7 open 1: DI7 closed	Displays the final level state of DI7.
L0012	VDI1	0: VDI1 open 1: VDI1 closed	Displays the final level state of VDI1.
L0013	VDI2	0: VDI2 open 1: VDI2 closed	Displays the final level state of VDI2.
L0014	VDI3	0: VDI3 open 1: VDI3 closed	Displays the final level state of VDI3.
L0015	VDI4	0: VDI4 open 1: VDI4 closed	Displays the final level state of VDI4.
L0016	VDI5	0: VDI5 open 1: VDI5 closed	Displays the final level state of VDI5.
L0017	VDI6	0: VDI6 open 1: VDI6 closed	Displays the final level state of VDI6.
L0018	DI1 inversion	0: The inverted value of DI1 is 0. 1: The inverted value of DI1 is 1.	Displays the state after the final output of DI1 is inverted.
L0019	DI2 inversion	0: The inverted value of DI2 is 0. 1: The inverted value of DI2 is 1.	Displays the state after the final output of DI2 is inverted.
L0020	DI3 inversion (valid only for MD630S)	0: The inverted value of DI3 is 0. 1: The inverted value of DI3 is 1.	Displays the state after the final output of DI3 is inverted (valid for MD630S).
L0021	DI4 inversion (valid only for MD630S)	0: The inverted value of DI4 is 0. 1: The inverted value of DI4 is 1.	Displays the state after the final output of DI4 is inverted (valid for MD630S).
L0022	DI5 inversion (valid only for MD630S)	0: The inverted value of DI5 is 0. 1: The inverted value of DI5 is 1.	Displays the state after the final output of DI5 is inverted (valid for MD630S).
L0023	DI6 inversion (valid only for MD630S)	0: The inverted value of DI6 is 0. 1: The inverted value of DI6 is 1.	Displays the state after the final output of DI6 is inverted (valid for MD630S).
L0024	DI7 inversion (valid only for MD630S)	0: The inverted value of DI7 is 0. 1: The inverted value of DI7 is 1.	Displays the state after the final output of DI7 is inverted (valid for MD630S).

Group L00			
Param.	Name	Display range	Description
L0028	VDI1 inversion	0: The inverted value of VDI1 is 0. 1: The inverted value of VDI1 is 1.	Displays the state after the final output of VDI1 is inverted.
L0029	VDI2 inversion	0: The inverted value of VDI2 is 0. 1: The inverted value of VDI2 is 1.	Displays the state after the final output of VDI2 is inverted.
L0030	VDI3 inversion	0: The inverted value of VDI3 is 0. 1: The inverted value of VDI3 is 1.	Displays the state after the final output of VDI3 is inverted.
L0031	VDI4 inversion	0: The inverted value of VDI4 is 0. 1: The inverted value of VDI4 is 1.	Displays the state after the final output of VDI4 is inverted.
L0032	VDI5 inversion	0: The inverted value of VDI5 is 0. 1: The inverted value of VDI5 is 1.	Displays the state after the final output of VDI5 is inverted.
L0033	VDI6 inversion	0: The inverted value of VDI6 is 0. 1: The inverted value of VDI6 is 1.	Displays the state after the final output of VDI6 is inverted.
L0034	RO	0: No output 1: RO output	Displays the final output state of relay RO1.
L0038	DO	0: No output 1: DO output	Displays the final output state of DO.
L0042	FMR (valid only for MD630S)	0: FMR output 1: FMR output	Displays the final output state of FMR (valid only for MD630S).
L0044	VDO1	0: No VDO1 output 1: VDO1 output	Displays the final output state of VDO1.
L0045	VDO2	0: No VDO2 output 1: VDO2 output	Displays the final output state of VDO2.
L0046	VDO3	0: No VDO3 output 1: VDO3 output	Displays the final output state of VDO3.
L0047	VDO4	0: No VDO4 output 1: VDO4 output	Displays the final output state of VDO4.
L0048	VDO5	0: No VDO5 output 1: VDO5 output	Displays the final output state of VDO5.
L0049	VDO6	0: No VDO6 output 1: VDO6 output	Displays the final output state of VDO6.
L0050	AI1 input limit exceeded	0: Not exceeded 1: Exceeded	Displays whether the AI1 input voltage exceeds the AI limit range.

Group L00			
Param.	Name	Display range	Description
L0051	AI2 input limit exceeded	0: Not exceeded 1: Exceeded	Displays whether the AI2 input voltage exceeds the AI limit range.
L0053	HDI input disconnected (valid only for MD630S)	0: Not disconnected 1: Disconnected	Indicates whether the HDI input is disconnected. Disconnection occurs when the HDI input pulse frequency is less than half of the HDI input lower limit or the input is disconnected.
L0054	AI1 used as DI level	0: Low level 1: High level	Indicates the level status when AI1 is used as the DI.
L0055	AI2 used as DI level	0: Low level 1: High level	Indicates the level status when AI2 is used as the DI.
L0057	AI2 temperature mode - Motor temperature reach	0: Temperature not reached 1: Temperature reached	Displays whether the motor temperature reaches E2-74 [AI2 temperature mode - motor temperature reached] in AI2 temperature mode.
L0058	AI2 temperature mode - Motor overtemperature fault	0: No overtemperature 1: Overtemperature occurred	Displays whether the motor temperature exceeds E2-76 [AI2 temperature mode - Motor overtemperature protection threshold] in AI2 temperature mode.
L0059	AI2 temperature mode - Motor overtemperature pre-alarm	0: No over-temperature pre-alarm 1: Over-temperature pre-alarm occurred	Displays whether the motor temperature exceeds E2-75 [AI2 temperature mode - Motor overtemperature pre-alarm threshold] in AI2 temperature mode.

Group L01			
Param.	Name	Display range	Description
L0100	Ready to switch on	0: Not ready to switch on 1: Ready to switch on	Displays whether the drive is ready to switch on.
L0101	Ready to run	0: Not ready to run 1: Ready to run	Displays whether the drive is ready to run.
L0102	In operation	0: Not in operation 1: In operation	Displays whether the AC drive is operating.
L0103	Fault activation	0: No fault 1: Fault occurred	Displays whether the drive is faulty.
L0104	OFF2 (coast to stop) flag	0: Valid 1: Invalid	Displays the current state of OFF2 (coast to stop) command.
L0105	OFF3 (quick stop) flag	0: Valid 1: Invalid	Displays the current state of OFF3 (quick stop) command.
L0107	Alarm/Minor fault activation	0: Not activated 1: Activated	Displays whether the drive encounters an alarm or a minor fault.

Group L01			
Param.	Name	Display range	Description
L0110	Target speed reached	0: Speed not reached 1: Speed reached	Displays whether the target speed of the drive is reached. When both the operating speed and the actual motor speed are in the range of target speed±P0-51 [Detection width] for a period longer than the time set by P0-52, the output is activated.
L0111	Torque limit reach	0: Torque/Current not limited 1: Torque/Current limited	Displays whether the torque reaches the set upper and lower limits. The data is valid when the torque is limited.
L0112	Forward speed	0: Invalid 1: Valid	Displays the direction of the operating speed. This parameter is valid when the operating direction is forward.
L0113	Reverse speed	0: Invalid 1: Valid	Displays the direction of the operating speed. This parameter is valid when the operating direction is reverse.
L0118	Current control channel	0: Control channel 1 1: Control channel 2	Displays the active control channel.
L0119	Current setting channel	0: Setting channel 1 1: Setting channel 2	Displays the active setting channel.
L0120	Active terminal start/stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	Displays the active terminal start/stop module.
L0121	Terminal control selection	0: Invalid 1: Valid	Displays whether the command source is terminal control. This parameter is valid when the command source is terminal control.
L0132	Error output	0: No output 1: Outputted	Displays whether the drive encounters a fault, a minor fault, or an alarm.
L0133	Error output (undervoltage fault excluded)	0: No output 1: Outputted	Displays whether the drive reports faults, minor faults, or alarms, excluding the undervoltage fault.
L0134	Fault output	0: The relay is inactive during fault and automatic reset. 1: The relay is active during fault and automatic reset.	Displays the fault output and whether the relay is active during automatic fault reset.
L0135	Stop at fault	0: Invalid 1: Valid	Displays whether the stop-at-fault command is active.
L0136	Operation state	0: Operating properly 1: Operating improperly	Displays whether the drive is in the normal operation state.
L0137	Jog	0: Non-jog 1: Jog	Displays whether the drive is in the jogging state.

Group L01			
Param.	Name	Display range	Description
L0138	Decelerate-to-stop state	0: Invalid 1: Valid	Displays whether the drive is decelerating to stop.
L0139	Quick stop state	0: Invalid 1: Valid	Displays whether the drive is in the quick-stop state.
L0140	Stop-at-maximum-capability state	0: Invalid 1: Valid	Displays whether the drive is in the stop-at-maximum-capability state.
L0156	Reverse run	0: Invalid 1: Valid	Displays whether the drive is operating in the reverse direction.
L0174	Bus voltage state	0: Abnormal 1: Normal	Displays the bus voltage state and the "ready to switch-on" state.

Group L02			
Param.	Name	Display range	Description
L0244	Power-on time reached	0: Not reached 1: Reached	Displays whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set power-on time (P0-16 and P0-17).
L0245	Operating time reached	0: Not reached 1: Reached	Displays whether the cumulative operating time (Ad-00 and Ad-01) reaches the set operating time (P0-18 and P0-19).
L0246	Timing duration reached	0: Not reached 1: Reached	Displays whether the timing duration reaches the set time (P0-14 and P0-15).
L0247	Current operating time reached	0: Not reached 1: Reached	Displays whether the current operating time reaches the set time (P0-20).
L0258	Current 1 reached	0: Not reached 1: Reached	Displays whether the output current reaches the range of current detection value 1.
L0259	Current 2 reached	0: Not reached 1: Reached	Displays whether the output current reaches the range of current detection value 2.
L0260	Zero current state	0: Invalid 1: Valid	Displays whether the drive is in the zero current output state.
L0261	Output current limit exceeded	0: Invalid 1: Valid	Displays whether the output current exceeds the limit.
L0262	Frequency level detection 1	0: Invalid 1: Valid	Displays whether the operating frequency reaches the frequency level detection 1 (FDT1) range.
L0263	Frequency level detection 2	0: Invalid 1: Valid	Displays whether the operating frequency reaches the frequency level detection 2 (FDT2) range.
L0264	Frequency reached	0: Not reached 1: Reached	Displays whether the operating frequency reaches the target frequency.
L0265	Detection frequency 1 reached	0: Not reached 1: Reached	Displays whether the operating frequency reaches detection frequency 1.

Group L02			
Param.	Name	Display range	Description
L0266	Detection frequency 2 reached	0: Not reached 1: Reached	Displays whether the operating frequency reaches detection frequency 2.
L0267	Frequency upper limit reached	0: Not reached 1: Reached	Displays whether the operating frequency reaches the upper limit. Note: The positive frequency upper limit is determined by C4-10 (Maximum motor frequency), d1-03 (Digital setting of positive frequency upper limit), and d1-05 (Positive frequency upper limit selection), whichever is the minimum. The reverse frequency upper limit is similar as the forward frequency upper limit.
L0268	Frequency lower limit reached (no output at stop)	0: Not reached 1: Reached	Displays whether the operating frequency reaches the lower limit. The connector output is valid when the operating frequency reaches the lower limit. This flag is invalid in the stop state. Note: The frequency lower limit is determined by C4-11 (Minimum motor frequency) and d1-07 (Digital setting of positive frequency lower limit), whichever is higher. The negative frequency lower limit is similar as the positive frequency lower limit.
L0269	Frequency lower limit reached (output generated even at stop)	0: Not reached 1: Reached	Displays whether the operating frequency reaches the lower limit. The connector output is valid when the operating frequency reaches the lower limit. This function is active even in the stop state. Note: The frequency lower limit is determined by C4-11 (Minimum motor frequency) and d1-07 (Digital setting of positive frequency lower limit), whichever is higher. The negative frequency lower limit is similar as the positive frequency lower limit.
L0270	Speed comparison reach 1	0: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 1.
L0271	Speed comparison reach 2	0: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 2.

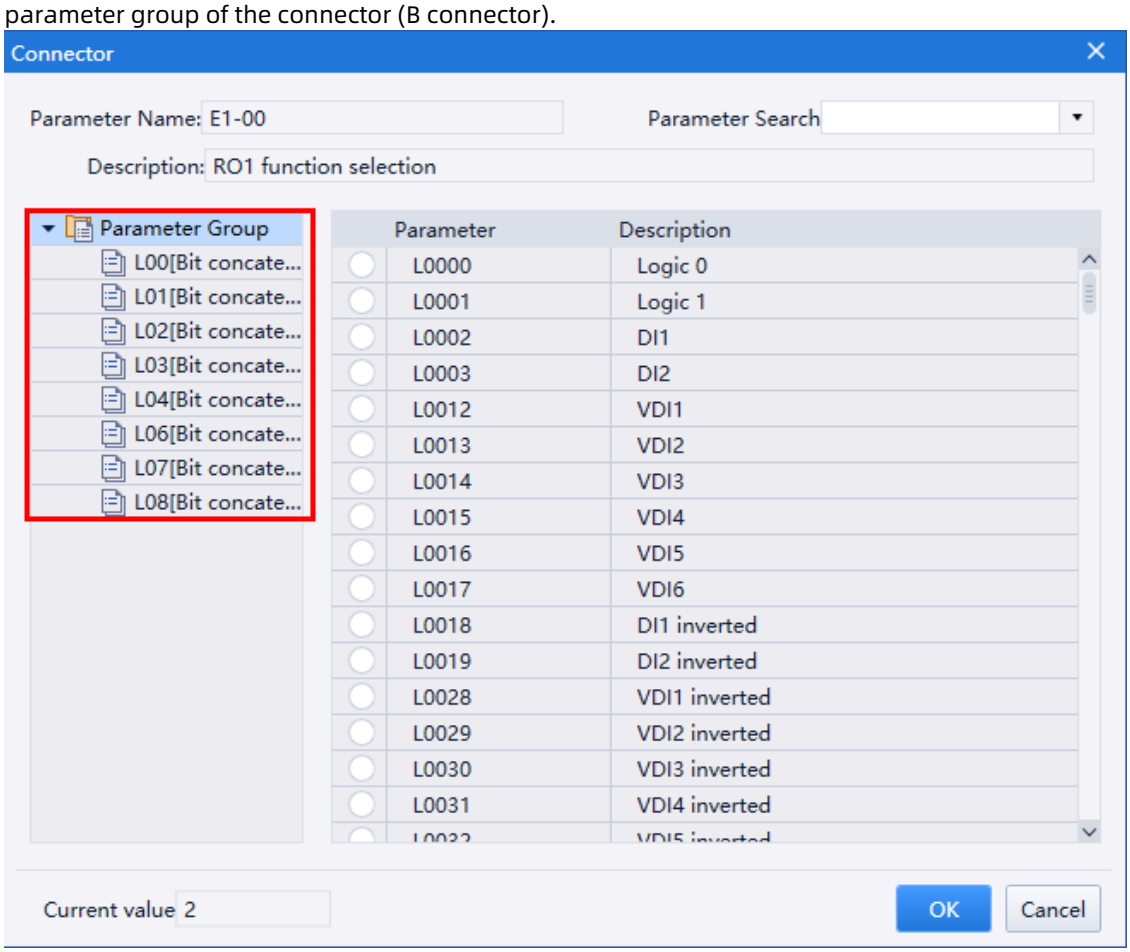
Application instance

Take E1-00 [RO output function selection] as an example to describe how to select the bit connector (B connector) as the parameter input.

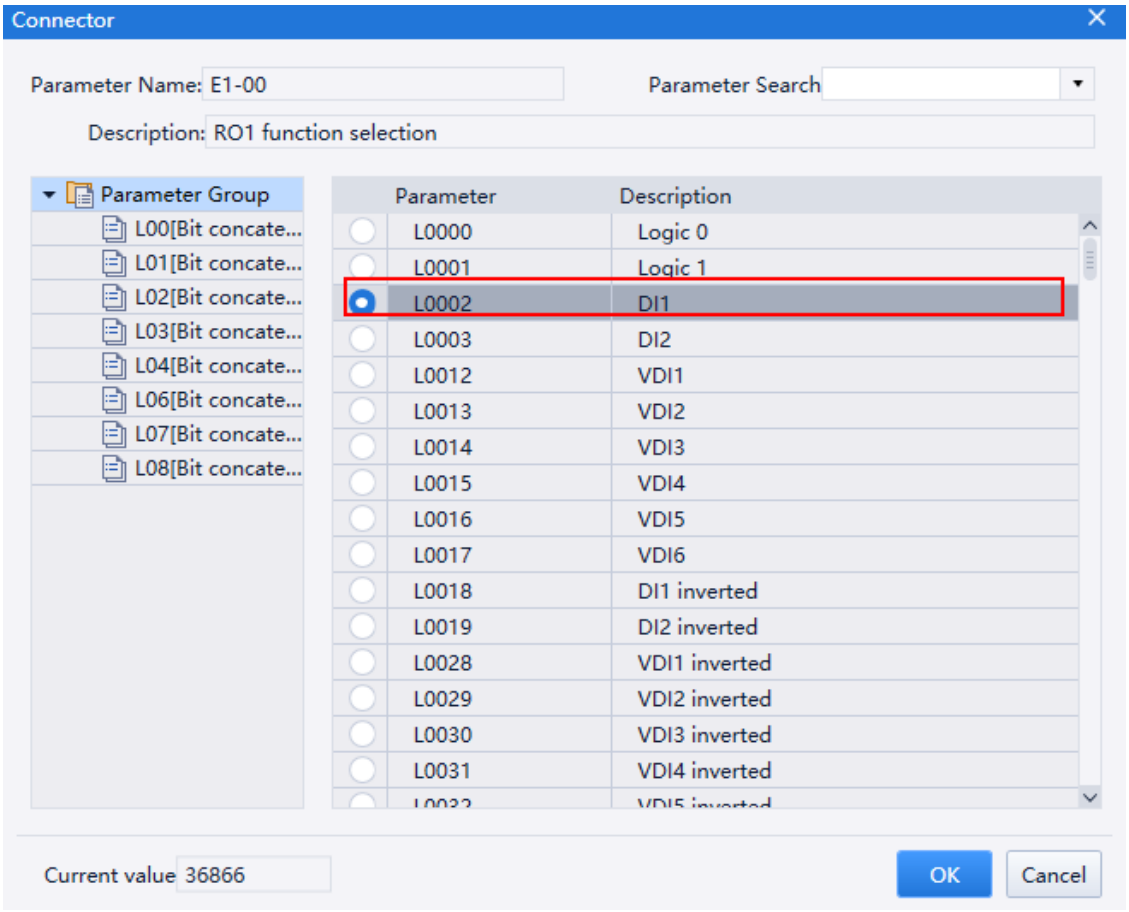
1. Select "Others [B connector]" in the drop-down menu of E1-00 (RO1 output function selection).

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...	Modify...	Display mode	Postal...
E1-00	RO1 function selection	2 [Fault]	-	2	0	46	AnyM...	Decimalism	0xE100
E1-04	DO1 output function selection	33 [Reverse run in progress]	-	0	0	46	AnyM...	Decimalism	0xE104
E1-10	VDO1 function selection	34 [Zero current state]	-	0	0	46	AnyM...	Decimalism	0xE10A
E1-11	VDO2 function selection	35 [Drive overtemperature threshold	-	0	0	46	AnyM...	Decimalism	0xE10B
E1-12	VDO3 function selection	36 [Output current limit exceeded]	-	0	0	46	AnyM...	Decimalism	0xE10C
E1-13	VDO4 function selection	37 [Frequency lower limit reached (c	-	0	0	46	AnyM...	Decimalism	0xE10D
E1-14	VDO5 function selection	38 [Error (Fault/Minor fault/Alarm)]	-	0	0	46	AnyM...	Decimalism	0xE10E
E1-15	VDO6 function selection	40 [Current operating time reached]	-	0	0	46	AnyM...	Decimalism	0xE10F
E1-16	RO1 switch-on delay	41 [Fault (excluding undervoltage)]	s	0	0	3600	AnyM...	Decimalism	0xE110
E1-17	RO1 switch-off delay	42 [STO]	s	0	0	3600	AnyM...	Decimalism	0xE111
E1-24	DO1 output switch-on delay	43 [Minor fault or alarm]	s	0	0	3600	AnyM...	Decimalism	0xE118
E1-25	DO1 output switch-off delay	44 [AI2 input limit violated]	s	0	0	3600	AnyM...	Decimalism	0xE119
E1-36	DO/RO/VDO output source	46 [Component lifetime alarm]	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE124
E1-37	DO/RO/VDO forced data	others [B Connector]	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE125
E1-38	DO/RO/VDO polarity selection		-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE126

2. After clicking "Others [B connector]", the following dialog box pops up. Click the left to select the parameter group of the connector (B connector).



3. Click L0002 DI1 and then click "OK".



4. When the current value of E1-00 [RO output function selection] is "L0002 [DI1]", the setting is successful.

Parameter	Description	Current value	Unit	Factory...	Minim...
E1-00	RO1 function selection	L0002[DI1]	-	2	0
E1-04	DO1 output function selection	0 [No output]	-	0	0
E1-10	VDO1 function selection	0 [No output]	-	0	0

After the above settings are done, if DI1 is closed, L0002 [DI1] is 1 and the RO1 terminal generates output.

5.7.1.1.3 Word Connector (K connector)

Scenarios

This connector enables state word monitoring in the system or serves as a signal source for certain functions.

1. When used to monitor the system status, the status word of a certain function is monitored generally, such as the control word, communication word, status word, and internal monitoring parameter of the drive. For example, you can monitor DI1 to DI7 and VDI1 to VDI6 through L1065 DI state.

2.Internal monitoring system per-unit value such as the frequency per-unit base value (L1101).

3. For parameter interconnection. The status word of a function module of the AC drive is used as the signal source. As the resource pool of the system, you can select a word connector from L10 to L19 as the input for the parameters in the drop-down menu "Others: K connector", and then implement

a specific function (including the word connector as the input source, converting it to a bit connector or a double word connector,. For details, see Free function blocks.

Function description

The word connector (K connector) stores information such as analog, status word, or command word in the system. It is divided into single-word and double-word connectors and can be used as the connector signal source for the parameter who uses word connector as source. The data type of single-word connector is 16-bit length single-word type. The parameter groups L10 to L19 are single word connectors.

Related parameters

Group L10			
Param.	Name	Value Range	Description
L1000	Current state of system state machine	0: Initialization 1: Switch-on prohibited 2: Switch-on permitted 3: Running permission 4: Start 5: Running 6: Stop 7: Self-test 8: Auto-tuning	This parameter indicates the current state of the system status machine.
L1001	Switchover command of system status machine	Bit 0: Start command active Bit 1: Stop active Bit 2: OFF2 (coast to stop) Bit 3: OFF3 (quick stop) Bit 4: Running permission active (currently non-hibernating) Bit 5: Running prohibition active Bit 6: Stop at fault Bit 7 to Bit 15: Reserved Bit value 0: Invalid Bit value 1: Valid	This parameter indicates the active system state machine switchover command. You can click the current value of the parameter to view the command and status indicated by each bit. Value description: Bit 0: Start command active - The start command is active. Bit 1: Stop active - The current stop command is active. Bit 4: OFF2 (coast to stop) - The OFF2 (coast to stop) command is active, and the motor coasts to stop. bit5: OFF3 (quick stop) - The OFF3 (quick stop) command is active, and the motor performs quick stop. Bit 4: Running permission active (currently non-hibernating) - The AC drive is currently allowed to run. Bit 5: Running prohibition active - The AC drive is not allowed to run currently. Bit 6: Stop at fault - The AC drive stops due to a fault.

Group L10			
Param.	Name	Value Range	Description
L1002	System status word 1	Bit 0: Ready to switch on Bit 1: Ready to run Bit 2: Running Bit 3: Faulty Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) Bit 6: Switch-on inhibited Bit 7: Alarm/Limited operation Bit 8: No speed deviation Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached Bit 11: Torque limited Bit 12: Forward speed Bit 13: Reverse speed Bit 14: Running (pulsing) Bit 15: Custom state 0 Bit values of bit 0–bit 8 and bit 10–bit 15 are: 0: Invalid 1: Valid	Displays the value of system status word 1. You may click the current value of the parameter to view the system status indicated by each bit. Value description: Bit 0: Ready to switch on - The AC drive passes self-test upon power-on and no fault occurs. Bit 1: Ready to run - The AC drive can run normally. Bit 2: Running - The AC drive is operating. Bit 3: Faulty - The AC drive stops due to a fault. Bit 4: OFF2 (coast to stop) - OFF2 (coast to stop) command is active, and the motor coasts to stop. Bit 5: OFF3 (quick stop) - OFF3 (quick stop) command is active, and the motor performs quick stop. Bit 6: Switch-on inhibited - The AC drive is in the switch-on inhibition state. Bit 7: Alarm/Limited operation - The AC drive reports Axxx.x (fault) or Lxxx.x (limited operation). Bit 8: No speed deviation - The deviation between the operating speed and target speed is within the allowable range. Bit 9: Local/Remote - The AC drive is in the local or remote control mode. Bit 10: Target speed reached - It indicates whether the set target speed is reached. Bit 11: Torque limited - It indicates whether the torque limit is triggered. Bit 12: Forward speed - The AC drive is operating in the forward direction. Bit 13: Reverse speed - The AC drive is operating in the reverse direction. Bit 14: Running (pulsing) - The AC drive is operating and generates output. Bit 15: Custom state 0 - The AC drive is in custom state 0. Whether this bit is valid depends on P0-59. If the value of P0-59 is 1, then bit 15 value is 1; when the word P0-59 is 0, then bit 15 value is 0.

Group L10			
Param.	Name	Value Range	Description
L1003	System status word 2	Bit 0: Self-test Bit 1: Parameter auto-tuning Bit 2: Light fault state Bit 3: Alarm state Bit 4: Speed mode Bit 5: Torque mode Bit 6: Position mode (reserved) Bit 7: RFG enable Bit 8: RFG operating Bit 9: Stop at fault Bit 10: Normal operation Bit 11: Jogging Bit 12: Decelerate to stop Bit 13: Reserved Bit 14: Terminal control Bit 15: Custom state 1 Bit value 0: Invalid Bit value 1: Valid	Displays the value of system status word 2. You may click the current value of the parameter to view the system status indicated by each bit. Value description: Bit 0: Self-test - The AC drive is in self-test state. Bit 1: Parameter auto-tuning - The AC drive is in the process of parameter auto-tuning. Bit 2: Light fault state - The AC drive stops due to a fault. Bit 3: Alarm state - The AC drive currently has the alarm code Axxx.x. Bit 4: Speed mode - Motor control mode is speed control. Bit 5: Torque mode - Motor control mode is torque control. Bit 6: Position mode (reserved) - Motor control mode is position control. Bit 7: RFG enable - RFG module is enabled. Bit 8: RFG operating - RFG module is in operation. Bit 9: Stop at fault - The AC drive is in the fault stop state and reports fault code Exxx.x. Bit 10: Normal operation - The AC drive is operating at the set frequency. Bit 11: Jogging - The AC drive is jogging. Bit 12: Decelerate to stop - The AC drive decelerates to stop. Bit 13: Reserved Bit 14: Terminal control - The current control mode of the AC drive is terminal control. Bit 15: Custom state 1 - The AC drive is in custom state 1. Whether this bit is valid depends on P0-60. If the value of P0-60 is 1, then bit 15 value is 1; when the word P0-60 is 0, then bit 15 value is 0.

Group L10			
Param.	Name	Value Range	Description
L1004	System status word 3	Bit 0: Control channel selection 0: Control channel 1 1: Control channel 2 Bit 1: Setting channel selection 0: Set channel 1 1: Set channel 2 Bit 2: Motor selection bit0 0: Logic 0 1: Logic 1 Bit 3: Motor selection bit1 0: Logic 0 1: Logic 1 Bit 4: Error (fault/alarm) 0: No error 1: Faulty Bit 5: EEPROM idle 0: EEPROM idle 1: EEPROM in use Bit 6: Communication control 0: Inactive 1: Active Bit 7: Relay action during automatic fault reset 0: Relay during automatic fault reset is inactive. 1: Relay during automatic fault reset is active. Bit 8: IGBT pulsing status 0: Stop 1: Running Bit 9: System command direction 0: Forward run 1: Reverse run (Continued)	Displays the value of system status word 3. You may click the current value of the parameter to view the system status indicated by each bit. Value description: Bit 0: Control channel selection - Displays the active control channel of the drive. Bit 1: Setting channel selection - Displays the active setting channel of the drive. Bit 2: Motor selection bit0 - State of motor group selection parameter Bit 0 Bit 3: Motor selection bit1 - State of motor group selection parameter Bit 1 Bit 4: Error (fault/alarm) - The drive is in the error sate with fault code Exxx.x or alarm code Axxx.x displayed. Bit 5: EEPROM idle - EEPROM is in the idle state and no read/write task exists. Bit 6: Communication control – Displays the system communication control status. Bit 7: Relay action during automatic fault reset Displays the relay action during automatic fault reset. Bit 8: IGBT pulsing state – Displays the current pulsing state. Bit 9: System command direction – Displays the system command direction. Bit 10: IGBT pulsing state with delay – Displays the IGBT pulsing state with delay. Bit 11: Internal parameter processing flag – Displays the internal parameter processing flag. Bit 12: Internal voltage OK - Displays the internal voltage status. Bit 14-bit 15: Power board initialization status – Displays whether the current power board initialization is complete.

Group L10			
Param.	Name	Value Range	Description
L1004	System status word 3	(Continued) Bit 10:IGBT pulsing state with delay 0: Stop 1: Running Bit 11: Internal parameter processing flag 0: No operation 1: Processing Bit 12: Internal voltage OK 0: Under voltage or uninitialized 1: Normal Bit 13: Reserved 0: Inactive 1: Active Bit 14-bit 15: Power board initialization state 0: Uninitialized 1: Initializing 2: Initialization completed 3: Reserved	Displays the value of system status word 3. You may click the current value of the parameter to view the system status indicated by each bit. Value description: Bit 0: Control channel selection - Displays the active control channel of the drive. Bit 1: Setting channel selection - Displays the active setting channel of the drive. Bit 2: Motor selection bit0 - State of motor group selection parameter Bit 0 Bit 3: Motor selection bit1 - State of motor group selection parameter Bit 1 Bit 4: Error (fault/alarm) - The drive is in the error sate with fault code Exxx.x or alarm code Axxx.x displayed. Bit 5: EEPROM idle - EEPROM is in the idle state and no read/write task exists. Bit 6: Communication control – Displays the system communication control status. Bit 7: Relay action during automatic fault reset Displays the relay action during automatic fault reset. Bit 8: IGBT pulsing state – Displays the current pulsing state. Bit 9: System command direction – Displays the system command direction. Bit 10: IGBT pulsing state with delay – Displays the IGBT pulsing state with delay. Bit 11: Internal parameter processing flag – Displays the internal parameter processing flag. Bit 12: Internal voltage OK - Displays the internal voltage status. Bit 14-bit 15: Power board initialization status – Displays whether the current power board initialization is complete.

Group L10			
Param.	Name	Value Range	Description
L1005	System status word 4	Bit 0: Operating at zero speed (inactive at stop) Bit 1: Operation at zero speed (active at stop) Bit 2: Frequency level detection 1 Bit 3: Frequency level detection 2 Bit 4: AI1/AI2 Bit 5: Simple PLC cycle completed 0: Not completed 1: Completed Bit 6: Value set through communication Bit 7: Reserved Bit 8: Current 1 reached Bit 9: Current 2 reached Bit 10: Zero current state Bit 11: Software current limit exceeded Bit 12: Motor overload alarm Bit 13: AC drive overload alarm Bit 14: Undervoltage Bit 15: Three-phase loss Bit values of bit 0-bit 4 and bit 6-bit 15 are: 0: Invalid 1: Valid	Displays the value of system status word 4. You may click the current value of the parameter to view the system status indicated by each bit. Value description: Bit 0: Operation at zero speed (inactive at stop) - The AC drive is in the operating-at-zero-speed state, which is inactive at stop. Bit 1: Operation at zero speed (active at stop) - The AC drive is in the operating-at-zero-speed state, which is active at stop. Bit 2: Frequency level detection 1 - This bit is valid when the operating frequency is higher than the frequency detection value 1 (FDT1). This bit invalid when the operating frequency is lower than the result of frequency detection value 1 minus frequency detection value 1 multiplied by frequency detection hysteresis coefficient 1. Set FTD1-related parameters through P0-34 to P0-35. Bit 3: Frequency level detection 2 The bit is valid when the running frequency is higher than the frequency detection value 2 (FDT2). The bit is invalid when the running frequency is lower than the result of frequency detection value 2 minus frequency detection value 2 multiplied by frequency detection hysteresis coefficient 2. Set FTD2-related parameters through P0-36 to P0-37. Bit 5: Simple PLC cycle completed - The bit is valid when the simple PLC module completes a cycle. Bit 6: Value set through communication - The AC drive sets the parameter value through communication. Bit 7: Reserved Bit 8: Current 1 reached - When the output current of the AC drive is within the range of (detection current 1 ± detection current amplitude 1)×rated motor current, this bit is valid. Set related parameters through P0-43 to P0-44. Bit 9: Current 2 reached When the output current of the AC drive is within the range of (detection current 2 ± detection current amplitude 2) x rated motor current, the bit is valid. Set related parameters through P0-45 to PO-46. Bit 10: Zero current state - When the output current of the AC drive has been less than or equal to the zero current detection level for a period longer than the zero current detection delay, the bit is valid. Set current-related parameters through P0-47 to P0-48. Bit 11: Output current limit exceeded - When the output current of the AC drive is higher than the output current limit violation threshold for a period longer than the output current limit violation detection delay, the bit is valid. Parameters related to output current limit violation detection are set through P0-49 to P0-50. Bit 12: Motor overload alarm - The AC drive reports A111.1 when this bit is active. Bit 13: AC drive overload alarm - The AC drive reports A110.1 when this bit is active. Bit 14: Undervoltage - The AC drive reports E009.1 when this bit is active. Bit 15: Three-phase loss - The AC drive reports E030.1 when this bit is active.

Group L10			
Param.	Name	Value Range	Description
L1006	Main status word of drive	Bit 0 to Bit 1: Running status 0: Initialization 1: Sampling preparation 2: Undervoltage 3: Preparation is complete Bit 2: Hardware information status 0: Not ready 1: Ready Bit 3: Running/stop state 0: Stop 1: Running Bit 4: Output blocked forcibly at fault 0: Inactive 1: Active Bit 5: Bus undervoltage state 0: Inactive 1: Active Bit 6 to Bit 15: Reserved	Displays the real-time operating status of the drive. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Value description: Bit 0-Bit 1: Running status - Displays the power-on initialization status of the drive. Bit 2: Hardware information status - Displays whether the hardware power-on self-test passed without exception. Bit 3: Running/stop status - Displays the current state of the drive. Bit 4: Forced output blocked by fault - The AC drive is in the output blockage state upon fault. Bit 5: Bus undervoltage state - The DC bus of the AC drive is in the undervoltage state.

Group L10			
Param.	Name	Value Range	Description
L1044	Custom command word of control channel 1	Bit 0: ON_OFF1 (start/stop) state 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 0: Stop 1: Running Bit 3: Running permitted 0: Not permitted 1: Permitted Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: Inversion disabled 1: Inverse	Displays the real-time operating status of the custom command word control channel 1. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Bit 0: ON_OFF1 (start/stop) state - Displays the ON_OFF1 (start/stop) status of the custom command word for control channel 1. Bit 1: OFF2 (coast to stop) state - Displays the OFF2 (coast to stop) state of the command word of control channel 1. Bit 2: OFF3 (quick stop) state - Displays the OFF (quick stop) status of the command word of control channel 1. Bit 3: Running permitted - Displays the running permitted state of the custom command word for control channel 1. Bit 4: Reset command - Displays the reset command status of the custom command word for control channel 1. Bit 5: Jog 1 - Displays the jog 1 state of the custom command word for control channel 1. Bit 6: Jog 2 - Displays the jog 2 state of the custom command word for control channel 1. Bit 7: Speed inversion - Displays the speed inversion state of the custom command word for control channel 1.

Group L10			
Param.	Name	Value Range	Description
L1045	Custom command word of control channel 2	Bit 0: ON_OFF1 (start/stop) state 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 0: Stop 1: Running Bit 3: Running permitted 0: Not permitted 1: Permitted Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverse	Displays the real-time operating status of the custom command word control channel 2. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Bit 0: ON_OFF1 (start/stop) stop – Displays the ON_OFF1 (start/stop) status of the custom command word for control channel 2. Bit 2: OFF2 (coast to stop) state – Displays the OFF2 (coast to stop) state of the command word of control channel 1. Bit 2: OFF3 (quick stop) state – Displays the OFF (quick stop) status of the command word of control channel 2. Bit 3: Running permitted – Displays the running permitted state of the custom command word for control channel 2. Bit 4: Reset command – Displays the reset command status of the custom command word for control channel 2. Bit 5: Jog 2 – Displays the jog 1 state of the custom command word for control channel 1. Bit 6: Jog 2 – Displays the jog 2 state of the custom command word for control channel 2. Bit 7: Speed inversion – Displays the speed inversion state of the custom command word for control channel 2.

Group L10			
Param.	Name	Value Range	Description
L1046	Auxiliary command word of control channel 1	Bit 0: OFF2 (coast to stop) state 2 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 3 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 2 0: Stop 1: Running Bit 3: OFF3 (quick stop) state 3 0: Not permitted 1: Permitted Bit 4: Reset command 2 0: Not reset 1: Reset Bit 5: Reset command 3 0: Not reset 1: Reset Bit 6: RFG disabled 0: Active 1: Inactive Bit 7: RFG paused 0: Active 1: Inactive Bit 8: RFG mandatory 0: Active 1: Inactive	Displays the real-time operating status of the auxiliary command word control channel 1. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Bit 0: OFF2 (coast to stop) state 2 – Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 1. Bit 0: OFF2 (coast to stop) state 3 – Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 1. Bit 2: OFF3 (quick stop) state 2 – Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 1. Bit 3: OFF3 (quick stop) state 3 – Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 1. Bit 4: Reset command 2 – Displays the reset command 2 status of the auxiliary command word of control channel 1. Bit 5: Reset command 3 – Displays the reset command 3 status of the auxiliary command word of control channel 1. Bit 6: RFG disabled – Displays the RFG disabled status of the auxiliary command word of control channel 1. Bit 7: RFG paused – Displays the RFG paused state of the auxiliary command word of control channel 1. Bit 8: RFG mandatory – Displays the RFG mandatory state of the auxiliary command word for control channel 1.

Group L10			
Param.	Name	Value Range	Description
L1047	Auxiliary command word of control channel 2	Bit 0: OFF2 (coast to stop) stop 2 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 3 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 2 0: Stop 1: Running Bit 3: OFF3 (quick stop) state 3 0: Not permitted 1: Permitted Bit 4: Reset command 2 0: Not reset 1: Reset Bit 5: Reset command 3 0: Not reset 1: Reset Bit 6: RFG disabled 0: Active 1: Inactive Bit 7: RFG paused 0: Active 1: Disable Bit 8: RFG mandatory 0: Active 1: Inactive	Displays the real-time operating status of the auxiliary command word control channel 2. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Bit 0: OFF2 (coast to stop) state 2 – Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 2. Bit 0: OFF2 (coast to stop) state 3 – Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 2. Bit 2: OFF3 (quick stop) state 2 – Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 2. Bit 3: OFF3 (quick stop) state 3 – Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 2. Bit 4: Reset command 2 – Displays the reset command 2 status of the auxiliary command word of control channel 2. Bit 5: Reset command 3 – Displays the reset command 3 status of the auxiliary command word of control channel 2. Bit 6: RFG disabled – Displays the RFG disabled status of the auxiliary command word of control channel 2. Bit 7: RFG paused – Displays the RFG paused state of the auxiliary command word of control channel 2. Bit 8: RFG mandatory – Displays the RFG mandatory state of the auxiliary command word for control channel 2.

Group L10			
Param.	Name	Value Range	Description
L1050	STO output status word	/	Displays the STO state, the input state of dual STOs, and the DO output state. Note: Bit 0 indicates the STO1 disconnection flag. When the 24 V input of STO1 is disconnected, this bit is set to 1. Bit 1 indicates the STO2 disconnection flag. When the 24 V input of STO2 is disconnected, this bit is set to 1. Bit 2 indicates whether the DO of STO is outputted. When both 24 V inputs are disconnected, a DO output signal is generated. In this case, this flag is set to 1. Bit 3 indicates the STO status flag bit. When both 24 V inputs are disconnected, this flag is set to 1.
L1051	LED control word	Bit 0: Start Bit 1: Stop Bit 2: Jog 1 Bit 3: Local control Bit 4: Reset Bit 5: Jog 2 Bit 6: Direction switching Bit value 0: Invalid Bit value 1: Valid	Displays the control command status of the LED operating panel. You can click current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Value Range	Description
L1054	Command channel control word	Bit 0: ON_OFF1 (start/stop) state 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 0: Active 1: Normal Bit 2: OFF3 (quick stop) state 0: Active 1: Normal Bit 3: Running permitted 0: Operation inhibited 1: Operation allowed Bit 4: RFG output forced to 0 0: Normal 1: The RFG output is forced to 0. Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: The RFG input is forced to 0. (To be continued)	This parameter indicates the input status of the command channel. You can click the current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Value Range	Description
Continued	Continued	(Continued) bit7: Fault reset 0: Inactive 1: Active Bit 8: Jog 1 0: Inactive 1: Active Bit 9: Jog 2 0: Inactive 1: Active Bit 10: Remote control reserved 0: Inactive 1: Active Bit 11: Speed inversion 0: Inversion disabled 1: Inversion Bit 12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active	Continued

Group L10			
Param.	Name	Value Range	Description
L1055	Communication setting control word	Bit 0: ON_OFF1 (start/stop) state 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 0: Stop 1: Running Bit 3: Running permitted 0: Not permitted 1: Permitted Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverse	This parameter indicates the input status of the communication control command. You can click the current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Value Range	Description
L1057	Terminal module control word	Bit 0: ON_OFF1 (start/stop) state 0: Stop 1: Running Bit 1: OFF2 (coast to stop) state 0: Stop 1: Running Bit 2: OFF3 (quick stop) state 0: Stop 1: Running Bit 3: Running permitted 0: Not permitted 1: Permitted Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverse	Displays the control command status of the terminal control mode. You can view the command status corresponding to the bit by clicking current value of the parameter.
L1058	Input state of terminal module A	Bit 0: ON_OFF1 (start/stop) state Bit 1: Reverse operation (Rev) Bit 2: Running permitted (Enable) Bit 3: Reset command (Reset) Bit 4: Jog 1 (JOG1) Bit 5: Jog 2 (JOG2) Bit 6: Reserved (Rsvd1) Bit 7: Terminal input input (In1) Bit 8: Terminal input input (In2) Bit 9: Terminal input input (In3) Bit value 0: Invalid Bit value 1: Valid	Displays the control command input state of terminal module A. You can click the current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Value Range	Description
L1059	Input state of terminal module B	Bit 0: ON_OFF1 (start/stop) state Bit 1: Reverse operation (Rev) Bit 2: Running permitted (Enable) Bit 3: Reset command (Reset) Bit 4: Jog 1 (JOG1) Bit 5: Jog 2 (JOG2) Bit 6: Reserved (Rsvd1) Bit 7: Terminal input input (In1) Bit 8: Terminal input input (In2) Bit 9: Terminal input input (In3) Bit value 0: Invalid Bit value 1: Valid	Displays the control command input state of terminal module B. You can click the current value of the parameter to view the control word status indicated by each bit.
L1060	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: User-defined	This parameter indicates the external command source.

Group L10			
Param.	Name	Value Range	Description
L1065	DI state	Bit 0: DI1 state Bit 1: DI2 state Bit 2: DI3 state (MD630S) Bit 3: DI4 state (MD630S) Bit 4: DI5 state (MD630S) Bit 5: DI6 state (MD630S) Bit 6: DI7 state (MD630S) Bit 10: VDI1 state Bit 11: VDI2 state Bit 12: VDI3 state Bit 13: VDI4 state Bit 14: VDI5 state Bit 15: VDI6 state Bit value 0: Low level Bit value 1: High level	Displays the final output status of DI and VDI. You can view the DI/VDI status of the bit by clicking the current value of the parameter.
L1068	DO state	Bit 0: RO state Bit 4: DO state Bit 8: FMR (MD630S) Bit 10: VDO1 state Bit 11: VDO2 state Bit 12: VDO3 state Bit 13: VDO4 state Bit 14: VDO5 state Bit 15: VDO6 state Bit value 0: Low level Bit value 1: High level	Displays the final output status of DO and VDO. You can view the DO/VDO status of the bit by clicking the current value of the parameter.

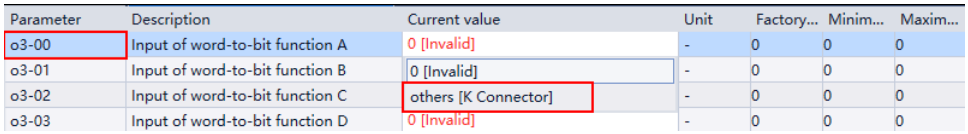
Group L11			
Param.	Name	Value Range	Description
L1100	Base value of speed per-unit value	0–65535rpm	Displays the base value of the current speed per-unit value. The speed per-unit value = the actual speed ÷ the base value
L1101	Base value of frequency per-unit value	0.0 Hz to 6553.5 Hz	Displays the base value of the current frequency per-unit value. The frequency per-unit value = the actual frequency ÷ the base value
L1102	Base value of voltage per-unit value	0.0 V to 6553.5 V	Displays the base value of the current voltage per-unit value. The frequency per-unit value = the actual frequency ÷ the base value
L1103	Base value of current per-unit value	0.0 A to 6553.5 A	Displays the base value of per-unit current value. The current per-unit value = the actual current ÷ the base value

Group L11			
Param.	Name	Value Range	Description
L1104	Base value of power per-unit value	0.0 kW to 655.35kW	Displays the base value of per-unit power. The power per-unit value = the actual power ÷ the base value
L1105	Base value of torque per-unit value	0.00–655.35N·m	Displays the base value of the current torque per-unit value. The torque per-unit value = the actual torque÷ the base value
L1106	Base value of DC bus voltage per-unit value	0 V to 65535 V	Displays the base value of DC bus voltage per-unit value. The bus voltage per-unit value = the actual bus voltage ÷ the base value

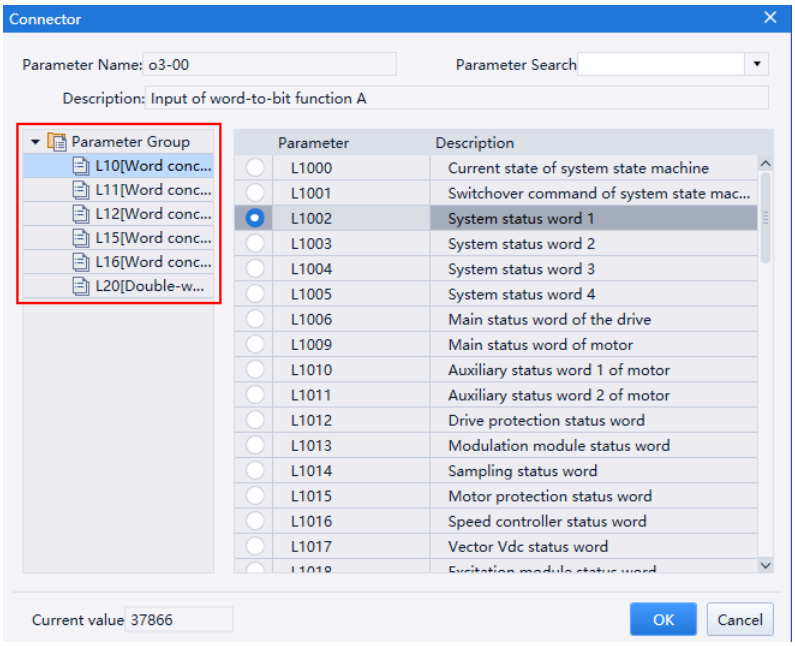
Instances

Take o3-00 as an example, and show how to select the word connector (K connector) as the parameter input.

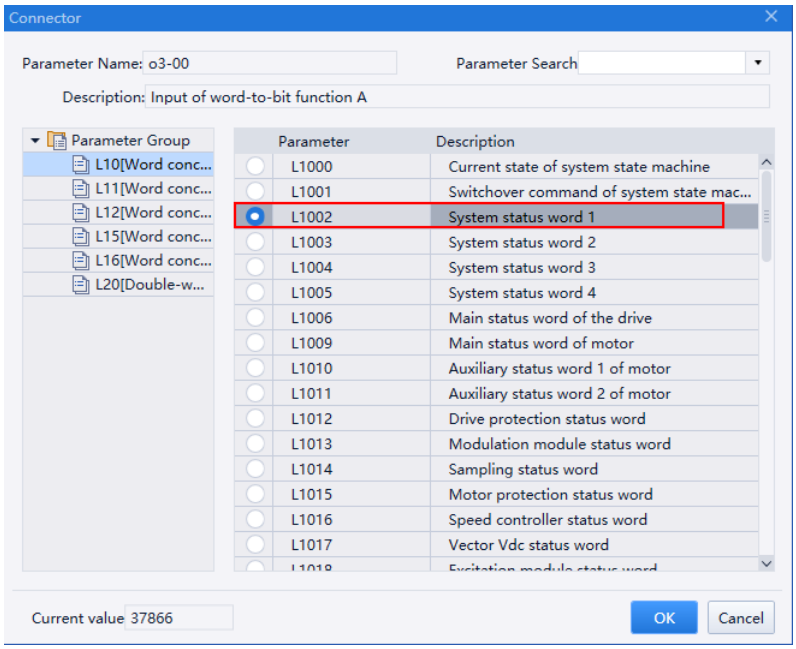
1. Select "Others [K connector]" in the drop-down menu of o3-00 [Input of word-to-bit function A].



2. After clicking "Others [K connector]", the following dialog box displays, then click on the left to select the parameter group of the word connector (K connector)



3. Click L1002 system status word 1, and then click "OK".



4. When the current value of o3-00 [Input of word-to-bit function A] is "L1002 [system status word 1]", the setting is done

Parameter	Description	Current value	Unit	Factory...	Minim...
o3-00	Input of word-to-bit function A	L1002[System status word 1]	-	0	0
o3-01	Input of word-to-bit function B	0 [Invalid]	-	0	0

After the preceding settings are done, you can convert L1002 [System status word 1] to a bit connector and display the bits in L0304 to L0319.

5.7.1.1.4 Double Word Connector (K Connector)

Scenario

The K connector can be used to monitor state words in the system or serves as a signal source for certain functions.

1. The K connector is used for system status monitoring, such as monitoring the output of a word-to-double word module A of the drive. Compared with a bit connector (one address can be used to read only 1 bit) and a word connector (one address can be used to read only 16 bits), the double word connector can read more information through one address. A double word connector can indicate more valid digits, improving the numerical value accuracy.

2. The K connector is used for parameter interconnection, and is used as the signal source input of the function module status word of the drive. As the resource pool of the system, you can select a word connector from L20 to L21 as the input for the parameter whose drop-down list menu contains "Other: K connector". Then a specific function is implemented (mainly for using the double word connector as the input source and converting it to a bit connector). For details, see "Free Function Block".

Function description

The word connector (K connector) stores information such as analog, status, or command words in the system. It is divided into word connectors and double word connectors. It can be used as the

connector signal source for the parameter with the setting source set to words. The data type of the double word connector is the double word with 32 bits. The parameter groups L20 to L21 are double word connectors.

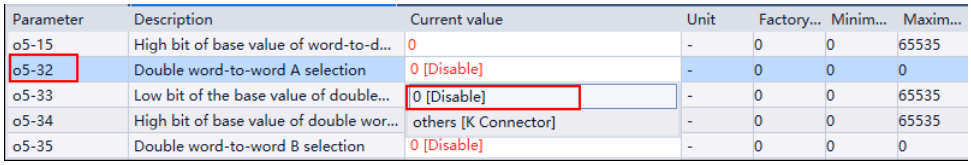
Related parameters

Group L20			
Parameter code	Parameter name	Display range	Value
L2000	Output of word-to-double word module A	0–0xFFFFFFFF	Indicates the output of word-to-double word module A.
L2002	Output of word-to-double word module B	0–0xFFFFFFFF	Indicates the output of word-to-double word module B.
L2004	Output of word-to-double word module C	0–0xFFFFFFFF	Indicates the output of word-to-double word module C.
L2006	Output of word-to-double word module D	0–0xFFFFFFFF	Indicates the output of word-to-double word module D.

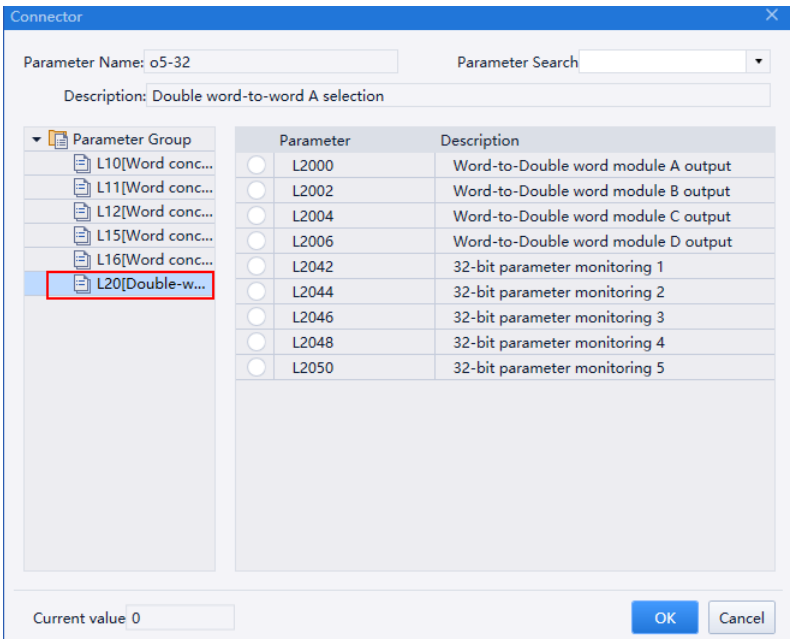
Instances

Take o5-32 (double word-to-word A selection) as an example to describe how to select a double word connector (K connector) as the parameter input.

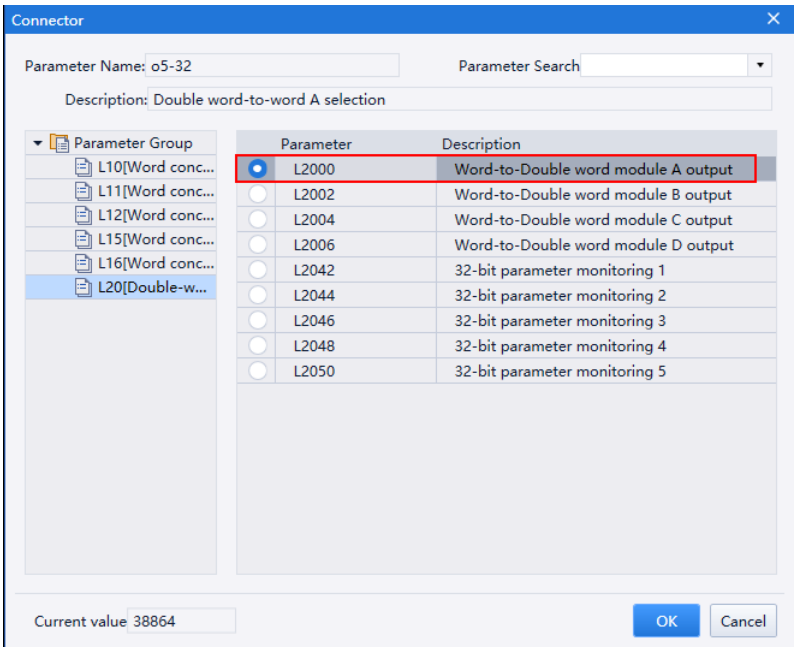
1. From the drop-down list menu of o5-32 (double word-to-word A selection), select "others [K Connector]".



2. After selecting "others [K Connector]", the following dialog box pops up. Click the parameter group of the double word connector (K connector) in the left pane.



3. Select "L200 Word-to-double word module A output" and click "OK".



4. Check that the value of o5-32 (double word-to-word A selection) is "L2000[Word-to-double word module A]", which means that the setting is successful.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
o5-15	High bit of base value of word-to-d...	0	-	0	0	65535
o5-32	Double word-to-word A selection	L2000[Word-to-Double word module...	-	0	0	0
o5-33	Low bit of the base value of double...	0	-	0	0	65535

After you complete the above setting, you can convert L2000 to a word connector (single word) and display it in L1212 and L1213.

5.7.1.1.5 Floating-Point Connector (F Connector)

Scenarios

This connector is used to monitor floating-point type data in the system or act as a signal source for certain functions.

1. It can be used to monitor the operation data of the system, including floating-point variables in the system, which are generally related to system operations such as output frequency and motor speed.

2. It can be used for parameter interconnection. The data related to a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a floating-point connector from L24 to L39 as the input of the parameter with the drop-down menu "Others: F connector", so as to achieve certain functions.

Description

The floating-point connector (F connector) saves information such as analog values in the system and can be used as the connector signal source for parameters of the floating-point source type. The data type in the floating-point connector is 32-bit data of single-precision floating-point type. Parameter groups L22 to L39 are floating-point connectors.

Related parameters

Group L22			
Param.	Name	Display range	Description
L2200	Output frequency	-800.0% to +800.0%	Displays the output frequency.
L2202	Motor speed	-800.0% to +800.0%	Displays the motor speed.
L2204	Output current	-800.0% to +800.0%	Displays the output current.
L2206	Output voltage	-800.0% to +800.0%	Displays the output voltage.
L2208	Output power	-800.0% to +800.0%	Displays the output power.
L2210	Output torque	-800.0% to +800.0%	Displays the output torque.
L2244	AI1 input value	-800.0% to +800.0%	Displays the per unit value of AI1 input.
L2246	AI2 input value	-800.0% to +800.0%	Displays the per unit value of AI2 input.
L2250	HDI input value	-800.0% to +800.0%	Displays the per unit value of HDI input.
L2252	AO value percentage written through communication (MD630S)	-800.0% to +800.0%	Displays the percentage of the AO value written through communication.
L2258	Per unit current value based on 1000 A at maximum	-800.0% to +800.0%	Displays the per unit current value based on 1000 A at maximum.
L2260	Per unit voltage value based on 1000 V at maximum	-800.0% to +800.0%	Displays the per unit voltage value based on 1000 V at maximum.
L2262	Absolute output of AO output torque (MD630S)	-800.0% to +800.0%	Displays the absolute output of AO output torque (MD630S).
L2264	Actual value of AO output torque (MD630S)	-800.0% to +800.0%	Displays the actual value of AO output torque (MD630S).

Group L23			
Param.	Name	Display range	Description
L2318	Multi-reference selection output	-800.0% to +800.0%	Displays the output corresponding to the selected multi-reference value.
L2320	Output corresponding to multi-reference 0	-800.0% to +800.0%	Displays the output corresponding to multi-reference 0.
L2322	Multi-reference 1 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 1.
L2324	Multi-reference 2 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 2.
L2326	Multi-reference 3 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 3.
L2328	Multi-reference 4 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 4.
L2330	Multi-reference 5 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 5.
L2332	Multi-reference 6 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 6.
L2334	Multi-reference 7 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 7.
L2336	Multi-reference 8 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 8.

Group L23			
Param.	Name	Display range	Description
L2338	Multi-reference 9 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 9.
L2340	Multi-reference 10 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 10.
L2342	Multi-reference 11 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 11.
L2344	Multi-reference 12 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 12.
L2346	Multi-reference 13 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 13.
L2348	Multi-reference 14 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 14.
L2350	Multi-reference 15 output	-800.0% to +800.0%	Displays the output corresponding to multi-reference 15.

Group L24			
Param.	Name	Display range	Description
L2452	Digital setting of forced value of motorized potentiometer	-800.0% to +800.0%	Displays the forced value of motorized potentiometer.
L2454	Reset value of motorized potentiometer	-800.0% to +800.0%	Displays the reset value of motorized potentiometer.
L2456	Maximum value of motorized potentiometer	-800.0% to +800.0%	Displays the maximum value of motorized potentiometer.
L2458	Minimum value of motorized potentiometer	-800.0% to +800.0%	Displays the minimum value of motorized potentiometer.
L2460	Initial value of motorized potentiometer	-800.0% to +800.0%	Displays the initial value of motorized potentiometer.
L2462	Process operation value of motorized potentiometer	-800.0% to +800.0%	Displays the process operation value of motorized potentiometer.
L2464	Final output value of motorized potentiometer	-800.0% to +800.0%	Displays the final output value of motorized potentiometer.
L2466	General PID output	-800.0% to +800.0%	Displays the total output of the general PID.
L2468	General PID error	-800.0% to +800.0%	Displays the error input of the general PID.
L2470	General PID reference	-800.0% to +800.0%	Displays the reference input of the general PID.
L2472	General PID feedback	-800.0% to +800.0%	Displays the reference input of the general PID.
L2474	General PID proportional output	-800.0% to +800.0%	Displays the proportional output of the general PID.
L2476	General PID integral output	-800.0% to +800.0%	Displays the integral output of the general PID.
L2478	General PID derivative output	-800.0% to +800.0%	Displays the derivative output of the general PID.

Group L24			
Param.	Name	Display range	Description
L2480	General PID reverse action cutoff output	-800.0% to +800.0%	Displays the maximum output upon cutoff of the PID reverse action.
L2482	Per unit value of simple PLC step	-800.0% to +800.0%	Displays the per unit value of simple PLC step.

Group L30			
Param.	Name	Display range	Description
L3000	Actual motor speed	-800.0% to +800.0%	Actual motor speed Note: The value of this parameter is the encoder speed in the FVC mode, motor observation speed in the SVC mode, and synchronous frequency before slip compensation in the V/f mode.
L3002	Final motor speed reference	-800.0% to +800.0%	Displays the final motor speed reference. Note: This parameter indicates the speed after the final output of RFG.
L3006	Target frequency	-800.0% to +800.0%	Displays the target frequency.
L3008	Operating frequency	-800.0% to +800.0%	Defines the real-time frequency output of the drive, which is also the motor control target frequency.
L3016	Jog 1 frequency	-800.0% to +800.0%	Defines jog 1 frequency of the active setting channel, which is obtained based on settings of the jog 1 frequency source and jog 1 frequency reference.
L3018	Jog 2 frequency	-800.0% to +800.0%	Defines jog 2 frequency of the active setting channel, which is obtained based on settings of the jog 2 frequency source and jog 2 frequency reference.
L3046	RFG reference input	-800.0% to +800.0%	Displays the frequency set by the input RFG.
L3052	RFG calculation output	-800.0% to +800.0%	Displays the frequency after RFG calculation.
L3054	RFG acceleration	-800.0% to +800.0%	Displays RFG acceleration rate.
L3058	UP/DOWN offset	-800.0% to +800.0%	Defines the offset frequency adjusted by UP/DOWN keys.
L3060	UP/DOWN upper limit	-800.0% to +800.0%	Displays the UP/DOWN upper limit.
L3062	Lower limit of frequency adjusted by UP/DOWN key	-800.0% to +800.0%	Displays the UP/DOWN lower limit.
L3064	Speed reference set through communication	-800.0% to +800.0%	Displays the per unit value of the speed reference set through communication.
L3066	Communication (0x1000H)	-800.0% to +800.0%	Displays the reference set through communication.
L3068	Maximum positive frequency	-800.0% to +800.0%	Displays the active maximum positive frequency.
L3070	Minimum positive frequency	-800.0% to +800.0%	Displays the active minimum positive frequency.

Group L30			
Param.	Name	Display range	Description
L3072	Maximum negative frequency	-800.0% to +800.0%	Displays the active maximum negative frequency.
L3074	Minimum negative frequency	-800.0% to +800.0%	Displays the active minimum negative frequency.

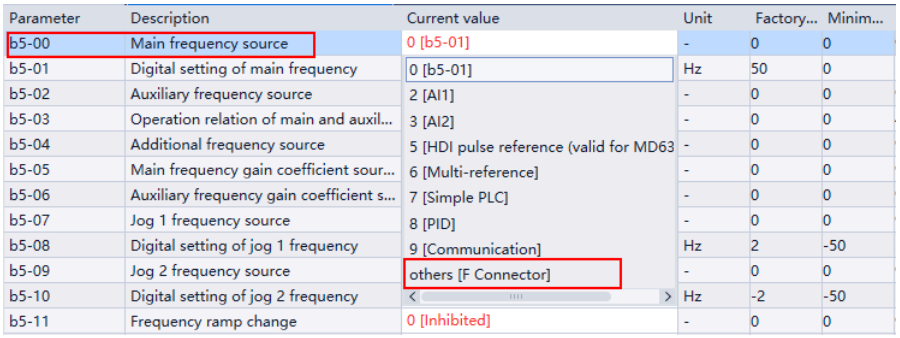
Group L31			
Param.	Name	Display range	Description
L3100	Torque reference	-800.0% to +800.0%	Displays the torque reference. Note: The torque reference is obtained after the torque is multiplied by the torque gain coefficient and after the torque is further processed based on the maximum and minimum torque limits.
L3112	Maximum positive torque	-800.0% to +800.0%	During operation without torque limit, the maximum positive torque is the lower value between digital setting of positive torque upper limit and the positive torque upper limit. During operation with torque limited, the maximum positive torque is the lower value among the digital setting of positive torque upper limit, positive torque upper limit selection, and the maximum positive torque limit.
L3114	Maximum negative torque	-800.0% to +800.0%	During operation without torque limit, the maximum negative torque is the higher value between inverted digital setting of negative torque upper limit and absolute value of negative torque upper limit. During operation with torque limited, the maximum negative torque is the higher value among the inverted digital setting of negative torque upper limit, negative torque upper limit selection, and the absolute value of maximum negative torque limit.
L3120	Target voltage upon V/f separation	-800.0% to +800.0%	In the non-operational state or when separated V/f is not enabled, the target voltage for separated V/f is 0. In the operational state and when separated V/f is enabled, the target voltage for separated V/f is the value outputted after digital setting of V/f separation voltage is processed with the V/f voltage upper limit.
L3122	V/f separation voltage output	-800.0% to +800.0%	In the non-operational state, the voltage output in separated V/f mode is 0. In the operational state, the voltage output in the separated V/f mode is the voltage processed with acceleration/deceleration.

Group L32			
Param.	Name	Display range	Description
L3208	Drive overload cumulative value	-800.0% to +800.0%	Displays the cumulative value of drive overload. Note: Defines the cumulative value of drive overload. When 100% is reached, the drive reports overload fault.
L3210	Motor overload cumulative value	-800.0% to +800.0%	Displays the cumulative value of motor overload. Note: Defines the cumulative value of motor overload. When 100% is reached, the motor reports overload fault.
L3212	Synchronous frequency	-800.0% to +800.0%	Displays the synchronous frequency.
L3228	Phase U current	-800.0% to +800.0%	Displays the phase U current.
L3230	Phase V current	-800.0% to +800.0%	Displays the phase V current.
L3232	Phase W current	-800.0% to +800.0%	Displays the phase W current.
L3234	Output current amplitude	-800.0% to +800.0%	Displays the amplitude of the output current.
L3238	Output voltage amplitude	-800.0% to +800.0%	Displays the amplitude of the output voltage.
L3248	Drive bus voltage	-800.0% to +800.0%	Displays the bus voltage of the drive.

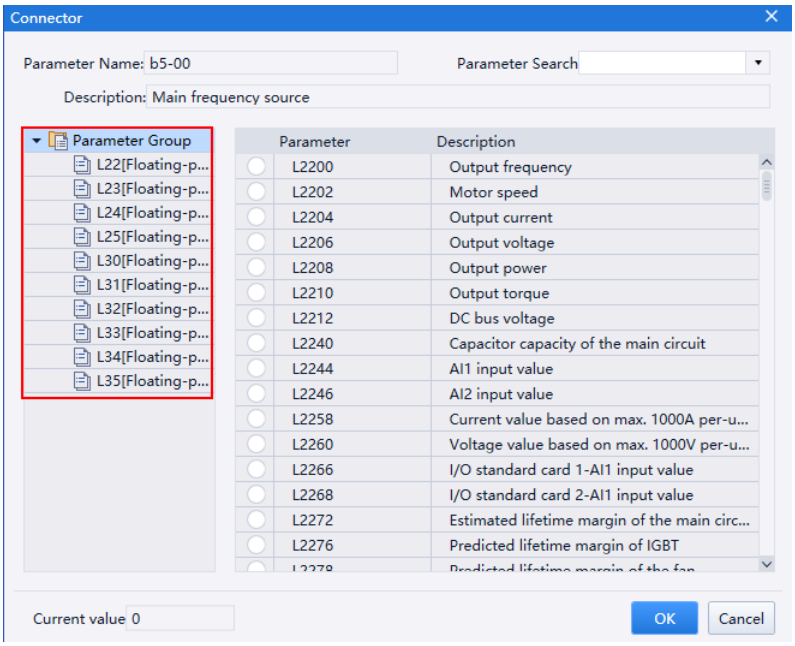
Application instance

Take b5-00 [Main frequency source] as an example to describe how to select the floating-point connector (F connector) as the parameter input.

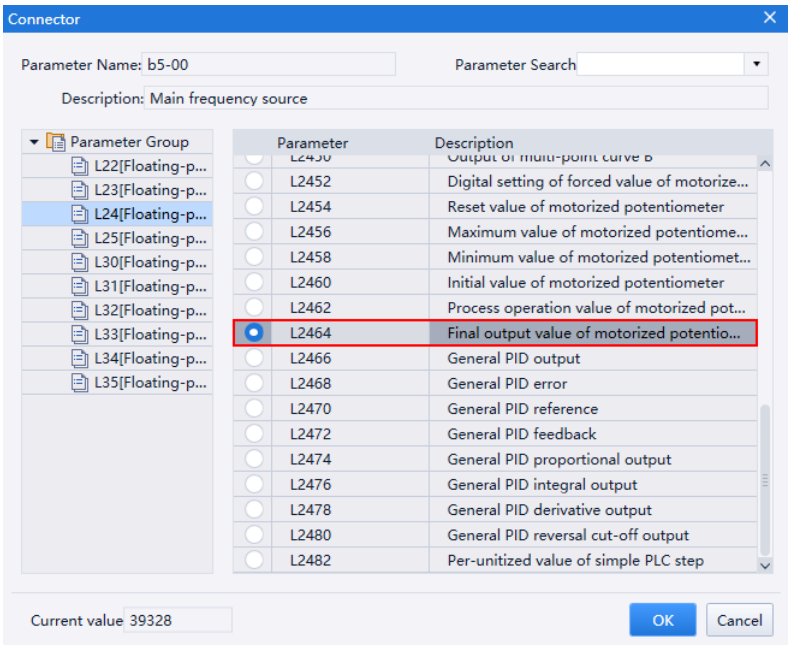
1. Select "Others [F connector]" from the drop-down menu of b5-00 [Main frequency source].



2. After clicking "Others [F connector]", the following dialog box pops up. You can click on the left to select the parameter group of the floating-point connector (F connector).



3. Click the final output value of L2464 motorized potentiometer and click "OK".



4. When the current value of b5-00 [Main frequency source] is "L2464 final output value of the motorized potentiometer", the setting is successful.

Parameter	Description	Current value	Unit	Factory...	Minim...
b5-00	Main frequency source	L2464[Final output value of motorize...	-	0	0
b5-01	Digital setting of main frequency	50.00	Hz	50	0

After the above settings are done, the motorized potentiometer can be used as the main frequency source.

5.7.1.2 Parameter Interconnection

Application scenarios

Parameter interconnection is a flexible way of setting parameters and combining input and output functions. It allows the connection between internal function modules and parameters. It is generally used for complex control scenarios requiring multiple modules and different parameters.

Function description

Parameter interconnection system means that some parameters or modules can read and use other parameters to implement corresponding control functions.

The connector parameter is a display parameter with read-only properties. It displays different states and data of the drive, which can be viewed by the user, or read or used by other parameters through the parameter interconnection. When "Others" is included in the parameter setting option, it indicates that the connector can be selected as the input value. The "Others" option is divided into the following categories:

Item	Description
Others: B connector	The input source is bit connector (B connector). Values are only 0 or 1. The connector value includes a bit of the DI input, DO output, communication word, control word, and status word. Fault status information, etc. It is located in parameter groups L00 to L09.
Others: K connector	You can select the input source word connector (K connector). The connector value includes the control word, communication word, status word, and internal monitoring parameter of the AC drive. It is located in parameter groups L10 to L19 and L20 to L21, where L20 to L21 are double word connectors.
Others: F connector	The input source is the floating-point connector (F connector). The connector value includes the unit value of the AC drive control-related data such as voltage, current, and power. It also contains the standard unit value of the data received through communication and analog measured by the AI/AO hardware. It is located in parameter groups L22 to L25 and L30 to L33.

There are two ways to set the parameter value source as the connector through the parameter interconnection: IFA commissioning software and operating panel settings.

When setting through iFA, set the parameter value to "Others" before selecting the connector parameter in the pop-up box. This setting method allows you to see the selected connector parameters visually, but you need to use a computer-connected device for commissioning.

When setting through the operating panel, set the parameter value directly to the connector number to be selected. This setting method is simple, but you cannot see the meaning of the connector. You need to know the connector definition to set it accurately.

Application example 1: Interconnection of parameters through iFA commissioning software

Set the frequency source as the connector parameter through the iFA commissioning software as follows:

1. As shown in the following figure, open the F0-29 (Main frequency source) drop-down box list, and the last item is the other F connectors.

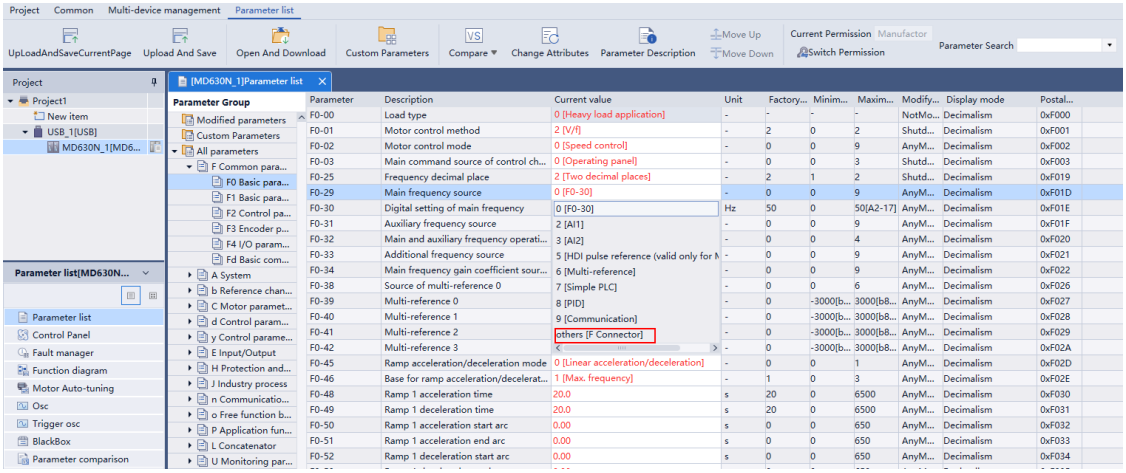


Figure 5-234 Parameter value source setting

2. Click the other F connector options in the drop-down box list. The following figure shows the pop-up selection screen. The upper part displays the parameter information, the left menu displays the connector groups that can be selected, and the right part displays the connector parameters that can be selected in the current connector group.

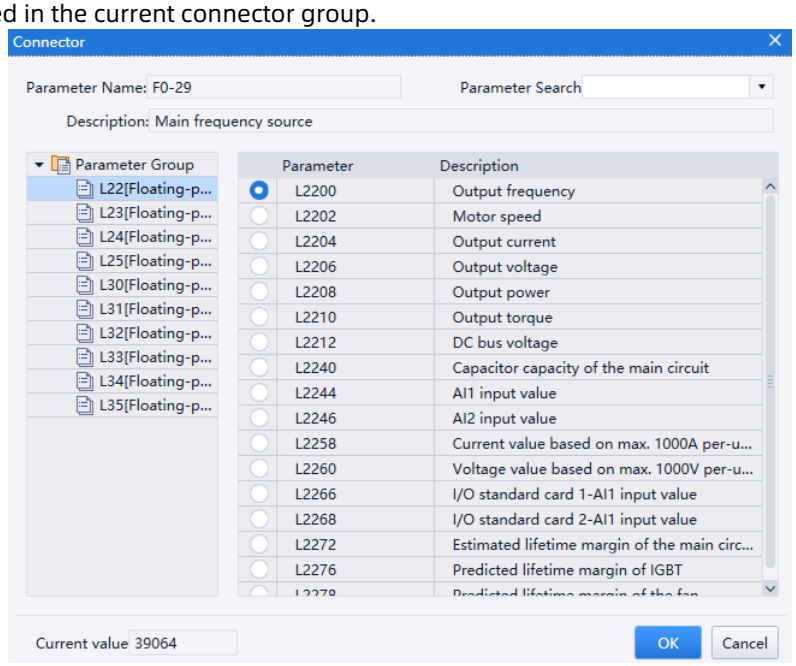


Figure 5-235 Connector selection window

3. Select the connector value to be set. As shown in the following figure, L2352 (Constant setting value 1 (per unit value)) is selected.

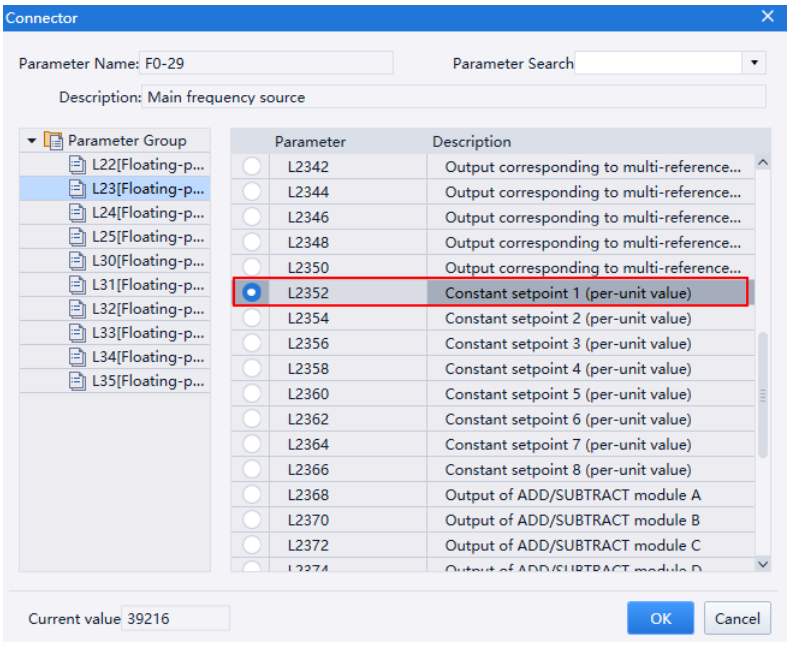


Figure 5-236 Select the floating-point connector

4. Select the connector and click OK to return to the parameter list. Set F0-29 (Main frequency source) to L2352 (Constant setting value 1 (per unit value)). Connector L2352 is the output of the constant value module. In this case, the main frequency of the AC drive can be modified by o1-00 (constant setting value 1).

Parameter	Description	Current value	Unit	Factory...	Minim...
F0-00	Load type	0 [Heavy load application]	-	-	-
F0-01	Motor control method	2 [V/f]	-	2	0
F0-02	Motor control mode	0 [Speed control]	-	0	0
F0-03	Main command source of control ch...	0 [Operating panel]	-	0	0
F0-25	Frequency decimal place	2 [Two decimal places]	-	2	1
F0-29	Main frequency source	L2352[Constant setpoint 1 (per-unit...	-	0	0
F0-30	Digital setting of main frequency	50.00	Hz	50	0

Figure 5-237 Result

Application example 2: Interconnection of parameters through the operating panel

Set the frequency source as the connector parameter through the operating panel as follows:

1. On the operating panel, enter the parameter menu to find F0-29 (Main frequency source).
2. Press the Enter key 

to enter the parameter value setting interface and press 

to change the parameter value.
3. Set the parameter value to connector L2352. Press the confirm key 

to save the parameter value.

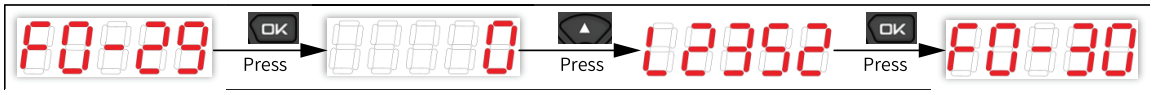


Figure 5-238 The operating panel sets connector parameters

5.7.2 Parameter Access Level

5.7.2.1 Parameter Access Level Introduction

Application scenario

The MD630-INT series supports parameter access permission levels. Different levels allow access to different numbers of parameters. The higher the access level, the more parameters the AC drive can access. You can switch to the corresponding access level for operation and maintenance.

The AC drive is set to the standard access level by default at the factory. At this level, you can access parameters for basic functions, while parameters for extended functions are not accessible. If you need to access parameters for extended functions, the current system parameter access level can be changed to extended level.

The standard access level includes common AC drive parameters, meeting the basic commissioning requirements of the AC drive. For complex and extended function commissioning scenarios, the current system parameter access level can be set to extended level.

Function description

MD630-INT classifies parameters into standard, extended, expert, and manufacturer access levels. The number of parameters that can be viewed varies according to the parameter access level. These correspond to the numbers 0 to 3, with higher numbers indicating higher levels and more accessible parameters.

Higher access levels include all the parameters of lower access levels, meaning that the parameters of lower levels are subsets of those in higher levels. The relationship between parameter access levels from low to high is shown in the following figure.

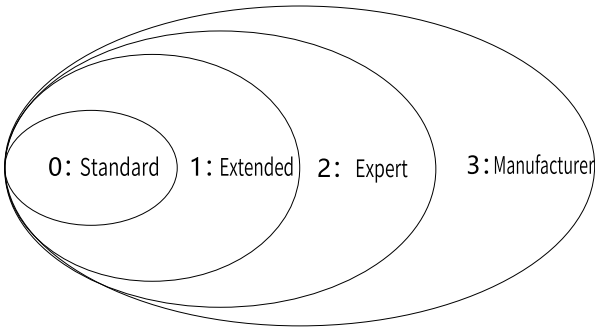


Figure 5-239 Inclusion relationship of parameter access levels from low to high

See the table below for explanations and applicable scopes of different parameter access levels:

Table 5–117 Parameter access level description

Parameter Access Level	Description	Remarks	Applicable scenario
0	Standard	It covers most common functions of the AC drive. If there is no requirement for advanced application functions or complex processes, it is recommended to use the standard level.	The default parameter access level mainly includes the parameters commonly used by the AC drive, meeting the basic function commissioning requirements of the AC drive.
1	Extended	Based on the common functions of the AC drive, extended application functions and complex processes, can be accessed in this level, such as user-defined parameters, VDI, VDO, wobble frequency, free function blocks, etc. If necessary, the extended level is recommended.	In addition to the access to standard parameters, get further access to the extended function parameters of the AC drive to meet the specific function requirements.
2	Expert	In addition to the access to extended function parameters, get further access to complex motor performance commissioning parameters, which must be accessed by password.	You need to use password to access more complex motor performance commissioning parameters, which are only applicable to professional commissioning personnel.
3	Manufacturer	The manufacturer access level is locked by password and includes parameters for Inovance only.	This level includes all parameters and only the manufacturer can access these parameters.

Note

1. The function codes corresponding to the standard and extension levels can meet the commissioning requirements of most scenarios.
2. If you have questions about expert parameters due to motor control effects, contact the manufacturer for technical support.
3. The manufacturer-level function code is not reflected in the manual. The modification needs to be confirmed by the manufacturer after-sales maintenance personnel. The modification is prohibited on site.

Related parameters

Param.	Name	Default	Setting range	Description
A0-10	System parameter access level	0	0: Standard 1: Extended 2: Expert 3: Manufacturer	Displays the parameter level of current system. Value description: 0: Standard - The default parameter access level. You can only access the standard-level parameters. Most common functions of the AC drive are at the standard level, meeting the requirements of most commissioning scenarios. 1: Extended - You can access the standard-level and extended-level parameters. Parameters at the extended level refer to those related to specific function requirements and process requirements. 2: Expert - You can access to the standard-level, extended-level and expert-level parameters. Expert-level parameters require a password for access and are intended for professional commissioning personnel. 3: Manufacturer - Manufacturer-level parameters can be accessed. The manufacturer-level parameters are password-locked and is used for Inovance only.
A0-11	Parameter access level setting	0	0: Standard 1: Extended 2: Expert	Sets the parameter access level. Value description: 0: Standard Standard-level parameters can be accessed. 1: Extended Extended-level parameters can be accessed. 2: Expert Expert-level parameters can be accessed. Note: If the expert password status (A0-14) is locked, you cannot switch directly to expert level.

Param.	Name	Default	Setting range	Description
A0-14	Expert password status	0	0: Invalid (no expert password assigned) 1: Locked (expert password set) 2: Unlocked (expert password set)	This parameter displays the current expert password status. Value description: 0: Invalid (expert password not set) - The expert password is set to 0. That is, no expert password is set. In this case, you can switch to the expert level directly through A0-11. 1: Locked (expert password has been set, locked state) - The expert password is set, and the expert-level parameters are locked. You need to enter the expert password to switch to the expert level through A0-11. 2: Unlocked (expert password has been set, unlocked state) - The expert password has been set and the correct expert password is entered. You can switch to the expert level directly through A0-11. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
A0-15	Expert password input	-	-	This parameter is used to input the expert password. Note: If the data entered through A0-15 is consistent with the expert password set in A0-16, you can unlock the expert-level parameters. This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
A0-16	Expert password setting	-	0 to 65535	This parameter sets the expert password. If this parameter is set to 0, the expert password is invalid. If this parameter is set to a non-zero value, the expert password is valid. Note: If the expert password is set, you need to enter the correct expert password through A0-15 before switching to the expert-level parameter through A0-11. If you enter the password incorrectly, you cannot enter the expert level. This parameter is an expert-level parameter, requiring access level A0-10 or higher in the expert category to display.

5.7.2.2 Parameter Access Level Switchover

The parameter access level of the AC drive is standard by default. You can switch to other parameter access levels when using the AC drive. The parameter access permission of the AC drive is displayed in A0-10 (Current system parameter access level).

The following figure shows how to switch the parameter access level.

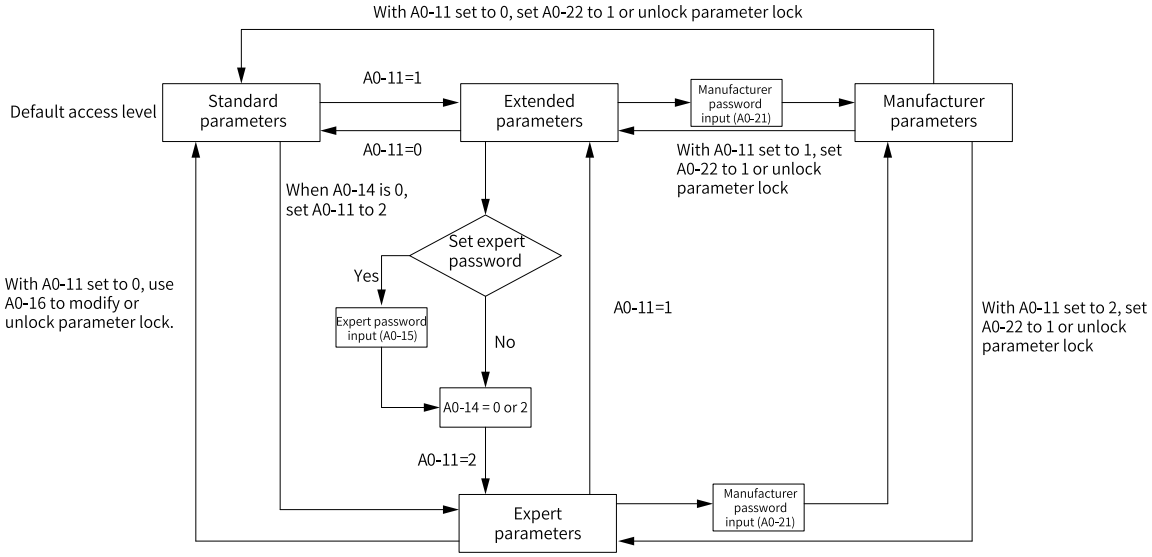


Figure 5-240 Parameter access level

The following rules apply to the switchover of parameter access levels:

1. For standard parameters and extended parameters, change the value of A0-11 directly.
   When A0-11 (Parameter access level setting) = 0 (Standard), the parameter access level is the standard parameter.

   When A0-11 (Parameter access level setting) = 1 (Extended), the parameter access level is the extended parameter.

2. For expert parameters.
   When A0-14 (Expert password status) is set to 0 (Invalid) or 2 (Unlocked), set A0-11 (Parameter access level setting) to 2 to switch directly to expert parameters. In this case, standard parameters, extended parameters, and expert parameters can be switched freely.

   When A0-14 (Expert password status) = 1: Locked (expert password set), set A0-11 (Parameter access level setting) to 1 (Extended). Switch to the extended parameter first and enter the expert password set in A0-15 (Expert password input). After unlocking, A0-14 (Expert password status) = 2 (Unlocked). In this case, set A0-11 (Parameter access level setting) to 2 (Expert) to switch to expert parameters.

3. There are three ways to exit from expert parameters:
   Method 1: Change the expert password in A0-16 (Expert password setting).

   Method 2: Set A0-11 (Parameter access level setting) to 0 (Standard) or 1 (Extended) to switch to standard or extended parameters.

   Method 3: The expert password is set to 0 by default. After the expert password is set to take effect, enter the expert parameter and wait for the unlock time of the expert password to reach 1 hour. Then automatic exit of expert parameters.

Switch from standard to extended parameters

1. By default, check that A0-10 (System parameter access level) is 0 (standard).
2. Modify A0-11 (Parameter access level setting) = 1 (Extended).

3. Check that A0-10 (System parameter access level) is 1 (Extended), indicating that the parameter has been switched from standard to extended.

Switch from standard parameters to expert parameters

- If A0-14 (Expert password status) = 0: Invalid (no expert password assigned) or 2: Unlocked (expert password set)
  Set A0-11 (Parameter access level setting) to 2 (Expert) to switch directly to expert parameters.
- If A0-14 (Expert password status) = 1: Locked (expert password set)
  1. Set A0-11 (Parameter access level setting) to 1 (Extended). Switch to the extended parameter first.
  2. Enter the set expert password in A0-15 (Expert password input). After unlocking, A0-14 (Expert password status) = 2: Unlocked (expert password set).
  3. Set A0-11 (Parameter access level setting) to 2 (Expert) to switch from standard to expert parameters.

5.7.3 Parameter Protection

5.7.3.1 Parameter Lock

5.7.3.1.1 Parameter Introduction

Application Scenario

This product provides parameter lock function. All parameters of the AC drive can be locked after commissioning is completed. In the locked state, all parameters are not allowed to be viewed or copied/downloaded. You can only view the monitoring parameters on the Monitoring page in the operating panel and user-defined parameter groups in the user menu.

If you do not want other unauthorized personnel to view the parameters of the AC drive after on-site commissioning, you can use this function to lock the parameters.

Description

The parameter lock function is turned off by default. If you need to enable the parameter lock function, it is recommended to turn on the parameter lock after all commissioning of the AC drive is completed to prevent frequent unlocking of the parameter lock during commissioning.

The parameter lock function can be used together with the user-defined parameter group. That is, the user-defined parameter group can be used as a group of interface parameters. The interface parameter is put into some monitoring parameters or non-critical debugging parameters. Enables simple monitoring and commissioning in the locked state of parameter lock.

After setting the parameter lock password, only users who know the password can modify the parameters.

The parameter lock is set as follows:

- By default, the parameter lock is invalid. All users can modify the parameters. Set the parameter lock password through A0-31 to enable the parameter lock and the AC drive parameter menu is locked immediately.
- After the parameter menu is locked, it can be unlocked only by entering the correct password. After unlocking, the value of A0-30 (Parameter lock status) is 2 (Parameter lock unlocked). Parameters can be modified normally. The parameter menu is automatically locked after the time set by A0-32 (Unlock effective time of parameter lock) is reached.
- After setting the parameter lock password, you can set A0-33 (Lock parameter lock) to 1 (Lock) to activate the parameter lock function, in addition to waiting for the time set by A0-32.
- When A0-30 (Parameter lock status) is set to 0 (Parameter lock inactive), setting A0-33 (Lock parameter lock) or A0-32 (Unlock effective time of parameter lock) is invalid, and the parameter lock will not be activated.

Related parameters:

Parameter Code	Name	Default	Value Range	Descriptions
A0-30	Parameter lock status	0	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	This parameter displays the parameter lock status. Value description 0: Parameter lock inactive (parameter lock not set) Parameter lock is set to 0, that is, parameter lock is not set. The parameter lock is inactive. 1: Parameter lock locked (parameter lock set) Parameter lock is set, and the parameter lock is in the locked state. You need to enter the correct parameter lock to unlock it. 2: Parameter lock unlocked (parameter lock set) The parameter lock is set, and the correct parameter lock is entered. The parameter lock is unlocked. Additional information: 1 .1. If the value of A0-31 is non-zero, the parameter lock takes effect. 2 .2. When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.
A0-31	Parameter lock setting	-	0 to 65535	This parameter sets the parameter lock. If the parameter lock is set to 0, the parameter lock is inactive. If the parameter lock is set to a value other than 0, the parameter lock is active. Additional information: 1 .1. If the value of A0-31 is non-zero, the parameter lock takes effect. 2 .2. When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.

Parameter Code	Name	Default	Value Range	Descriptions
A0-32	Unlock effective time of parameter lock	3600	60 to 65535s	Set the duration for parameter lock unlock, that is, after the parameter lock is activated and the correct password is entered, the timer starts. After the set time is reached, The parameter lock is automatically locked. Additional information: 1 .1. The parameter lock is valid when A0-31 is not 0. 2 .The parameter lock is automatically locked after the unlock time exceeds the effective time. You need to enter the correct parameter lock again to unlock the parameter.
A0-33	Lock parameter lock	0	0: No operation 1: Lock	This parameter sets whether to lock the parameter lock manually. Value description 0: No operation. Disable this function. 1: Enable - The parameter lock is locked. Additional information: 1 .1. The parameter lock is valid when A0-31 is not 0. 2 .2. After A0-33 is set to 1, you do not need to wait for the time set by A0-32, and the parameter lock is locked immediately. You need to enter the correct parameter lock again to unlock the parameter. 3 .3. Automatic clearing is performed after parameter lock is locked.

Notes

If the parameter lock function needs to be enabled, remember the parameter lock password. Otherwise, the AC drive will be locked and the parameter cannot be viewed again.

5.7.3.1.2 Setting the Password for Locking Parameters

It is recommended to set a parameter lock password after all parameters of the AC drive are commissioned and all parameters are basically fixed to prevent the parameter lock from being unlocked frequently during commissioning.

The steps for setting the parameter lock are as follows:

1. Check that the basic commissioning of the AC drive is complete.
2. Check that A0-30 (Parameter lock state) is set to 0 (Parameter lock invalid (parameter lock not set)).
3. Record the password to be set and enter A0-31 (Parameter lock setting).

The parameter lock becomes effective after the preceding steps are set. After the function is enabled, you are prompted to enter a password when you access the function code. That is:

When accessing function codes via the operation panel, enter the base mode or -C- (user modification) mode in the QUICK menu, and then enter the password. When accessing function codes via the iFA background, enter the parameter list and enter the password.

5.7.3.1.3 Accessing user-defined parameter groups

The user-defined parameter groups (AE-00 to AE-31) and AC drive fault information are not affected by the parameter lock and can be accessed even if a parameter lock is set.

The parameter lock is generally used in combination with the user-defined parameter group.

Prerequisites

The AC drive has been commissioned and is ready to enter the stable running phase.

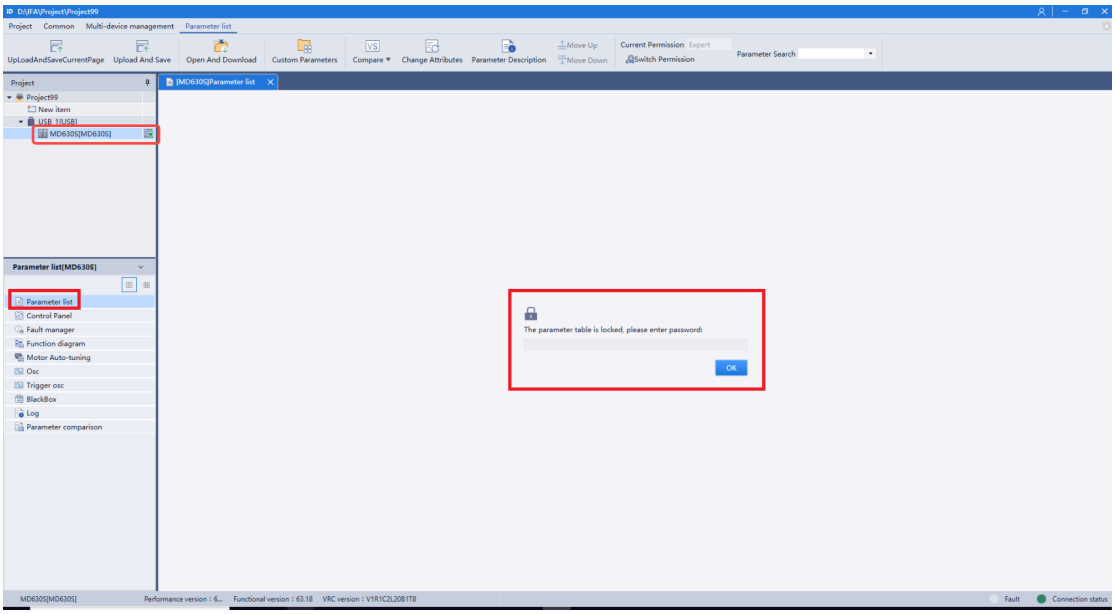
Operating procedure

1. Map common user parameters and user-defined parameter groups (AE-00 to AE-31).
   Use the operating panel to open group AE function code. AE-00 (User function code 0) is filled in uF0.30, AE-01 (User function code 1) is filled in uF0.48, and AE-02 (User function code 2) is filled in uF0.49. Enter uF0.49 for AE-03 (User function code 3), uU0.26 for AE-04 (User function code 4), and uU0.61 for AE-05 (User function code 5) to set F0-30 (Main frequency digital setting). F0-48 (ramp 1 acceleration time), F0-49 (ramp 1 deceleration time), U0-26 (current running time), and U0-61 (drive state 1) are mapped to group AE. For details, see "User-defined Parameter Groups".
2. Check that A0-30 (Parameter lock state) is set to 0 (Parameter lock invalid (parameter lock not set)).
3. Adjust A0-32 (Parameter lock unlock holding time).
4. Write the password in A0-31 (Parameter lock setting) and remember the password. Function code parameters (other than user-defined parameter groups) cannot be accessed normally after the password is entered.
5. Switch the operating panel to the user mode in the QUICK menu. You can access F0-30 (main frequency digital setting), F0-48 (ramp 1 acceleration time), F0-49 (ramp 1 deceleration time), U0-26 (current running time), and U0-61 (AC drive state 1) through user-defined parameter groups when the parameter lock is locked.

5.7.3.1.4 Unlock Parameters

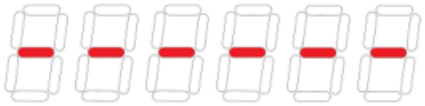
The parameters cannot be accessed in the locked state. You need to unlock the parameters first. The steps for unlocking the parameters are as follows:

- For the iFA commissioning software, click the Parameter List button. Enter the parameter lock password in the pop-up dialog box and click OK to unlock it.



- For the operating panel, switch to the base mode or the -C-(user-modified) mode in the QUICK menu of the operating panel. In the displayed "----", enter the parameter lock password and click 

to unlock.



5.7.3.1.5 Modifying the Parameter Lock Password

When the parameter lock is unlocked, enter a different password in A0-31 (Parameter lock setting) to modify the password.

> ***Note***
> The parameter lock is automatically locked after the password is modified.

5.7.3.1.6 Disable Parameter Lock

1. In the parameter lock unlock state, enter 0 in A0-31 (Parameter lock setting).
2. Check that A0-30 (Parameter lock status) is 0 (Parameter lock inactive (parameter lock not set)), and the parameter lock function is canceled.
   After cancellation, access to parameters is not restricted by the parameter lock.

5.7.3.1.7 Re-lock

Scenarios

- The AC drive needs to be commissioned again (the user-defined parameter group cannot meet the commissioning requirements).
- Batch copy of AC drive parameters is required.

Operation steps:

1. Check that commissioning/copying is completed.
2. Set A0-33 to 1 to lock the parameter immediately.

The parameter lock becomes effective after the preceding steps are set. After the function is enabled, you are prompted to enter a password when accessing parameters. Which is to say:

For the operating panel, you need to enter the password to access the parameters in the base mode or -C (user-changed) mode in the QUICK menu. For the iFA software, when entering the parameter list, you need to enter the password.

5.7.3.1.8 Designated Unlocked Functions

After the parameter lock is enabled, the following functions are not affected.

For operating panel:

1. Monitor display
2. All keys on the operating panel
3. User mode display in QUICK menu
4. Err fault menu display

For iFA commissioning software:

1. Oscilloscope
2. Control panel
3. Fault management
4. Function diagram

5.7.3.2 Parameter-write Protection

Scenarios

When this function is enabled, the AC drive parameters cannot be modified except for a few parameters that can be modified internally. This is to prevent the commissioning parameters to be modified incorrectly.

Description

Set the parameter write protection function through A0-44. When A0-44 (Parameter write protection) = 1 (Enable), the parameter write protection function takes effect, and the AC drive parameters cannot be modified except for a few parameters that can be modified internally.

Parameters that can be modified after write protection is enabled are as follows:

Param.	Parameter Name	Description
A0-44	Parameter write protection	Sets whether to enable parameter write protection.
A0-11	Parameter access level setting	Sets the parameter access level. Value description 0: Standard Standard-level parameters can be accessed. 1: Expansion Expansion-level parameters can be accessed. 2: Expert Expert-level parameters can be accessed. Additional information: If the expert password status (A0-14) is locked, you cannot switch directly to expert level.
A0-15	Expert password input	This parameter is used to input the expert password. Additional information: If the data entered through A0-15 is consistent with the expert password set in A0-16, you can unlock the expert-level parameter.
A0-21	Factory password input	This parameter indicates the manufacturer password input window which is used to enter the manufacturer password. Note: After the correct manufacturer password is entered through A0-21, the manufacturer password is unlocked and the system automatically switches to the manufacturer level. A0-10 displays the manufacturer.

Param.	Parameter Name	Description
A0-22	Exit manufacturer level	Used to exit manufacturer level. Value description 0: No operation No operation is performed. 1： Exit - Exit the manufacturer level and switch to the level set by A0-11. Additional information: Automatic clearing is performed after the manufacturer level is exited.
A0-33	Lock parameter lock	This parameter sets whether to lock the parameter lock manually. Value description 0: No operation No operation is performed. 1: Lock The the parameter lock is locked. Additional information: 1. The parameter lock is valid when A0-31 is not 0. 2. After A0-33 is set to 1, you do not need to wait for the time set by A0-32, and the parameter lock is locked immediately. You need to enter the correct parameter lock again to unlock the parameter. 3. Automatic clearing is performed after parameter lock is locked.

Different from the parameter lock function, the parameter protection function allows users to view parameter menu and modify the parameter access level to check AC drive parameters if the function is enabled.

Related parameters

Param.	Parameter Name	De fault	Value Range	Descriptions
A0-44	Parameter write protection	0	0: Disable 1: Enable	Used to set whether the write protection of the drive parameters is enabled. After the parameter-write protection is enabled, the drive parameters are not allowed to be changed. 0： Disable - Parameter-write protection is disabled. 1： Enable - Parameter-write protection is enabled. The drive parameters are not allowed to be changed. Note： A0-11, A0-15, A0-33, and A3-00 drive models are not controlled by A0-44.

5.7.4 Restore Parameters to Default Settings

In A0-00 (Parameter initialization), you can restore the specified parameter values to the default settings by selecting the required action. After the operation is completed, A0-00 (parameter initialization) is automatically reset to 0 (no operation).

5.7.4.1 Restore Factory Parameters Except for Motor Parameters

Application

This function applies to the scenario where the parameter initialization is required while the motor parameters have been set and do not need to be reset.

Description

Set A0-00 (Parameter initialization) to 1 to restore parameters (excluding motor parameters) to default settings.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

5.7.4.2 Restoring Factory Parameters (Including Motor Parameters)

Application scenarios

It is applicable when the motor parameters are not set or if you want the motor parameters to be reset and the parameters to be initialized.

Function description

Set A0-00 (Parameter initialization) to 3 (Restore factory parameters (including motor parameters)) to restore the AC drive parameters to factory values, including motor parameters.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

5.7.4.3 Back up current user parameters

Application Scenario

It is applicable to situations where you want to back up the parameters set to local storage.

Description

Set A0-00 to 4 (Back up the current user parameters) to back up the user-defined parameter settings that are different from the default parameter settings.

> ***Note***
> Same as A0-39 (User backup) when it is set to 400.

5.7.4.4 Restore user backup parameters

Application Scenario

It is applicable to situations where you want to restore the backed-up parameters from the local device.

Description

Set A0-00 to 501 (Restore user backup parameters) to restore the parameters backed up by setting A0-00 to 4.

> ***Note***
> Same as A0-38 (Backup parameter restore) when it is set to 500.

5.7.4.5 Clear Records

Function description

Set A0-00 (parameter initialization) to 2 (clear record information) to clear the recorded parameters.

> ***Note***
> - The parameters Ad-00 to Ad-17 are record parameters.
> - The parameters in groups H6 to Hb of historical fault records are record parameters.
> - P1-05 to P1-07 are record parameters in the simple PLC function.

5.7.4.6 Clear Issue Information

Function description

Parameter A0-00 (parameter initialization) can be set to 5 (clear issue information to clear the historical issue information in groups H6 to Hb.

5.7.4.7 Restoring Factory Parameters (Including Motor Parameters) and Clearing the Records

Application scenarios

It is applicable when motor parameters are not set, or if you want the motor parameters to be reset, and the recorded parameters are cleared and parameters are initialized.

Function description

Set A0-00 (Parameter initialization) to 503 (Restore factory parameters (including motor parameters) and clear the recorded information) to restore the AC drive parameters to factory values, including motor parameters, and clear the recorded parameters.

Note

The parameters related to the model are restored to the default values of the model instead of the factory values.

5.7.5 User-defined Parameters

5.7.5.1 User-defined parameters

Application Scenario

Users classify common parameters dispersed in different function code groups into a user-defined parameter group for easy access and debugging.

Description

Group AE consists of user-defined parameters (AE-00 to AE-31). Users can define up to 32 commonly used parameters for easier check and modification. Only fill in the addresses of commonly used parameters in the user-defined parameter group. Accessing and modifying user-defined parameter groups is the same as accessing and modifying commonly used parameters distributed among different function code groups. The two form a mapping relationship.

As shown in the following figure, common parameters that are more dispersed can be grouped into user-defined parameter groups for unified management.

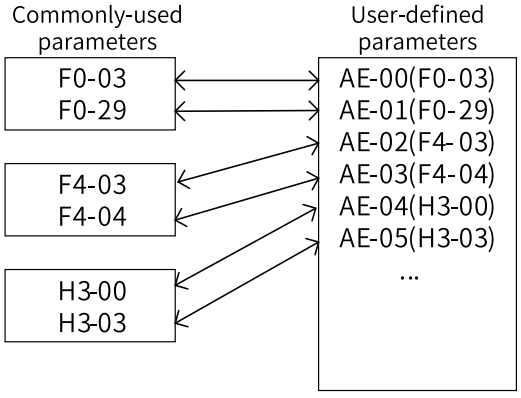


Figure 5-241 **Application example 3: Configure the mapping relationship between common parameters and user-defined parameter groups through communication**

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-72	Parameter display setting	111	Ones position: 0: Hide user mode 1: Show user mode Tens: 0: Hide calibration mode 1: Show calibration mode Hundreds: 0: Hide error menu 1: Display error menu	This parameter is used to determine whether the user-defined parameter group, user-modified parameter group, and error menu are displayed on the operating panel through the ones, tens, and hundreds places.
AE-00	User-defined parameter 0	F0-00	0x0000 to 0xFFFF	User-defined parameters A total of 32 user-defined parameters can be set through AE-00 and AE-31. Additional information: This group of parameters is user-defined. You can select required parameters from all parameters and summarize them into the AE group for ease of viewing and modification. To view user-defined parameters, long-press the Back key to switch to the -USER menu.
AE-01	User-defined parameter 1	Same as AE-00	Same as AE-00	Same as AE-00
AE-02	User-defined parameter 2	Same as AE-00	Same as AE-00	Same as AE-00
AE-03	User-defined parameter 3	Same as AE-00	Same as AE-00	Same as AE-00
AE-04	User-defined parameter 4	Same as AE-00	Same as AE-00	Same as AE-00
AE-05	User-defined parameter 5	Same as AE-00	Same as AE-00	Same as AE-00
AE-06	User-defined parameter 6	Same as AE-00	Same as AE-00	Same as AE-00
AE-07	User-defined parameter 7	Same as AE-00	Same as AE-00	Same as AE-00
AE-08	User-defined parameter 8	Same as AE-00	Same as AE-00	Same as AE-00
AE-09	User-defined parameter 9	Same as AE-00	Same as AE-00	Same as AE-00
AE-10	User-defined parameter 10	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default	Value Range	Descriptions
AE-11	User-defined parameter 11	Same as AE-00	Same as AE-00	Same as AE-00
AE-12	User-defined parameter 12	Same as AE-00	Same as AE-00	Same as AE-00
AE-13	User-defined parameter 13	Same as AE-00	Same as AE-00	Same as AE-00
AE-14	User-defined parameter 14	Same as AE-00	Same as AE-00	Same as AE-00
AE-15	User-defined parameter 15	Same as AE-00	Same as AE-00	Same as AE-00
AE-16	User-defined parameter 16	Same as AE-00	Same as AE-00	Same as AE-00
AE-17	User-defined parameter 17	Same as AE-00	Same as AE-00	Same as AE-00
AE-18	User-defined parameter 18	Same as AE-00	Same as AE-00	Same as AE-00
AE-19	User-defined parameter 19	Same as AE-00	Same as AE-00	Same as AE-00
AE-20	User-defined parameter 20	Same as AE-00	Same as AE-00	Same as AE-00
AE-21	User-defined parameter 21	Same as AE-00	Same as AE-00	Same as AE-00
AE-22	User-defined parameter 22	Same as AE-00	Same as AE-00	Same as AE-00
AE-23	User-defined parameter 23	Same as AE-00	Same as AE-00	Same as AE-00
AE-24	User-defined parameter 24	Same as AE-00	Same as AE-00	Same as AE-00
AE-25	User-defined parameter 25	Same as AE-00	Same as AE-00	Same as AE-00
AE-26	User-defined parameter 26	Same as AE-00	Same as AE-00	Same as AE-00
AE-27	User-defined parameter 27	Same as AE-00	Same as AE-00	Same as AE-00
AE-28	User-defined parameter 28	Same as AE-00	Same as AE-00	Same as AE-00
AE-29	User-defined parameter 29	Same as AE-00	Same as AE-00	Same as AE-00
AE-30	User-defined parameter 30	Same as AE-00	Same as AE-00	Same as AE-00
AE-31	User-defined parameter 31	Same as AE-00	Same as AE-00	Same as AE-00

5.7.5.2 Address Mapping

The parameter addresses of group AE are 0x2F00 to 0X2F1F, which are used to establish the mapping relationship. Write the address that needs to be mapped to 0x2F00 to 0X2F1F,and then the mapping is completed. 0xAE00 to 0xAE1F are addresses for users to access. They are used for users to access the commonly-used parameters after the mapping relationship is established. Reading

and writing to these addresses is equivalent to reading and writing the mapped user-commonly-used parameters.

Table 5–118 Parameter group AE

Param.	Name	Parameter Address (Used for establish mapping)	Parameter Address (For Users to access)
AE-00	User-defined parameter 0	0x2F00	0xAE00
AE-01	User-defined parameter 1	0x2F01	0xAE01
AE-02	User-defined parameter 2	0x2F02	0xAE02
AE-03	User-defined parameter 3	0x2F03	0xAE03
AE-04	User-defined parameter 4	0x2F04	0xAE04
AE-05	User-defined parameter 5	0x2F05	0xAE05
AE-06	User-defined parameter 6	0x2F06	0xAE06
AE-07	User-defined parameter 7	0x2F07	0xAE07
AE-08	User-defined parameter 8	0x2F08	0xAE08
AE-09	User-defined parameter 9	0x2F09	0xAE09
AE-10	User-defined parameter 10	0x2F0A	0xAE0A
AE-11	User-defined parameter 11	0x2F0B	0xAE0B
AE-12	User-defined parameter 12	0x2F0C	0xAE0C
AE-13	User-defined parameter 13	0x2F0D	0xAE0D
AE-14	User-defined parameter 14	0x2F0E	0xAE0E
AE-15	User-defined parameter 15	0x2F0F	0xAE0F
AE-16	User-defined parameter 16	0x2F10	0xAE10
AE-17	User-defined parameter 17	0x2F11	0xAE11
AE-18	User-defined parameter 18	0x2F12	0xAE12
AE-19	User-defined parameter 19	0x2F13	0xAE13
AE-20	User-defined parameter 20	0x2F14	0xAE14
AE-21	User-defined parameter 21	0x2F15	0xAE15
AE-22	User-defined parameter 22	0x2F16	0xAE16
AE-23	User-defined parameter 23	0x2F17	0xAE17
AE-24	User-defined parameter 24	0x2F18	0xAE18
AE-25	User-defined parameter 25	0x2F19	0xAE19
AE-26	User-defined parameter 26	0x2F1A	0xAE1A
AE-27	User-defined parameter 27	0x2F1B	0xAE1B

Param.	Name	Parameter Address (Used for establish mapping)	Parameter Address (For Users to access)
AE-28	User-defined parameter 28	0x2F1C	0xAE1C
AE-29	User-defined parameter 29	0x2F1D	0xAE1D
AE-30	User-defined parameter 30	0x2F1E	0xAE1E
AE-31	User-defined parameter 31	0x2F1F	0xAE1F

5.7.5.3 Create Mapping Relationship

Enter the addresses of commonly used parameters into the parameter group AE (AE-00 to AE-31) to complete the mapping relationship. The default values of AE-00 to AE-31 are 0xF000, indicating that no parameters are mapped.

The mapping relationship can be established through the operating panel, iFA commissioning software, and communication.

You can directly modify the parameters AE-00 to AE-31 using the operating panel or the iFA commissioning software. To set up the mapping relationship, simply enter the corresponding parameter address in the range AE-00 to AE-31.To establish the mapping through communication, write the parameter address to be mapped in group AE.

After the mapping relationship is established, reading and writing to the addresses 0xAE00 to 0xAE1F through communication is equivalent to reading and writing to the addresses of the commonly used parameters in different parameter groups.

Application example 1: Configure the mapping relationship between common parameters and user-defined parameter groups through the operating panel

Set the mapping relationship between AE-00 (User-defined parameter 0) and F0-03 (Command source of control channel 1) through the operating panel:

1. Locate the AE group parameters of the secondary menu on the operating panel. For details, see section *6.1 Operating Panel*.
2. After finding AE-00, press OK to enter the AE-00 mapping configuration. uF0.00 is displayed by default.
3. Continue to press ▲ to adjust the mapping parameters. Press ▲ three consecutive times to adjust to uF0.03.
4. Press OK to complete the mapping. The operating panel displays AE-01

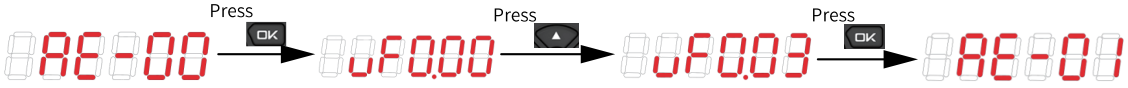
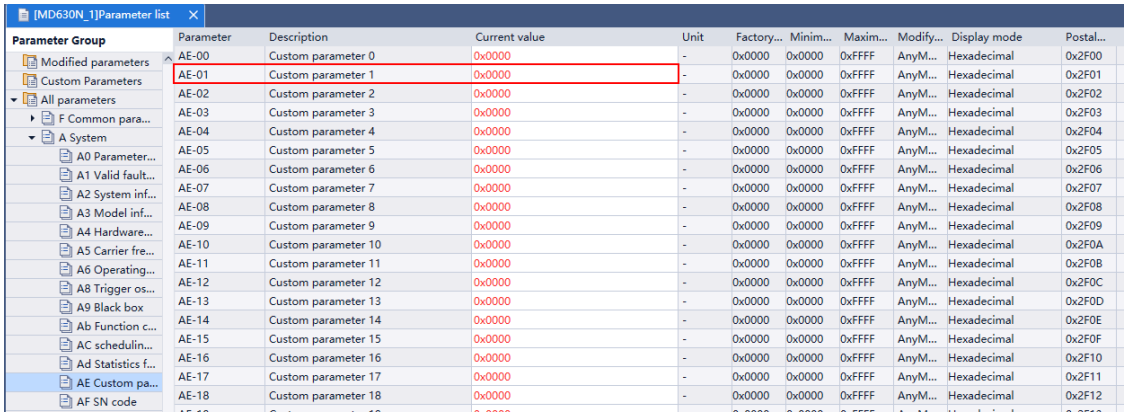


Figure 5-242 Set the mapping relationship through the operating panel

Application example 2: Configure the mapping relationship between common parameters and user-defined parameter groups through the iFA software

Set the mapping relationship between AE-01 (User-defined parameter 1) and F0-29 (Main frequency source) through the iFA:

1. Locate the AE parameter group and find the AE-01.



2. Input 0xf01D in AE-01 and press Enter. Then the mapping is established.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
AE-00	Custom parameter 0	0x0000	-	0x0000	0x0000	0xFFFF
AE-01	Custom parameter 1	0xF01D	-	0x0000	0x0000	0xFFFF
AE-02	Custom parameter 2	0x0000	-	0x0000	0x0000	0xFFFF
AE-03	Custom parameter 3	0x0000	-	0x0000	0x0000	0xFFFF

Figure 5-243 Set the mapping relationship through iFA

Application example 3: Configure the mapping relationship between common parameters and user-defined parameter groups through communication

Set the mapping relationship between AE-02 (User-defined parameter 2) and F4-03 (DI1 function selection) through communication:

1. Write 0xF403 (Address of F4-03) to 0x2F02 (Address of AE-02) to establish the mapping relationship.
2. Read the address 0xAE-02 (user parameter access address of AE-02), that is, read the value of F4-03.
3. Write 2 to 0xAE02 (user parameter access address of AE-02), which is to write 2 to F4-03.

Notes

These user-defined parameters are displayed differently on the operating panel and the commissioning software. The operating panel displays the selected parameter name and the commissioning software displays the corresponding communication address.

For example, when the operating panel displays AE-00 (user-defined parameter 0) = uF0.03, the user-defined parameter 0 is F0-03 (Command source of control channel 1). The value of AE-00 in the commissioning software is 0xF003, which is the communication address of F0-03 (Command source of control channel 1).

5.7.5.4 QUICK Menu

The QUICK menu on the operating panel contains four modes: Base mode, user-defined mode (User mode), user-modified mode (-C– mode), and fault mode (-Err– mode).

- Base mode: Displays all parameters of F0, F1....A0...
- User-defined (user) mode: Displays parameters mapped by group AE (that is, parameters commonly used by users), such as F0-03, F0-29, F0-29, F4-03 parameters. In this mode, you can view and modify the values of commonly-used parameters through mapping parameters.
- User-modified mode (-C– mode): Displays the modified parameters, that is, the parameters that are different from the default value.
- Fault mode (-Err– mode): Displays current AC drive fault information.

The following figure shows the switchover of the four modes.

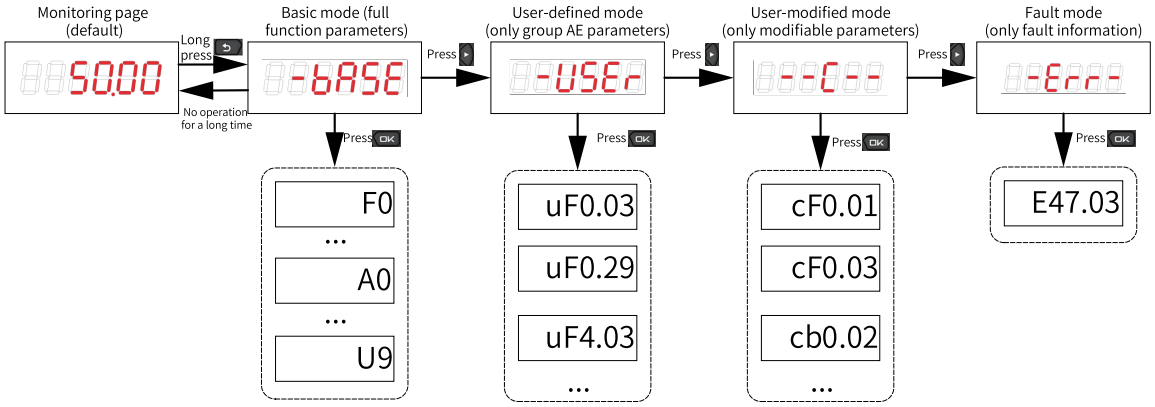


Figure 5-244 Diagram of the mode switchover on QUICK menu

Application example: Modifying user commonly-used parameters after mapping in user mode

You can view and set the values of commonly-used parameters after mapping through the user mode in the QUICK menu on the operating panel. As shown in the following figure, enter the user mode from the default monitoring page. In the user mode, you can access and set the commonly-used parameters after mapping.

Conditions

The mapping between AE-00 and F0-03 as well as AE-01 and F0-29 are established.

Operation steps:

1. On the default monitoring page, long press  to enter the QUICK menu.
2. After entering the QUCIK menu, the base mode is the default. Press  to select the user mode.
3. When the operating panel displays "-user", press  to enter the user mode, and you can see the parameter of the first group AE mapping, uF0.03 (F0-03).
4. Continue to press  to select the second AE group mapped parameter uF0.29 (F0-29).
5. When uF0.29 is displayed, press  to access the current value of F0-29.

6. Continue to press ▼ to modify the value of F0-29.

7. Press OK to save the value of F0-29.

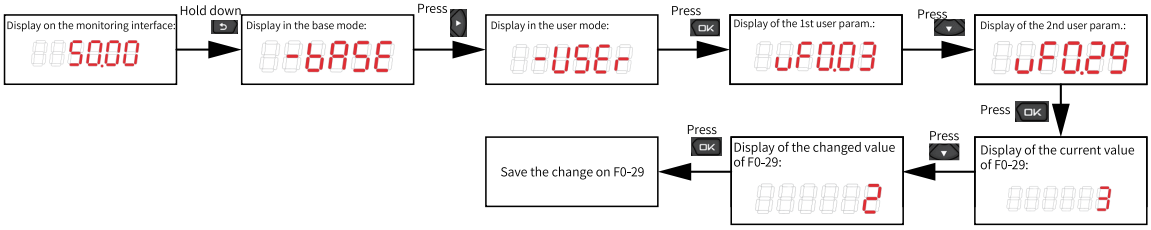


Figure 5-245 Example of entering the user mode

The default values of AE-00 to AE-31 are 0xF000 (uF0.00 is displayed on the operating panel). In this case, only F0-00 is displayed in the user mode.

5.7.6 Black Box

The MD630-INT series products are equipped with the built-in black box function. The black box is mainly used for recording important internal data when special events are triggered. This function is enabled by default, and starts automatically upon power-on.

Application

You can maintain the AC drive through the data recorded in the black box, but the data analysis of the black box requires professional commissioning personnel.

Function Description

The black box supports automatic triggering of fault and user-defined triggering, either of which will trigger the black box recording. The logged data is stored on MD630-INT's own flash, which stores up to 20 data sets that have occurred recently. Each set can contain up to 6 configurable-period data, 16 fixed-period data, and corresponding event information. After more than 20 sets of data, the oldest triggered data is automatically overwritten. The configurable-period can be a carrier cycle or 0.5 ms cycle, and configured through the parameter A9-15 [Data sampling cycle of configurable-period 1 to 6 channel], while the fixed-period data acquisition period is a 2 ms cycle.

By default, the black box is triggered by any fault, and the trigger condition can be selected through A9-66.

Automatic fault trigger condition: When the AC drive enters to the fault state, black box record will be triggered once automatically.

User-defined triggering: You can define a black box triggering condition through a custom logical combination. When the set condition is met, the black box record is triggered once.

The parameters related to black box trigger is shown in the following table. The user-defined trigger condition A and B have the same function. Take the user-defined trigger condition A as an example.

5.7.7 Clear Records

5.7.7.1 Fault Log Clear

Scenarios

The parameter groups H6 to Hb of the AC drive are used to store fault record information. After the fault is reset, the fault record can be cleared through the fault record clearing function.

Description

Set A0-00 (Parameter initialization) to 5 (Clear fault information) and perform parameter initialization to clear the fault information recorded by groups H6 to Hb of the AC drive.

You can also set A0-00 (Parameter initialization) to 2 (Clear log information) to clear the fault records. However, this method also clears all the records of the AC drive, such as the cumulative running time, cumulative power-on time, and cumulative power consumption. It is not recommended to clear fault records.

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-00	Parameters Initialization	0	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records	0: No operation 1: AC drive parameters except factory parameters, motor parameters, and records are restored to default settings. 2: Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared. 3: AC drive parameters except factory parameters and records are restored to default settings. 4: The current parameter values are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear the fault information recorded in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 is set to 500. 503: AC drive parameters except factory parameters are restored to default settings and records are cleared. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time. Note: After the parameter operation is done, this parameter is automatically restored to 0.

5.7.7.2 Record Clearance

Scenarios

Records such as accumulative running time and accumulative power consumption cannot be reset automatically after the AC drive is powered on again. You can clear the records by clearing the records and start the statistics again.

Description

When A0-00 is set to 2, fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared.

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-00	Parameters Initialization	0	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records	0: No operation 1: AC drive parameters except factory parameters, motor parameters, and records are restored to default settings. 2: Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared. 3: AC drive parameters except factory parameters and records are restored to default settings. 4: The current parameter values are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear the fault information recorded in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 is set to 500. 503: AC drive parameters except factory parameters are restored to default settings and records are cleared. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time. Note: After the parameter operation is done, this parameter is automatically restored to 0.

5.7.8 Modified Parameter List

Scenarios

When different groups of parameters are modified during function commissioning, and you need to adjust the modified parameters again, you can quickly find the modified parameters through the modified parameter list to improve the commissioning efficiency.

If any parameter is modified by misoperation you can also quickly locate it through the modified parameter list to restore the modified parameter.

Function description

The modified parameter list is used to summarize the modified parameters in different groups to the same menu level for easy search and commissioning. You can access the modified parameter list through the operating panel or the iFA commissioning software.

Application example 1: Access the modified parameter list through the operating panel

You can view the modified parameter list through the user-modified in the QUICK menu on the operating panel. For details on the operating panel, see *" Commissioning Tool List" on page 103*. For details on the QUICK menu, see *"5.7.5.1 User-defined parameters" on page 825*.

The basic steps for accessing the modified parameter list through the operating panel are shown in the following figure.

1. Long press the Back key  on the default monitoring page to enter the QUICK menu.
2. After entering the QUICK menu, the basic mode (-bASE) is set by default. Press the right shift key  to switch to the user-modified mode.
3. When the operating panel displays "-C-", press the Enter key  to enter the user-modified mode. The first modified parameter is cF1.01 (F1-01).
4. Continue to press the up key  to see that the second modified parameter is cF1.04 (F1-04).
5. Press the Enter key  when cF1.04 is displayed to access F1-04. The parameter value shown in the figure is 6.70.
6. Continue to press the up  or down key  to modify F1-04. The value is modified to 6.85.
7. Press the Enter key  to save the modified F1-04 parameter value.

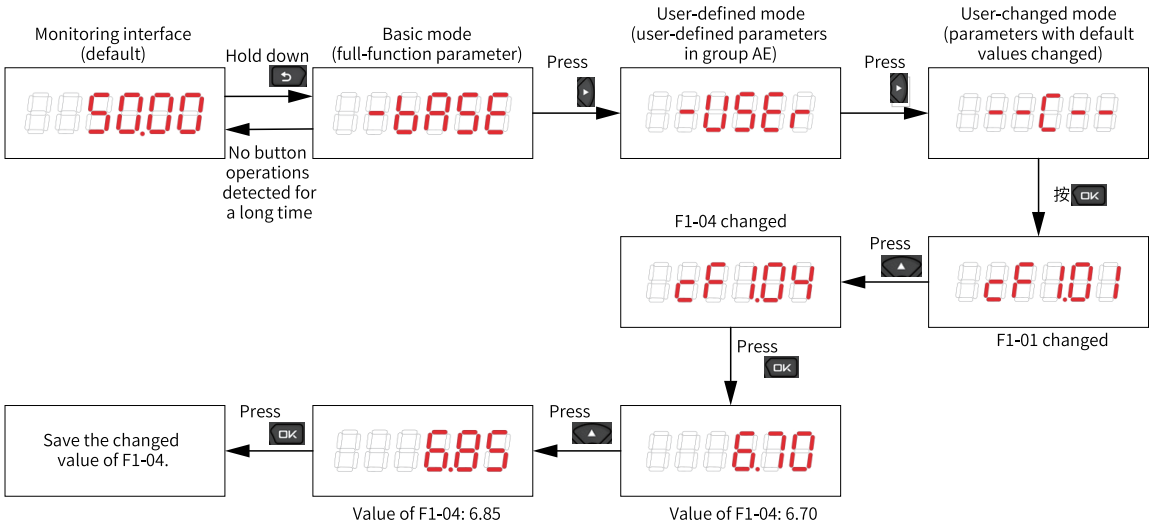


Figure 5-246 Access the modified parameter list through the operating panel

Application example 2: Access the modified parameter list through the iFA commissioning software

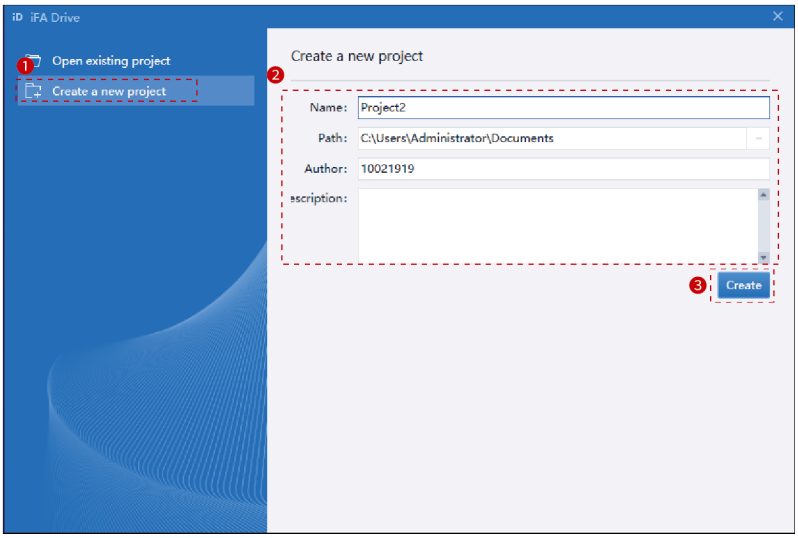
Note

To obtain, install, upgrade, and use the iFA Drive software, see *"4.2.2.1 Commissioning Software" on page 112*.

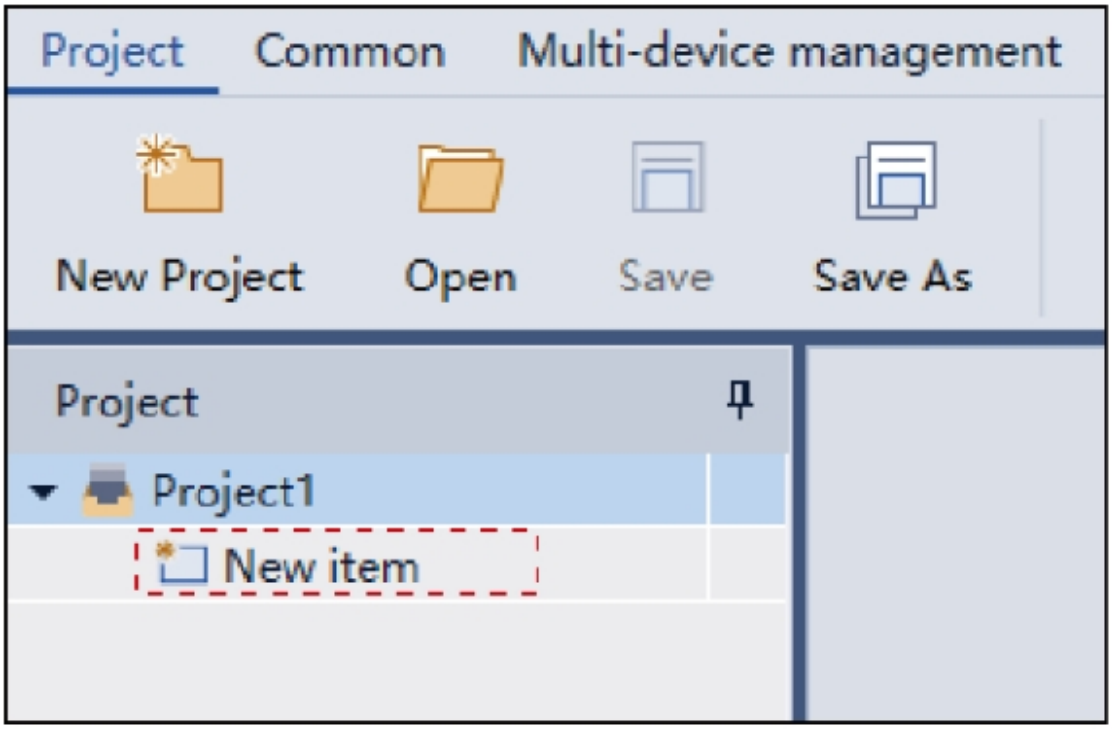
You can also view the modified parameters of the AC drive through the iFA commissioning software.

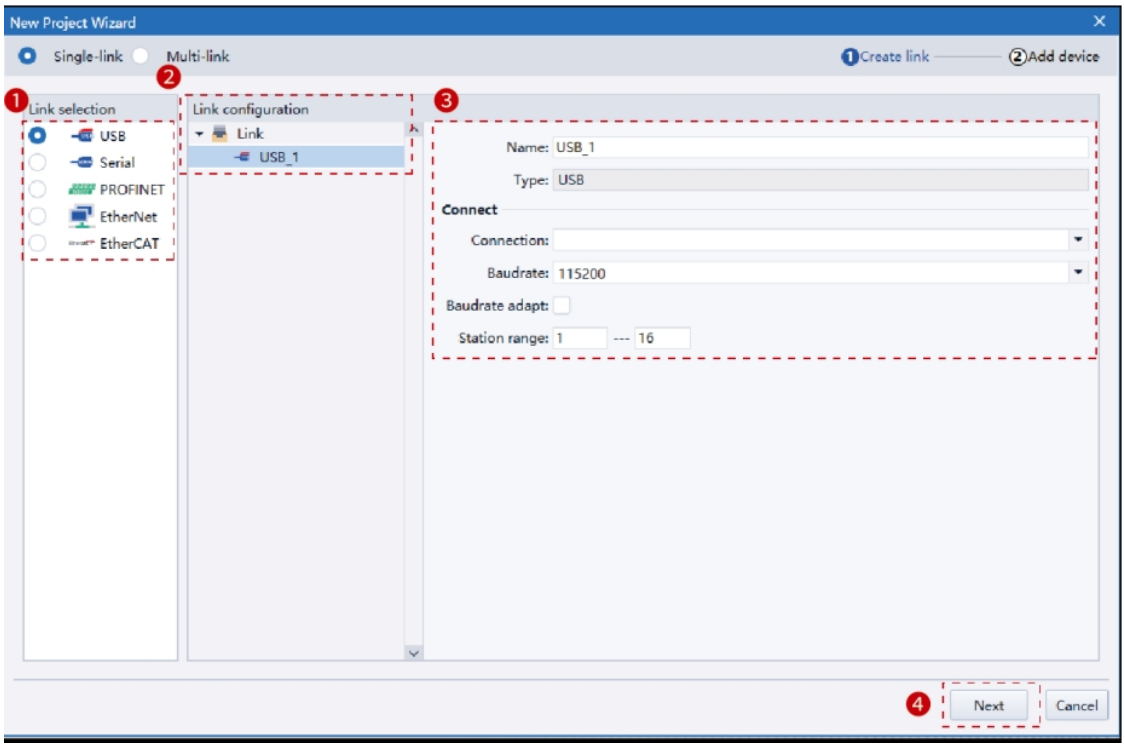
The basic steps for accessing the modified parameter list through the iFA commissioning software are as follows:

1. Open the iFA commissioning software, enter the project information, and click the Create button to create a new project.

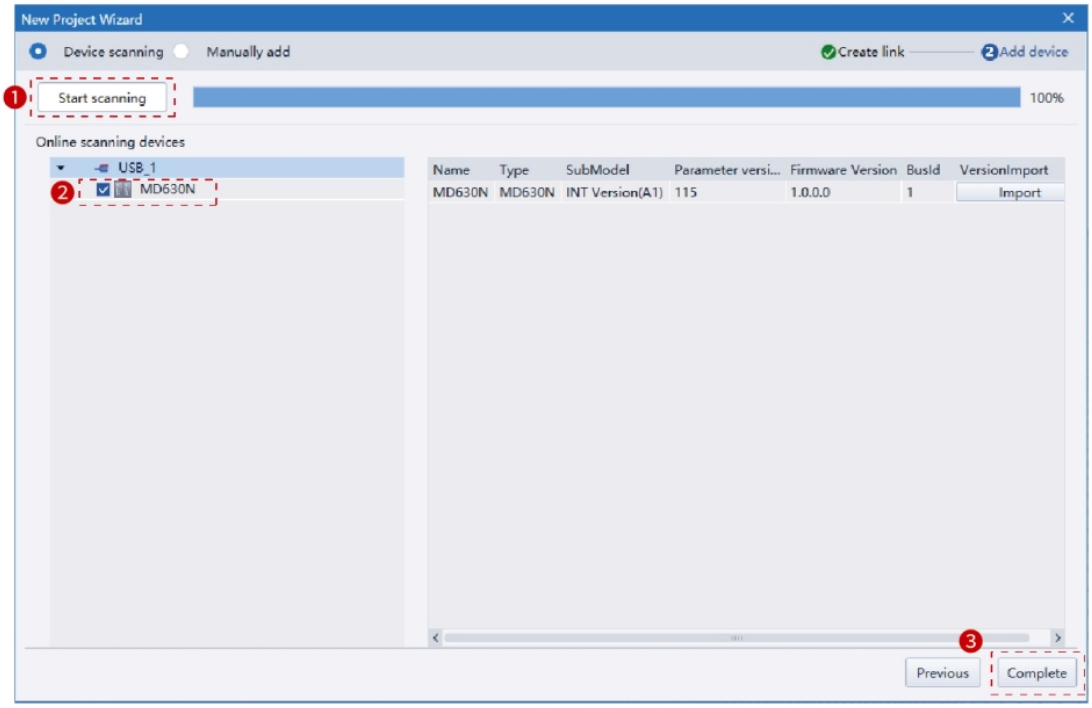


2. After entering the main page, click Add a new item on the left and fill in the baud rate and station number information in the new project wizard. Then click Next.

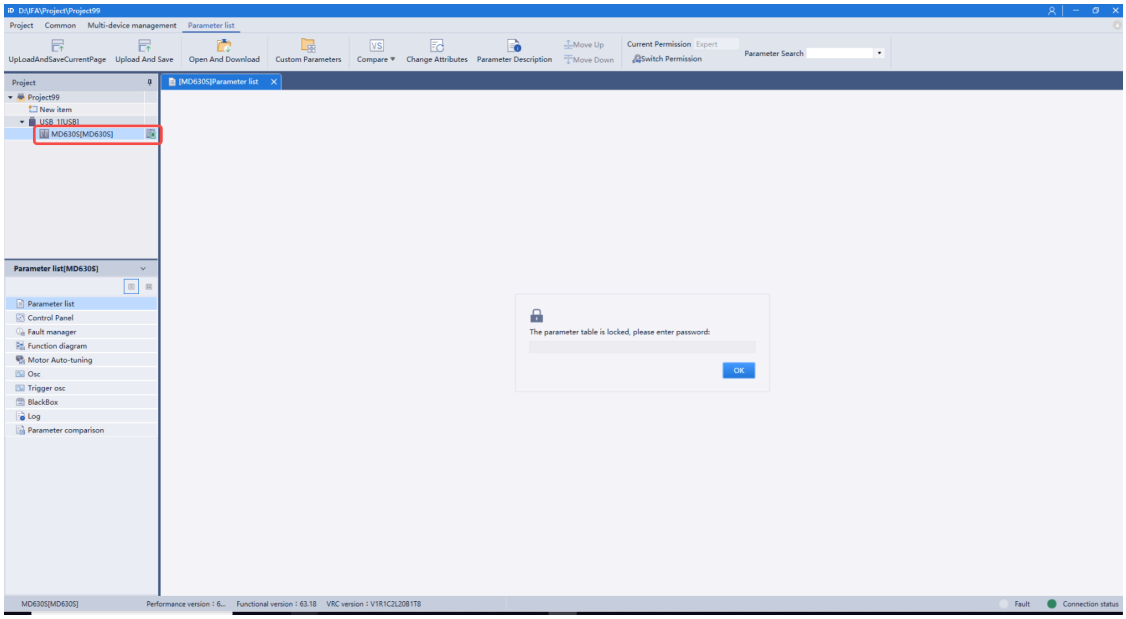


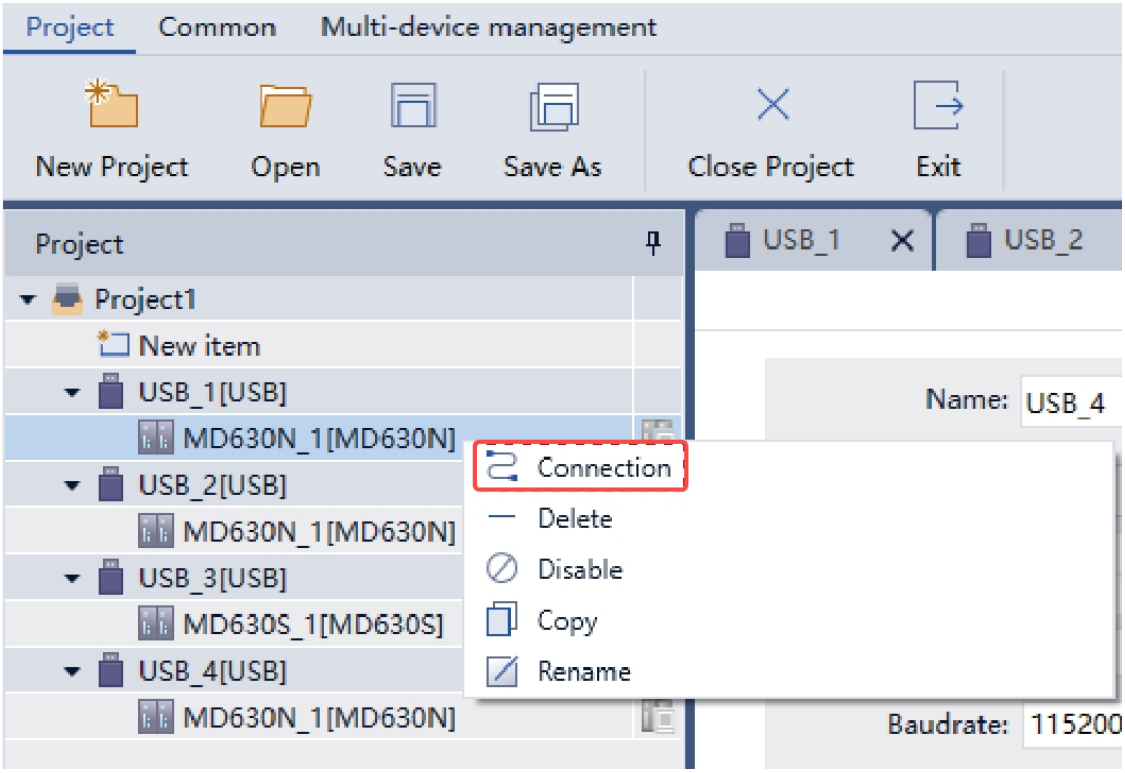


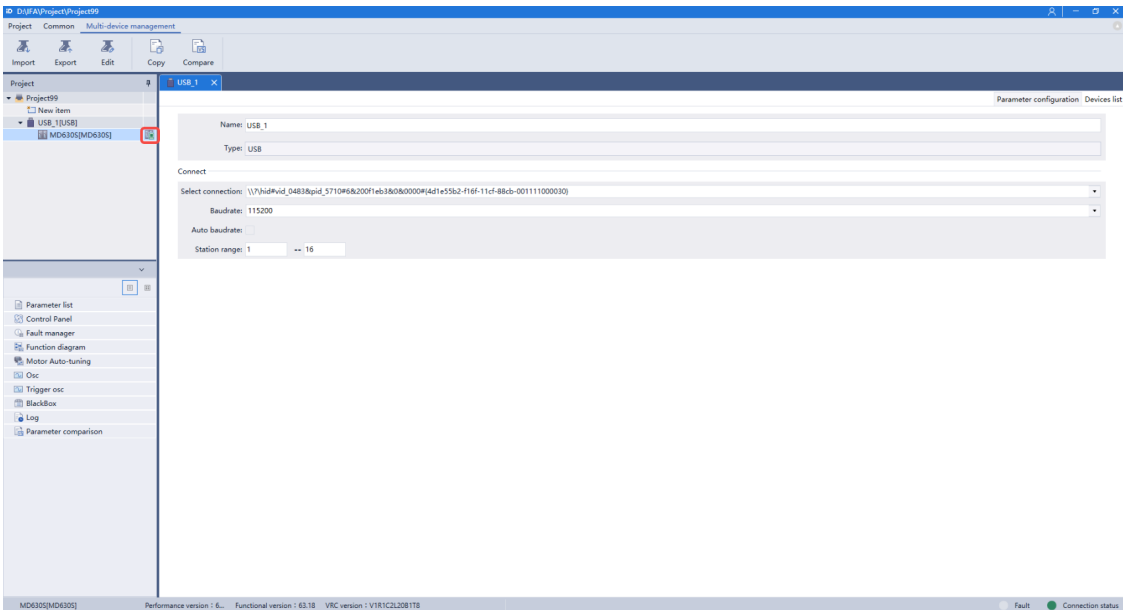
3. On the new page, click the Start Scan button to scan the device. After the scan is complete, the connected device information is displayed. Then, click the Finish button to return to the main interface.



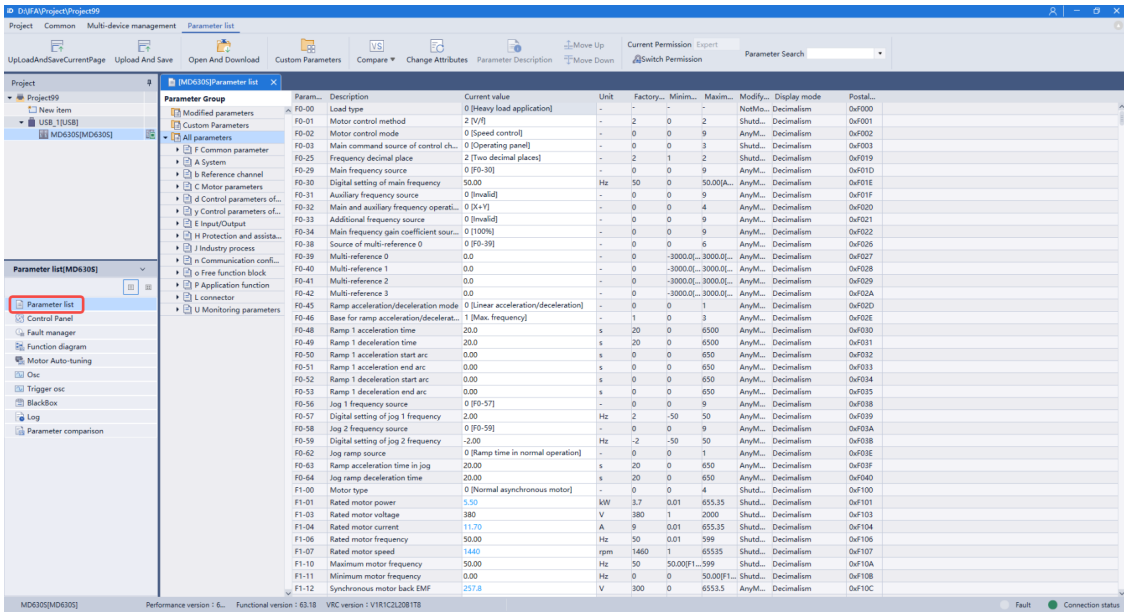
4. Right-click the device name on the left side of the main interface. In this case, MD630S-INT is displayed. In the pop-up box, select Connect. A green flag is displayed next to the device name, indicating that the device is connected successfully.



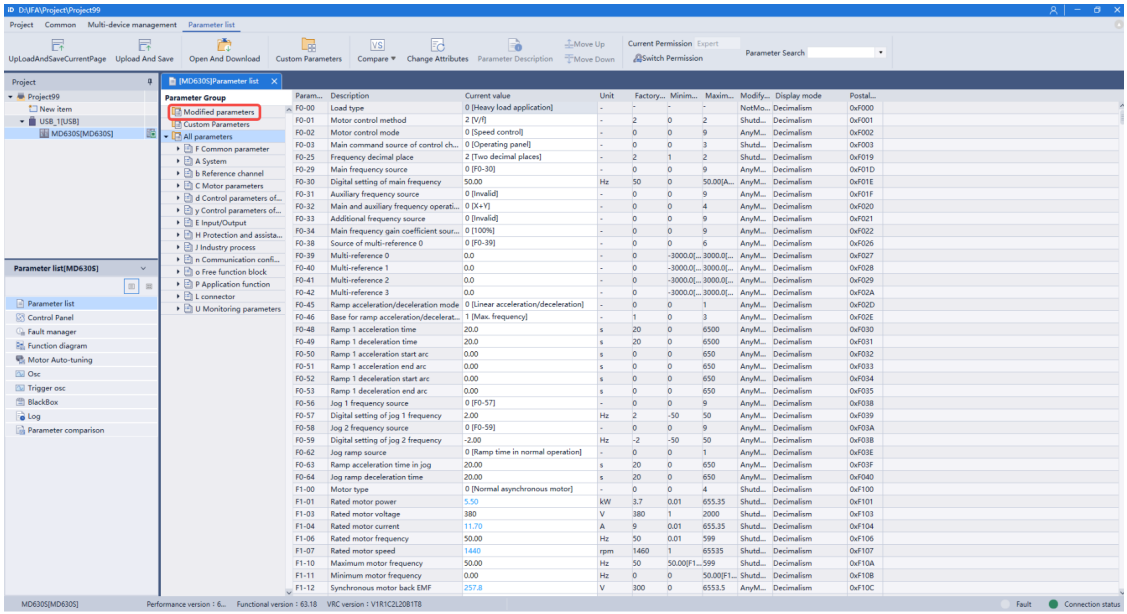


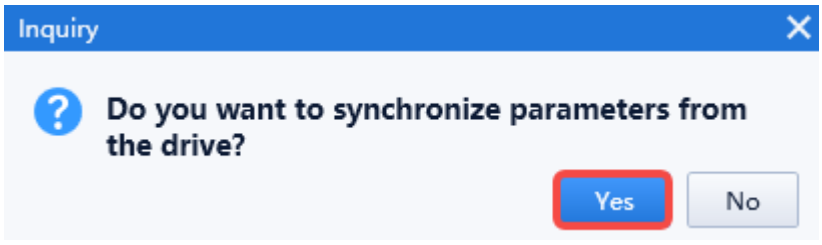


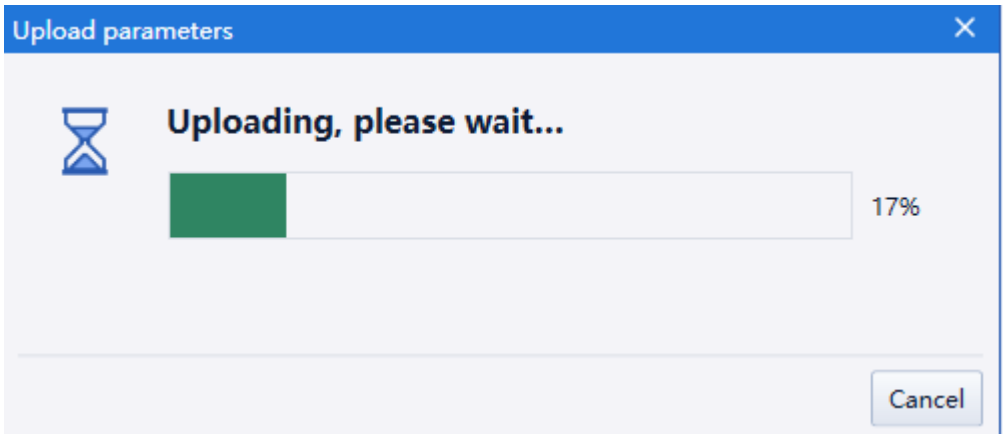
5. After the device is connected successfully, click the parameter list on the left side of the interface to display the parameters of the AC drive, and you can see all parameter groups on the right side.



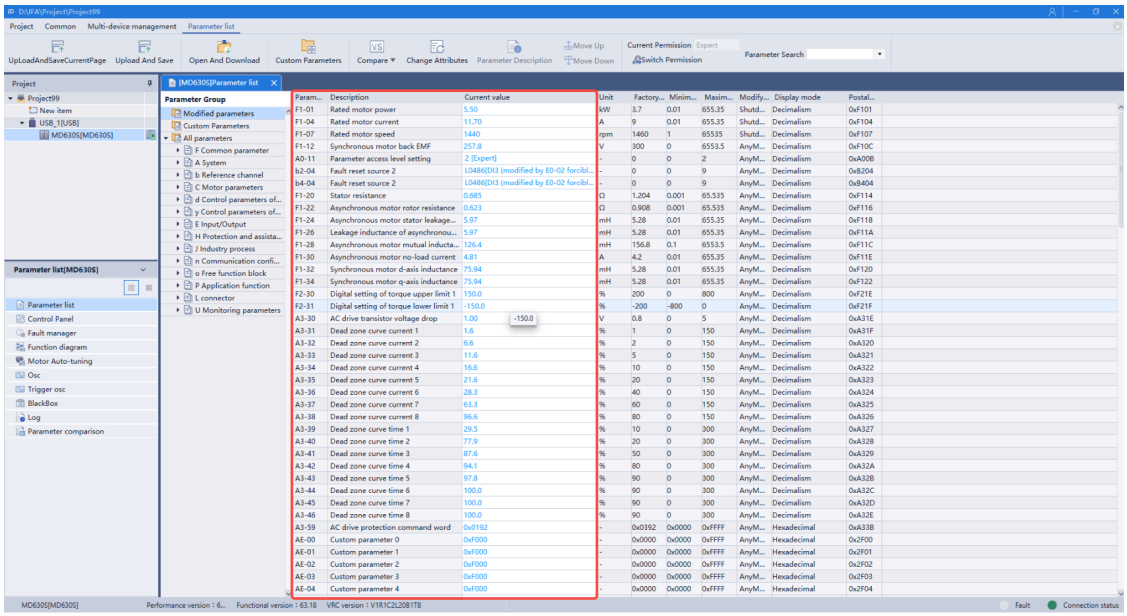
6. Click the modified parameters on the right side of the window, click "Yes" in the pop-up box, and then "Uploading, please wait" is displayed. Then modified parameters are being synchronized.







7. After synchronization is completed, the commissioning software displays the modified parameters as follows. You can view them by sliding the mouse wheel up and down or click the parameter current value input box to modify them.



6 Communication

6.1 List of Terms

Table 6–1 List of Terms

Function type	Terms	Explanation
Communication	CW	Control word
	SW	Status word
EtherCAT	EtherCAT	Ethernet for Control Automation Technology
	CoE	CANopen over EtherCAT
	PDO	Process data object
	SDO	Service data object
	WKC	Working counter
	FCS	Frame check sequence
	EoE	Ethernet over EtherCAT
	CoE	CANopen over EtherCAT
	FoE	File access over EtherCAT
	SoE	Servo drive over EtherCAT
	VoE	Vendor specific profile over EtherCAT
EtherNet/IP	EtherNet/IP	EtherNet industrial protocol
	TCP	Transmission control protocol
	UCMM	Unconnected message manager
	UDP	User datagram protocol
	DHCP	Dynamic host configuration protocol
Modbus-RTU	Modbus-RTU	Modbus-Remote terminal unit
PROFINET	PROFINET	Process field network
	MRP	Media redundancy protocol
	DCP	Discovery and basic configuration protocol
	LLDP	Link layer discovery protocol
	FSU	Prioritized startup
	SFD	Start frame delimiter
	APDU	Application protocol data unit
	IOPS	Input output object provider status
	IOCS	Input output object consumer status
	RPC	Remote procedure call
Modbus TCP	Modbus TCP	Modbus transmission control protocol, a Modbus protocol based on Ethernet TCP/IP

6.2 Communication System Connections

The communication system is divided into periodic data and service data.

- Periodic data is periodic interaction data, also known as process data. It usually transmits control words, set value, status word and actual value.
- Service data is non-periodic interaction data. Data transmission occurs only after the corresponding request is executed. It also becomes SDO data, which is usually used to read and write parameters.

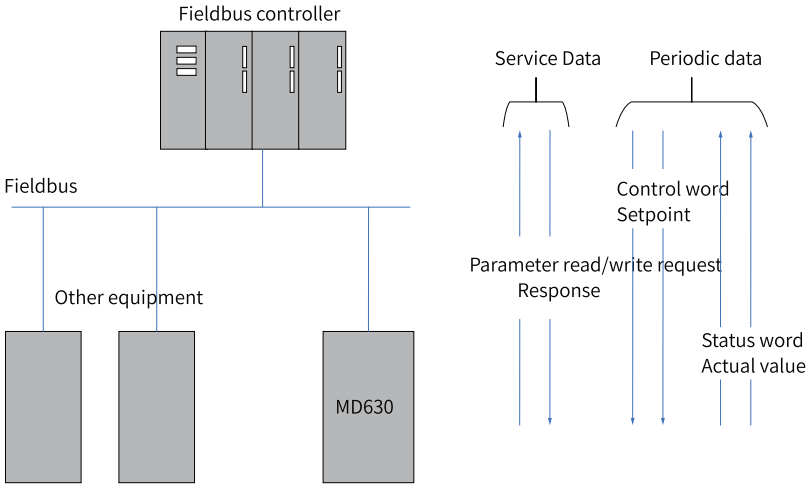


Figure 6-1 Communication system connection diagram

6.3 List of Communication Protocols

The MD630-INT drive is divided into two versions, MD630S-INT and MD630N-INT.

See the following table for the supported communication protocols.

Model	Supported Protocol	Communication Hardware
MD630S-INT	Modbus	RS485 terminal of MD630 AC drive
MD630N-INT	EtherCAT, EtherNet/IP, PROFINET, and Modbus TCP	RJ45 network port of MD630 AC drive

6.4 Communication Configuration Process

The communication configuration of this product is generally performed according to the following procedure:

1. According to the communication type selected, connect the AC drive to the bus system.
2. Depending on the communication type selected, configure communication between the drive and the bus controller, including:

   a. Set the communication parameters in the drive to ensure that the communication parameters of the drive and the bus controller match.

   b. Set the bus controller and ensure that the AC drive can communicate with the bus controller [Note 1].

3. Set the functions of the AC drive that need to be set through communication. The communication data received by the AC drive is used as the reference source for the corresponding function [Note 2] [Note 3].

Note 1: For the MD630N-INT model, you need to set n0-10 (Communication type selection) first. Option 1 is EtherCAT, option 2 is EtherNet/IP, option 3 is PROFINET, and option 4 is Modbus TCP. After switching the communication type to the desired communication type, set the corresponding communication parameters.

Note 2: For example, if a bus controller sends command words to control the start/stop operation of the drive, you need to set the active main command source of the control channel. Two control channels are available. F0-03/b1-00 are for channel 1 and b3-00 (2: communication) is for channel 2.

Note 3: For example, if the bus controller sends the frequency and controls the output frequency of the drive, you need to set the active main frequency source. Two set channels are available. F0-29/ b5-00 are for channel 1 and b6-00 (9: communication) is for channel 2.

6.5 Parameter Communication Address

The communication address of the parameter is in the unsigned 16-bit format and is expressed in hexadecimal. For example, the communication address of F1-10 is 0xF10A.

The communication address of the parameter can be obtained in the corresponding product manual or in the communication address column of the parameter list in the commissioning software.

In addition, non-storage communication addresses are provided. If the parameters modified by the communication do not need to be saved at power failure, you can change the value in the non-storage communication address. To access the non-storage communication address of the parameters, simply add 100 to its storage communication address.



Generally, the parameter is written to the communication address of the read-write parameter, and the parameter value is saved at power failure. It is forbidden to write values to the storage communication address frequently, which may affect the service life of the storage device of the AC drive.

6.5.1 Special Communication Address

This product provides special communication address that can be read and written. This allows the host controller to write certain values, configuring communication setting of certain functions of the AC drive. The special communication addresses described in this section are not retentive at power failure.

6.5.1.1 Communication control

Set F0-03/b1-00 or b3-00 (Main command source of control channel 1) to 2 (Communication) and configure the communication parameters correctly. After sending a command to the control command address of the AC drive according to the communication protocol, you can control the start, stop, forward running, reverse running, jog, and fault reset of the AC drive.

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop (stop according to F2-17 (OFF1 stop mode)) 1: Forward run 2: Reverse running 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 (OFF1 stop mode)) 7: Fault reset 8: Emergency stop For example, write 1 to 7311H to control the forward running of the AC drive.
Communication setting control word 1	7321H	The setpoint of 7321H is in hexadecimal format. bit00: ON_OFF1; 0: stop, 0 to 1: run bit01: OFF2 (coast to stop); 0: active, 1: inactive bit02: OFF3 (quick stop); 0: active, 1: inactive bit03: Running allowed; 0: disable, 1: enable bit04: Reset command; 0: invalid, 0 to 1: reset bit05: JOG1; 0: active, 1: inactive bit06: JOG2; 0: active, 1: inactive bit07: speed inverted; 1: inverted For example, write 0x000F to 7321H to control the start of the AC drive.

Note

Select the command source as communication. When control commands are sent through 7311H and 7321H respectively, the AC drive executes the commands according to the receiving order.

Take 7311H as an example. The following steps are used to set communication as the command source.

1. Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect.
2. Set the communication parameters under the corresponding communication type to match the communication parameters between the host computer and the AC drive, and establish communication between the host computer and the AC drive.
3. Set the command source to communication. Set b0-02 (Control channel selection) to 0 (Control channel 1) and b1-00 (Main command source of control channel 1) to 2 (Communication).
4. Send a write command to the AC drive through the host controller; write 1 to 7311H to start the AC drive, and write 0 to stop the AC drive.

6.5.1.2 Communication Setpoint

The communication address of the communication setpoint supported by the AC drive is as follows.

Address	Description	
Communication setpoint 2	7310H	Communication setpoint

The target frequency can be set by writing the communication setpoint by the host controller. Set the main frequency source parameters such as b5-00/F0-29 or b6-00 to 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the communication address specified by the AC drive according to the communication protocol, you can set the main frequency of the AC drive.

The data format of the special address 7310H is set by n0-14 [7310H setting], as shown in the following table.

n0-14 options	Unit	Data format	Number of digits of the decimal part	Communication setpoint example	Actual value
0: Frequency (UInt16)	Hz	UInt16	Determined by A0-70 (Frequency decimal place), 2 places by default	1000	10.00 Hz
				2000	20.00 Hz
1: Frequency (Int16) (Default)	Hz	Int16	Determined by A0-70 (Frequency decimal place), 2 places by default	1000	10.00 Hz
				-1000	-10.00 Hz
2: Speed (Int16)	rpm	Int16	No fractional part	1500 (motor pole pairs 2)	1500rpm (50.00 Hz)
				-1500 (motor pole pairs 2)	1500rpm (-50.00 Hz)
3: Percentage (corresponds to rated frequency/Int16/2 decimal places)	%	Int16	Two decimal places	1000: Rated frequency (50.00 Hz)	10.00% (5.00 Hz)
				-1000: Rated frequency (100.00 Hz)	-10.00% (-10.00 Hz)
3: Percentage (corresponds to maximum frequency/Int16/2 decimal places)	%	Int16	Two decimal places	1000: Maximum frequency (50.00 Hz)	10.00% (5.00 Hz)
				-5000: Maximum frequency (100.00 Hz)	-50.00% (-50.00 Hz)

Take 7310H as an example. The following steps are used to set communication as the frequency source.

1. Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect.
2. Set the corresponding communication parameters under the communication type to match the host controller and establish communication between the host controller and the AC drive.
3. Set communication as the frequency source. Set parameter b0-03 [Set channel selection] = 0 [set channel 1]; set parameter F0-29 (b5-00) [main frequency source] = 9 [communication].
4. The target frequency is written to the AC drive through the host controller. For example, when n0-14 = 1 and A0-70 = 2 , write 2500 to 7310H to set the main frequency to 25.00 Hz. Write -2500 to 7310H to set the main frequency to -25.00 Hz.

6.5.1.3 Other Special Addresses

AC drive state address

When the AC drive running status is read through communication, the communication address is 703DH to 7044H. The host controller enables you to obtain the current running status information of the drive by reading the address. The addresses are defined as follows:

Communication Address		Address Attribute	Description
AC drive state 1	703DH	Read-only	Convert the read values of 703DH to the values in the decimal format. The AC drive states corresponding to different values are as follows: 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault
AC drive state 2	7044H	Read-only	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: bit00: Running status. 0: Stopped; 1: Running bit01: Running direction. 0: Forward; 1: Reverse bit02: Fault state. 0: No fault; 1: Fault bit03: Frequency reached. 0: Not reached; 1: Reached bit04: Reserved bit05: Reserved bit06: Reserved bit07: Reserved bit08-15: Fault code. For details, see specific fault descriptions.

DO terminal control

When the RO/DO1/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the special address 7312H. The address is defined as follows:

Address		Address Attribute	Description
DO control	7312H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. If the value of the bit is 1, the corresponding terminal output is valid. When the value of the bit is 1, the corresponding terminal output is invalid. The relationship between bits and DOs is as follows. bit00: RO bit01: Reserved bit02: Reserved bit03: Reserved bit04: DO bit05: Reserved bit06: Reserved bit07: Reserved bit08: FMR (valid only for MD630S) bit09: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6

For example, set E1-00 (RO function selection) to 20 (communication), and then set the corresponding communication parameters. Write 0001H to 7312H in the instruction format and set the value of bit0 to 1 to set the RO to active.

AO terminal control

When E3-00 (AO1 function selection) is set to 12 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 7313H, as defined below.

Address		Address Attribute	Description
AO setting	7313H	Read/Write	Set the AO output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO output value is 0% to 100%

Set E3-00 (AO function selection) to 12 (communication), and then set the corresponding communication parameters. Write 7FFFH to 7313H in the instruction format to set the AO1 output proportion to 100%.

AC drive fault information query

The state of the AC drive is read through communication from the communication address 702DH to 7030H. The host controller can obtain the current running or fault information of the AC drive by reading data in the addresses. The addresses are defined as follows.

Communication Address		Address Attribute	Description
Fault Code	702DH	Read-only	Current AC drive fault code
Minor fault code	702EH	Read-only	Current AC drive minor fault code
Alarm code	702FH	Read-only	Current AC Drive alarm code
Prompt code	7030H	Read-only	Current AC drive prompt code

6.5.1.4 Modbus Compatible Address

In addition to the above special communication addresses, 1000H to 1020H, 2000H to 2004H, 3000H, and 8000H to 8001H are compatible communication addresses dedicated to the Modbus communication, which can also be read and written to the Modbus communication of some preceding products.

Set whether the Modbus communication address is compatible by setting n0-12 (Compatibility with legacy communication address). When n0-12 = 1 [Compatible], the Modbus compatible communication address can be accessed. Otherwise, the Modbus compatible communication address cannot be accessed normally.

Param.	Name	Default Value	Value Range
n0-12	Compatible with old communication address	1	0: Not compatible 1: Compatible

The Modbus compatible communication addresses are as follows.

Start/stop command

Set F0-03/b1-00 or b3-00 (Main command source of control channel 1) to 2 (Communication) and configure the Modbus communication parameters correctly. After sending a command to 2000H according to the communication protocol, you can control the start, stop, forward running, reverse running, jog, and fault reset of the AC drive.

Communication Address		Address Attribute	Description
Control command input to AC drive 2	2000H	Read/Write	It can be used as the command source for communication. The value format is decimal. 0: Stop (stop according to F2-17 (OFF1 stop mode)) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 (OFF1 stop mode)) 7: Reset upon fault 8: Emergency stop For example, write 2 to 2000H to control the reverse running of the AC drive.

Note

When this address is active, the AC drive executes the start/stop commands based on the order in which it receives 2000H, 7311H, and 7321H.

Communication setting

Set the main frequency source parameters such as b5-00/F0-29 or b6-00 to 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the 1000H according to the communication protocol, you can set the main frequency of the AC drive.

Address		Address Attribute	Description
Communication setpoint	1000H	Read/Write	The value written to this address can be set as communication reference. The value attribute is switched by n0-13 (1000H set selection).

Note

When this address is valid, the communication value written later in 1000H and 7310H is the final valid communication value.

The data format of the special address 1000H is set by n0-13 [1000H setting], as shown in the following table.

Param.	Name	Default	Value Range
n0-13	1000H setting selection	2	0: Percentage (corresponds to rated frequency/1 decimal place) 1: Percentage (corresponds to rated frequency/2 decimal place) 2: Percentage (corresponds to maximum frequency/2 decimal places)

The following table shows the format of the n0-13 [1000H setting selection] setpoint.

n0-12 setpoint	Unit	Number of digits of the decimal part	Communication setpoint example	Actual value
0: Percentage (corresponds to rated frequency/1 decimal place)	%	Two decimal places	100: Rated frequency (50.00 Hz)	10.0% (5.00 Hz)
			-100: Rated frequency (100.00 Hz)	-10.0% (-10.00 Hz)
1: Percentage (corresponds to rated frequency/2 decimal place)	%	Two decimal places	1000: Rated frequency (50.00 Hz)	10.00% (5.00 Hz)
			-1000: Rated frequency (100.00 Hz)	-10.00% (-10.00 Hz)
2: Percentage (corresponds to maximum frequency/2 decimal places)	%	Two decimal places	1000: Maximum frequency (50.00 Hz)	10.00% (5.00 Hz)
			-5000: Maximum frequency (100.00 Hz)	-50.00% (-50.00 Hz)

State query

When the AC drive running status is read through communication, the host controller enables you to obtain the current running status information of the drive by reading the following address. The addresses are defined as follows:

Parameter	Name	Change Mode	Value Range
Operating frequency	1001H	Read-only	It indicates the AC drive running frequency (unit: 0.01 Hz).
Bus voltage	1002H	Read-only	It is used to set the bus voltage of the AC drive (unit: 0.1 V).
Output voltage	1003H	Read-only	It is used to set the output voltage of the AC drive (unit: 1 V).
Output current	1004H	Read-only	It is used to set the output current of the AC drive (unit: 0.01 A).
Output power	1005H	Read-only	It is used to set the output power of the AC drive (unit 0.1 kW).
Output torque	1006H	Read-only	It is used to set the output torque of the AC drive (unit 0.1%).
Running speed	1007H	Read-only	It indicates the AC drive running speed (unit: 0.01 Hz).
DI input flag	1008H	Read-only	This parameter shows the input state of the DI terminal of the AC drive.
DO output flag	1009H	Read-only	This parameter shows the output state of the DO terminal of the AC drive.
AI1 voltage	100AH	Read-only	It is used to set the AI1 voltage of the AC drive (unit: 0.001 V).
Load speed	100FH	Read-only	It indicates the load running speed (unit: rpm).
PID reference	1010H	Read-only	PID setting
PID feedback	1011H	Read-only	PID feedback
PLC step	1012H	Read-only	PLC current step
HDI input pulse frequency	1013H	Read-only	HDI input, unit 0.01 kHz
Feedback speed	1014H	Read-only	Load feedback speed (unit: 0.01 Hz)
Remaining operating time	1015H	Read-only	Displays the remaining running time during timed running (unit: 0.1 min).
AI1 voltage before correction	1016H	Read-only	Displays AI1 raw voltage value (unit: 0.001 V).
Motor speed	1019H	Read-only	Motor speed (rpm)
Current power-on time	101AH	Read-only	Indicates current power-on time of the AC drive (unit: 1 min).
Current operating time	101BH	Read-only	Indicates current running time of the AC drive (unit: 0.1 min).
Communication setpoint	101DH	Read-only	The value given by communication.
Display of main frequency X	101FH	Read-only	Main frequency setpoint (unit: 0.01 Hz)

Parameter	Name	Change Mode	Value Range
Display of auxiliary frequency Y	1020H	Read-only	Auxiliary frequency setpoint (unit: 0.01 Hz)
Read AC drive state 1	3000H	Read-only	The read results are converted to values in the decimal format. The AC drive states corresponding to different values are as follows: 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault

DO terminal control

When the RO/DO/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the compatible address 2001H. The address is defined as follows:

Param.	Name	Change Mode	Value Range
DO control	2001H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. If the value of the bit is 1, the corresponding terminal output is valid. When the value of the bit is 1, the corresponding terminal output is invalid. The relationship between bits and DOs is as follows. bit00: RO bit01: Reserved bit02: Reserved bit03: Reserved bit04: DO bit05: Reserved bit06: Reserved bit07: Reserved bit08: FMR (valid only for MD630S) bit09: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6

AO terminal control

When E3-00 (AO1 function selection) is set to 12 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 2002H, as defined below.

Param.	Name	Change Mode	Value Range
AO1 control	2002H	Write-only	Set the AO1 output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO1 output value is 0% to 100%

6.5.2 Control Word and Status Word

6.5.2.1 Control Word

The control word for communication ranges from 0 to 8, and the options are as follows:

Address	Description
0x7311H	0: Stop (the drive stops according to the mode set by OFF1)
	1: Forward run
	2: Reverse run
	3: Jog 1
	4: Jog 2
	5: Coast to stop
	6: Stop (the drive stops according to the mode set by OFF1)
	7: Reset upon fault
	8: Emergency stop (the drive stops according to the mode set by OFF3)

The control word setting is valid when the main command source (b1-00/F0-03, or b3-00) is set to 2 (communication) in the control channel (b0-02) currently set.

The target frequency of communication is as follows:

Param.	Description
Target frequency	The target frequency of the AC drive can be set through communication address. The attributes of values written by this address is defined by n0-14 (7310H setting selection).

The control word setting is valid when the main command source (F0-29/b5-00 or b6-00) is set to 9 (communication) in the current set channel.

The data format of the frequency setting is determined by n0-14 (7310H setting selection), as shown in the following table.

N0-14 Option	Unit	Data Format	Number of Decimal Places	Communication Example	Actual Value
0: Frequency (unsigned 16-bit)	Hz	UInt16	Determined by A0-70 (frequency decimal place), 2 places by default	1000	10.00 Hz
				2000	20.00 Hz
1: Frequency (signed 16-bit) (Default)	Hz	Int16	Determined by A0-70 (frequency decimal place), 2 places by default	1000	10.00 Hz
				-1000	-10.00 Hz

N0-14 Option	Unit	Data Format	Number of Decimal Places	Communication Example	Actual Value
2: Speed (signed 16-bit)	rpm	Int16	No decimal place	1500 (Number of motor pole pairs is 2)	1500 rpm < 50.00 Hz
				-1500 (Number of motor pole pairs is 2)	1500 rpm < -50.00 Hz
3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places)	%	Int16	Two decimal places	1000: Rated frequency (50.00 Hz)	10.00% (5.00 Hz)
				-1000: Rated frequency (100.00 Hz)	-10.00% (-10.00 Hz)
3: Percentage (corresponds to maximum frequency/signed 16-bit/two decimal places)	%	Int16	Two decimal places	1000: Maximum frequency (50.00 Hz)	10.00% (5.00 Hz)
				-5000: Maximum frequency (100.00 Hz)	-50.00% (-50.00 Hz)

6.5.2.2 Status Word

The meaning of the status word bits is as follows:

Address	Bit	Description	Description
0x7044H	0	0: Stop	The AC drive is in the stop state.
		1: In operation	AC drive running status
	1	Motor forward running	Motor speed actual value
		Motor reverse running	Motor speed actual value
	2	0: Fault present	AC drive fault
		1 = Fault	AC drive faulty Reset the fault by writing 7 to the control word
	3	0: Frequency reached	The operating frequency of the AC drive does not reach the target frequency detection range.
		1: Frequency reached	The operating frequency of the AC drive is within the target frequency detection range (target frequency ± A2-04 x frequency reaching detection width P0-38).
	4 to 7	Reserved	/
	8 to 15	Fault code	Current AC drive fault code

The target frequency of communication is as follows:

Item	Description
Operating frequency	AC drive running frequency The data format is signed 16 bits and 2 decimal places.

6.5.3 Mapping Table

Mapping table

The following table lists the monitoring and setting parameters commonly used for communication.

Communication Address (Hexadecimal)	Communication Address (Decimal)	Name	Change Mode	Value Range	Unit	Data Type	Param.
AC drive state							
0x7000	28672	Operating frequency	Read-only	0.00 to 600.00	Hz	UInt16	U0-00
0x7001	28673	Set frequency	Read-only	0.00 to 600.00	Hz	UInt16	U0-01
0x7002	28674	Bus voltage	Read-only	0.0 to 6553.5	V	UInt16	U0-02
0x7003	28675	Output voltage	Read-only	0 to 65535	V	UInt16	U0-03
0x7004	28676	Output current	Read-only	0.00 to 655.35	A	UInt16	U0-04
0x7005	28677	Output power	Read-only	-3276.8 to 3276.7	kW	Int16	U0-05
0x7006	28678	Output torque	Read-only	-3276.8 to 3276.7	%	Int16	U0-06
0x702D	28717	Fault code	Read-only	0.0 to 6553.5	-	UInt16	U0-45
0x702E	28718	Minor fault code	Read-only	0.0 to 6553.5	-	UInt16	U0-46
0x702F	28719	Alarm code	Read-only	0.0 to 6553.5	-	UInt16	U0-47
0x7030	28720	Prompt code	Read-only	0.0 to 6553.5	-	UInt16	U0-48
0x7052	28754	Module temperature	Read-only	-20.0 to 120.0	℃	Int16	U0-82
0x7053	28755	Ambient temperature	Read-only	-20.0 to 120.0	℃	Int16	U0-83
Digital input state							
0x7007	28679	DI state	Read-only	Bit 0 to Bit 1: DI1 state to DI2 state 0: Low level 1: High level Bit 2 to Bit 6: DI3 state to DI7 state (valid only for MD630S) 0: Low level 1: High level Bit 7 to Bit 9: Reserved Bit 10 to Bit 15: VDI1 state to VDI6 state 0: Low level 1: High level	-	UInt16	U0-07
Digital output state							

Communication Address (Hexadecimal)	Communication Address (Decimal)	Name	Change Mode	Value Range	Unit	Data Type	Param.
0x7008	28680	DO state	Read-only	Bit 0 RO state 0: Low level 1: High level Bit 1 to Bit 3: Reserved Bit 4: DO state 0: Low level 1: High level Bit 5 to Bit 7: Reserved Bit 8: FMR state (valid only for MD630S) 0: Low level 1: High level Bit 9: Reserved Bit 10 to Bit 15: VDO1 state to VDO6 state 0: Low level 1: High level	-	UInt16	U0-08
High-speed digital input state							
0x7012	28690	HDI pulse input frequency (valid only for MD630S)	Read-only	0.00 to 20.00	kHz	UInt16	U0-18
Analog input state							
0x7009	28681	AI1 voltage	Read-only	-10.57 to 10.57	-	Int16	U0-09
0x700A	28682	AI2 voltage	Read-only	-10.57 to 10.57	-	Int16	U0-10
Analog output state							
0x7123	28963	AO after correction (valid only for MD630S)	Read-only	-32.767 to 32.767	V	Int16	U1-35
Common settings							
0xF030 (0xB704)	61488 (46852)	Ramp 1 acceleration time	Read/Write	0.0 to 6500.0	s	UInt16	F0-48 (b7-04)
0xF031 (0xB705)	61489 (46853)	Ramp 1 deceleration time	Read/Write	0.0 to 6500.0	s	UInt16	F0-49 (b7-05)

6.6 Modbus RTU Drive Control

6.6.1 Overview

Modbus RTU supports multiple electrical interfaces, such as RS-485 and RS-232. The communication medium generally uses twisted pair cables and the master/slave communication architecture, in which the master device initiates communication requests and the slave device responds to the requests. Only one device can transmit data at a time, with the others receiving the data. Each device involved in communication must have a unique communication address. The communication address range is 1 to 247, and 0 is the broadcast communication address.



Before use, check whether communication parameters, including communication address, baud rate, and data bits, are configured correctly. Stop bit and check mode. Otherwise, communication will be abnormal.

6.6.2 Communication Specifications

Item	Specification
Communication protocol	Modbus-RTU communication protocol
Transmission mode	Master/slave communication mode
Communication Mode	Half-duplex communication
Topology	Bus type
Transmission rate	300 bps, 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps
Transmission medium	Twisted pair cable
Transmission distance	Below 1000 m
Communication port	RS-485
Modbus frame length	5 bytes to 137 bytes
Max. cable length	1000 m
Max. number of slaves connected	247
Number of request messages received at the same time	1

6.6.3 Communication System Connections

As shown in the following figure, the drive receives the data request from the controller as a slave device and returns the result of the request processing to the controller to complete the communication process. When multiple drives or Modbus communication devices need to be networked, it is recommended to connect each device in a daisy chain topology. Connect the RS485 signal reference ground of all nodes (up to 247 nodes) together. RS485 communication supports up to 32 nodes in the absence of the repeater.

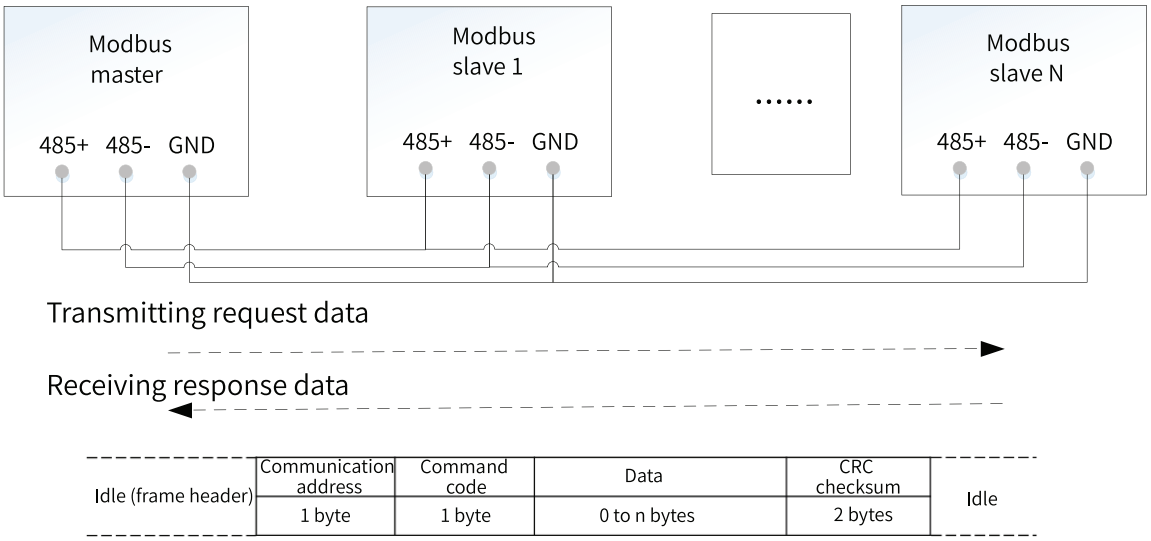


Figure 6-2 Daisy chain connection topology diagram

The transmission distance of the RS485 bus is directly related to the baud rate and the communication cable. The following table describes the relationship between the maximum bus length and the baud rate.

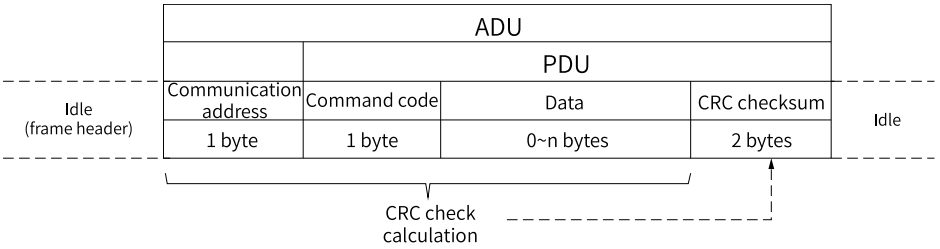
Table 6–2 Transmission distance and number of nodes

Transmission Distance (m)	Rate (kbps)	Number of Nodes	Cable Diameter
100	115.2	128	AWG26
1000	9.6	128	AWG26

6.6.4 Message

6.6.4.1 Message Structure

The Modbus RTU protocol communication data message consists of the communication address, command code, data, and CRC. The frame structure is shown in the following figure.



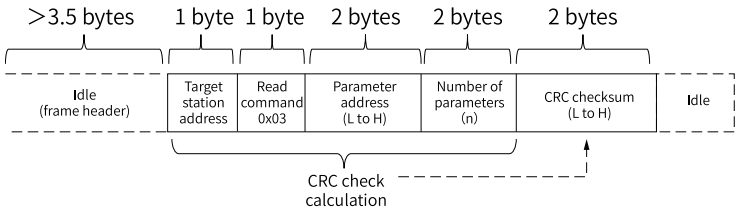
Field	Description
Communication address	It is used to uniquely identify yourself in the network, which is one byte, and can be set by n2-03.
Command Code	The command code specified for Modbus standard communication, which occupies one byte.
Data	The length of the data field is related to commands and specific usage. For example, the 0x06 function code write command can only be used to write one function code, with a fixed length of 4 bytes. The 0x03 read function code command and 0x10 write multiple function code commands can read or write multiple function codes. The length is related to the usage.
CRC checksum	The CRC value is calculated by the standard Modbus CRC16 check algorithm and occupies two bytes.

Instances

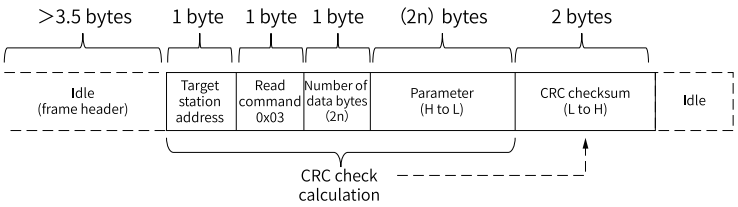
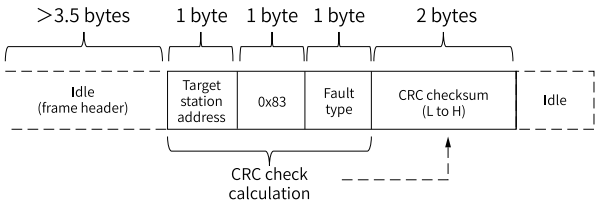
The AC drive supports reading or writing only of word type parameters, and does not support reading or writing of bytes or bits. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is 0x10.

1. Communication read process

The controller or host controller sends a read request data frame to the AC drive.

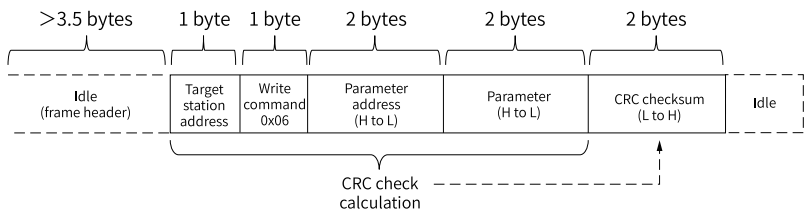
Read parameter request	

The AC drive sends a normal response frame to the read request based on the data processing result of the read request, and an abnormal response frame to the read request when the error occurs.

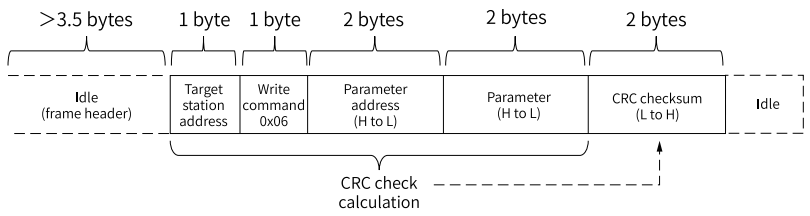
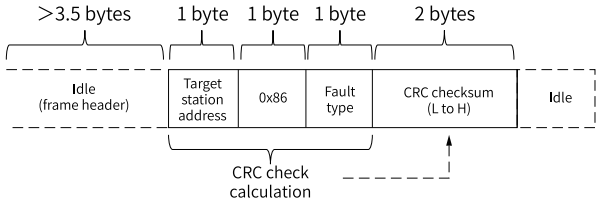
Normal response to read parameter	
Abnormal response to read parameter	

2. Communication write process

The controller or host controller sends a write request data frame to the AC drive.

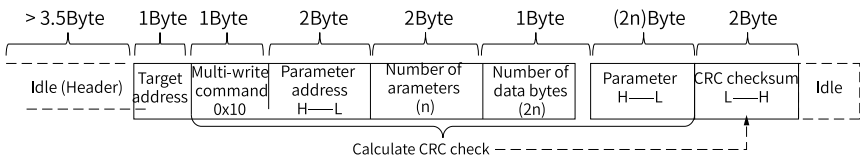
Write parameter request	

The AC drive sends a normal response frame to the write request based on the data processing result of the write request, and an abnormal response frame to the write request when the error occurs.

Normal response to write parameter	
Abnormal response to write parameter	

3. Multi-write process

The controller or host controller sends a multi-write request data frame to the AC drive.

Multi-write parameter request	

The AC drive sends a normal response frame to the multi-write request based on the data processing result of the multi-write request, and an abnormal response frame to the multi-write request when the error occurs.

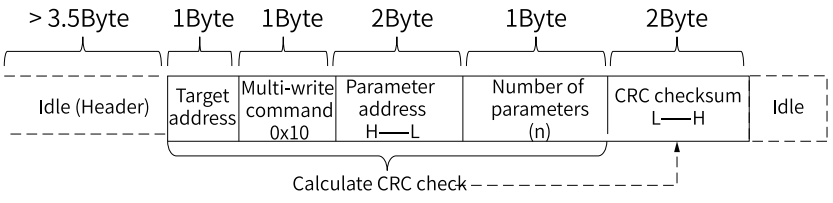
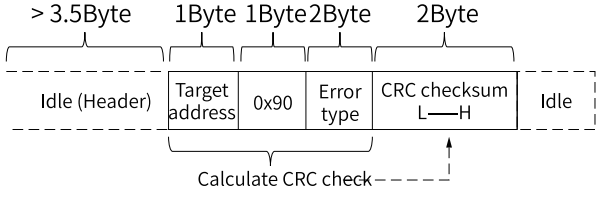
Normal response to multi-write parameter	
Abnormal response to multi-write parameter	

Table 6–3 Field description of data frame structure

Field	Remarks
Frame header	An idle level for a duration greater than or equal to 3.5-byte transmission time
Destination address	Communication address range: 1 to 247; 0: Broadcast address
Command code	03: Read parameter, 06: Write parameter, 10: Multi-write parameter.
Parameter address (H)	The internal parameter address of the AC drive, in hexadecimal format. Low-order bytes follow high-order bytes during transmission.
Parameter address L	
Number of parameters	Indicates the number of parameters read/written in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission. Note: The communication write operation (0x06) does not have this field.
Number of data bytes	Data length, which is twice the number of parameters
Parameter H	Read request response data or data to be written (Low-order bytes follow high-order bytes during transmission.)
Parameter L	
CRC H	Detection value: CRC16 check value. High-order bytes follow low-order bytes during transmission.
CRC L	
Idle	An idle level for a duration greater than or equal to 3.5-byte transmission time

6.6.4.2 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 853*.

6.6.4.3 Baud rate

To avoid data conflict during transmission, Modbus generally requires a 3.5-character interval between frames. Take the default Modbus data format (n2-01 = 0) as an example, when the Modbus response delay (n2-03) is 0. The transmission delay and minimum interval between frames of each character at different baud rates are as follows:

Baud rate (bit/s)	Time of transmission of one character (ms)	Minimum interval between frames (ms)
300	36.666	128.333
600	18.333	64.166
1200	9.166	32.083
2400	4.583	16.041
4800	2.291	8.020
9600	1.145	4.010
19200	0.572	2.005
38400	0.286	1.002
57600	0.190	0.668
115200	0.095	0.334

6.6.4.4 Mapping table (AC drive data)

For details, see *"6.5.3 Mapping Table" on page 854*.

6.6.5 Communication Ports

The MD630-INT standard model (MD630S-INT) supports Modbus communication. Modbus communication uses RS485 electrical standard and supports 1-way 485. It uses J5 interface and S1 DIP switch. The position diagram of the communication port and DIP switch is shown in the following figure.

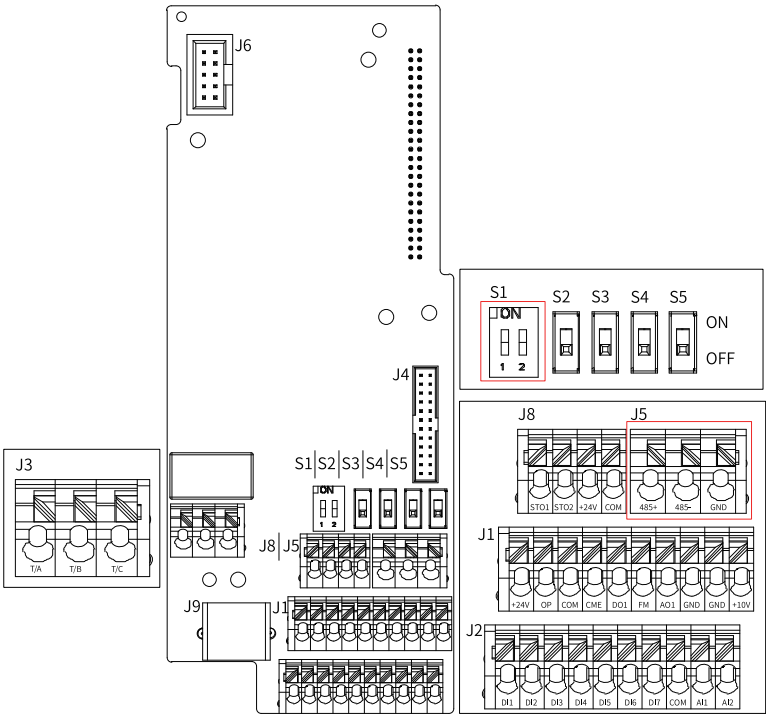


Figure 6-3 Layout of Modbus communication ports and DIP switches

Table 6–4 RS-485 communication terminals

External terminal	Type	Transmission Information Type	Terminal Mark	Name	Function
J5	Crimping terminal block with three terminals, 5 mm	485 communi-cation	485+	RS485 differential signal (+)	Maximum baud rate: 115200 bps Maximum communication distance: 1 km Maximum number of nodes: 247
			485-	RS485 differential signal (-)	
			GND	RS485 differential pair reference ground	

Table 6–5 DIP switches

Name	Function
S1	DIP switch for RS485 termination and bias resistor selection • When both are ON, the 485 ± signal is terminated and offset. • When both are OFF (default), the 485 ± signal is not terminated or offset. Note: S1 is a two-position DIP switch, which must be both ON or OFF at the same time.

6.6.6 Connect the AC drive to the bus system through the RS485 interface

Steps for connecting to PC:

1. Disable system power supply.
2. As shown in the following figure, 485+ and 485- of the Modbus master (PLC) and slave (AC drive) are connected by twisted-pair cables (signal cables) according to the bus-type topology.

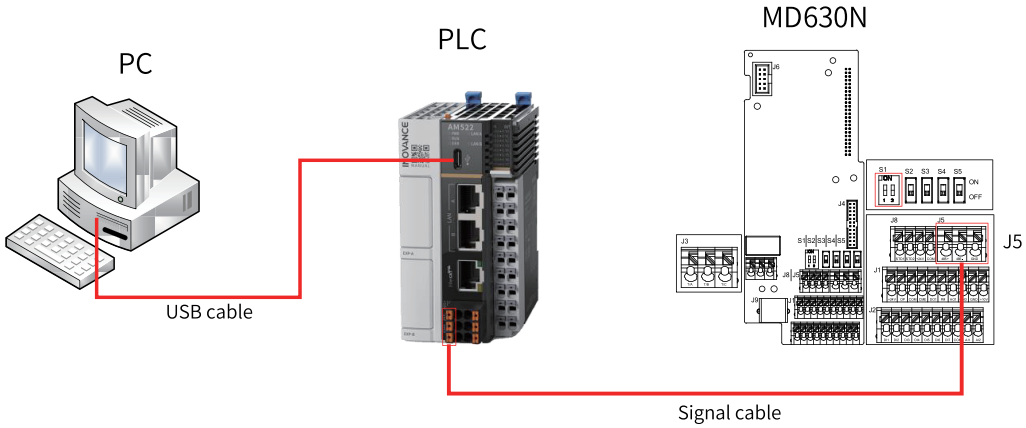


Figure 6-4 Modbus Communication

Use a three-conductor shielded cable as the RS485 bus to connect to 485+, 485-, and GND terminals of the AC drive. Use the twisted pair cable to connect to the 485+ and 485- terminals and use the other cable to connect to the RS485 reference ground terminal GND. Connect the shield to the equipment ground.

The cable length between adjacent devices should be less than 3 m and the maximum number of connections 247. The following figure shows the connection of the signal cables of the master and slave stations.

The master station can be equipped with an external termination resistor (mode 1) or set a termination resistor (mode 2) by DIP.

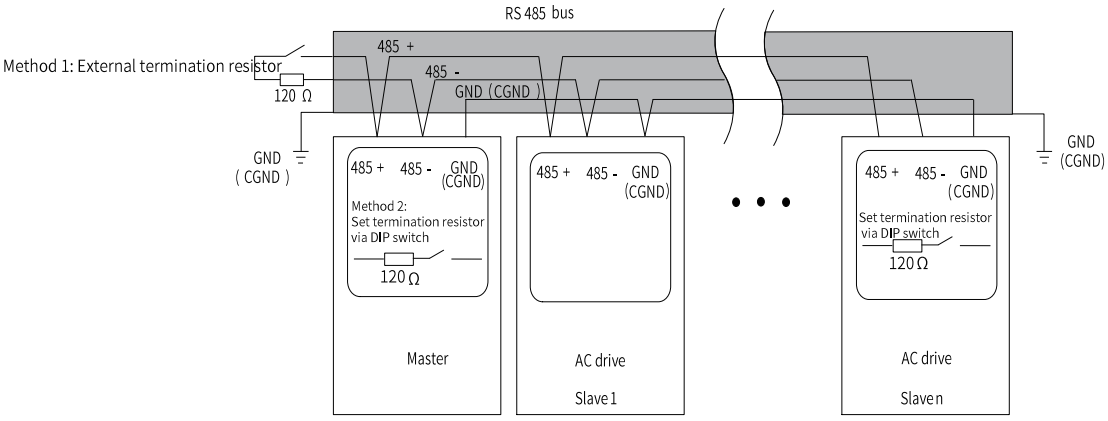


Figure 6-5 Signal cable connection of master and slave

3. Connect a 120 Ω termination resistor between 485+ and 485- of the first station (usually the master) and the final station (usually the slave) to prevent signal reflection. The termination resistor of the AC drive can be connected through the DIP switch.
4. Power on the device after ensuring that the cables are connected correctly.

6.6.7 Configure Communication Between AC Drive and Controller

The MD630-INT standard model (MD630S-INT) can communicate with master stations that support standard Modbus RTU, such as Inovance PLCs.

1. For details about connecting the main station and AC drive, see *"6.6.6 Connect the AC drive to the bus system through the RS485 interface" on page 863*.
2. Set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for channel 1 (b0-03 = 0, b5-00 = 9). (You can operate through the operating panel or the software.)
3. Set a different communication address (n2-02) for each AC drive, and configure the baud rate (n2-00) and the same data format (n2-01) for all AC drives to be consistent.
4. Configure the communication between the master station (controller) and the slave station (AC drive). For details, see *"6.6.10.1 Configuration for RS485 Communication Between AC Drive and H5U" on page 866*.



Ensure that the baud rate and data format of the master are consistent with the settings of the slave. Otherwise, communication errors may occur.

6.6.8 Communication Parameters

Parameter	Parameter Name	Default	Value Range	Change Method	Parameter description:
n2-00 Fd-05	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	At stop:	This parameter defines the speed of data transmitted between the host controller and the AC drive. The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n2-01 Fd-06	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	Real time	Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n2-02 Fd-07	Modbus local address	1	1 to 247	At stop:	The local address must be unique, which is the basis for point-to-point communication between the host controller and the AC drive.
n2-03 Fd-08	Modbus response delay	2	0 ms to 20 ms (valid for Modbus)	Real time	It is used to set the time interval from the time when the AC drive finishes receiving data to the time when the AC drive starts to send data to the host controller. • If the response delay is shorter than the system processing time, the system processing time prevails. • If the response delay is longer than the system processing time, the AC drive sends data to the host controller only after the response delay elapses.
n2-04 Fd-09	Modbus communication timeout	0	0.0 (invalid) 0.1s to 600.0s	Real time	If this parameter is set to a valid value, when the drive does not receive the communication signal within the time set in this parameter, Err160.1 will be reported. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication.
n2-05	Limit on the number of data written/ read in Modbus	12	12 to 100	Real time	The maximum number of function codes that can be read and written at a time.

6.6.9 Communication Fault Diagnosis

Table 6–6 Modbus-RTU communication fault diagnosis

Error code	Fault Name	Cause:	Confirmation	Solution
E160.1	Modbus-RTU communication timeout	Ambient interference exists.	1. Check whether the RS485 communication cable is connected properly.	Connect the 485 communication cable.
		The baud rate and data format of the master and slave are inconsistent.	Check whether communication parameters such as Modbus local address (n2-02), Modbus baud rate (n2-00), and Modbus data format (n2-01) are set correctly. The baud rate and data format set by the host controller and the AC drive must be consistent. The station number must be unique. Otherwise, communication can fail.	Ensure that the baud rate, data format, and station number set by the host controller and those set in the AC drive are consistent.
		The master does not send request data to the slave within the timeout period.	1. Check whether the master configures data request commands for the slave that reports errors. 2. Check whether the values of the Modbus communication timeout (n2-04) and the PLC communication cycle are proper. The Modbus communication timeout (n2-04) must be greater than the PLC communication cycle.	1. Ensure that the master configures data request command for the slave that reports errors. 2. Ensure that the value of the Modbus communication timeout (n2-04) is higher than the PLC communication cycle.

6.6.10 Communication Configuration Examples

6.6.10.1 Configuration for RS485 Communication Between AC Drive and H5U

Prerequisite

1. Log in to Inovance website ***https://www.inovance.com/portal/serviceSupport/download*** and download the AutoShop PLC programming software.
2. Equipments: the AC drive, H5U PLC, cables, and distributor.
3. Ensure that the controller and the AC drive are connected correctly (H5U as Modbus master and MD630S-INT as Modbus slave). Connect the H5U PLC to the 485+, 485-, and GND of the AC drive respectively. For details, see *"6.6.6 Connect the AC drive to the bus system through the RS485 interface" on page 863*.
4. Ensure that the data format of the controller is consistent with the Modbus data format of the AC drive.

Configuration steps

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

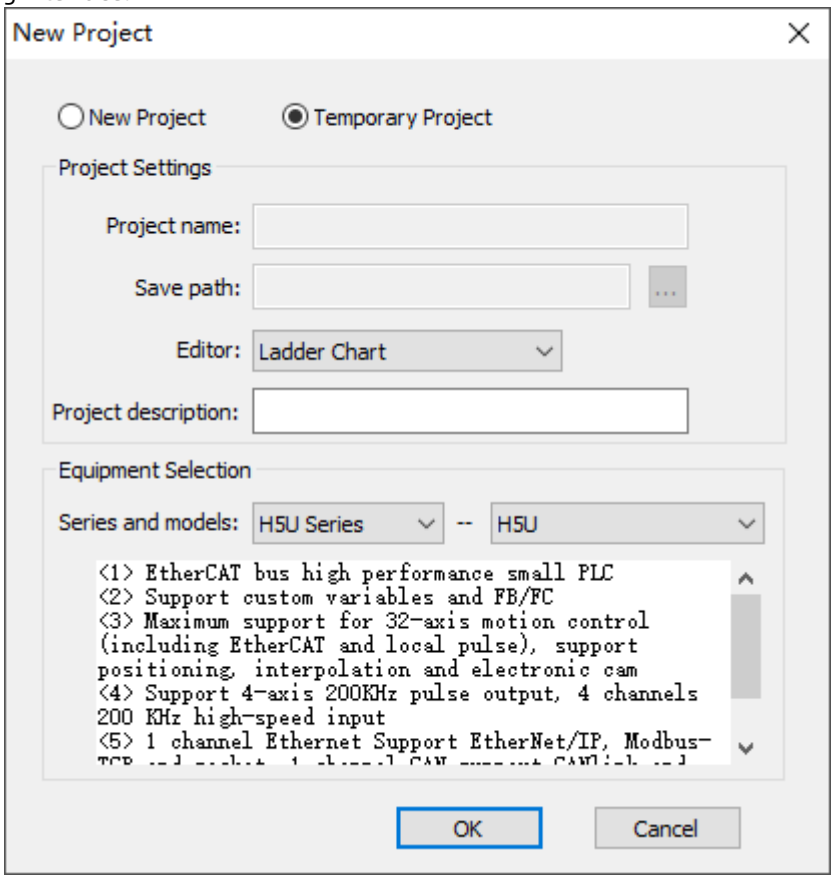
1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

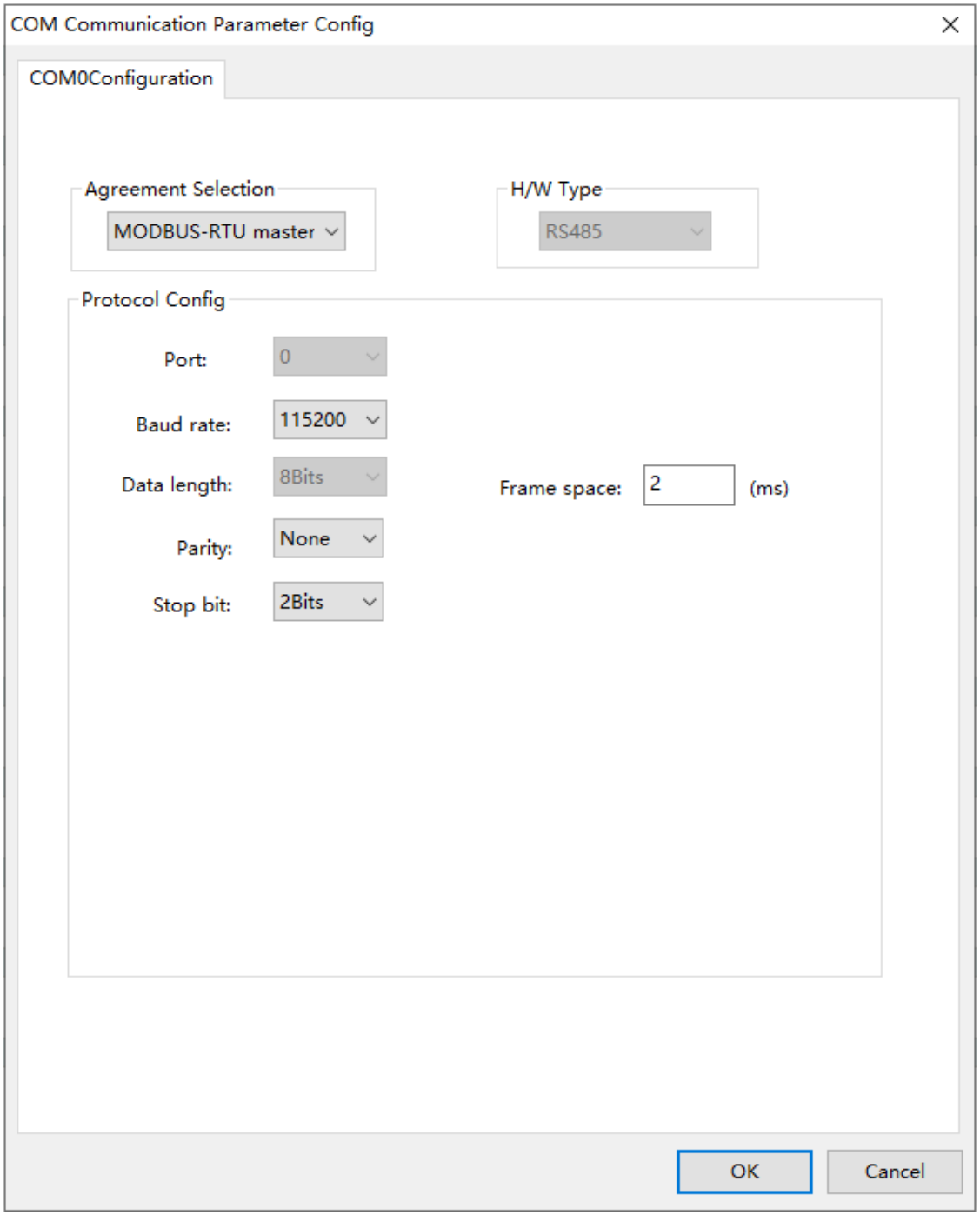
1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish Modbus RTU communication connection

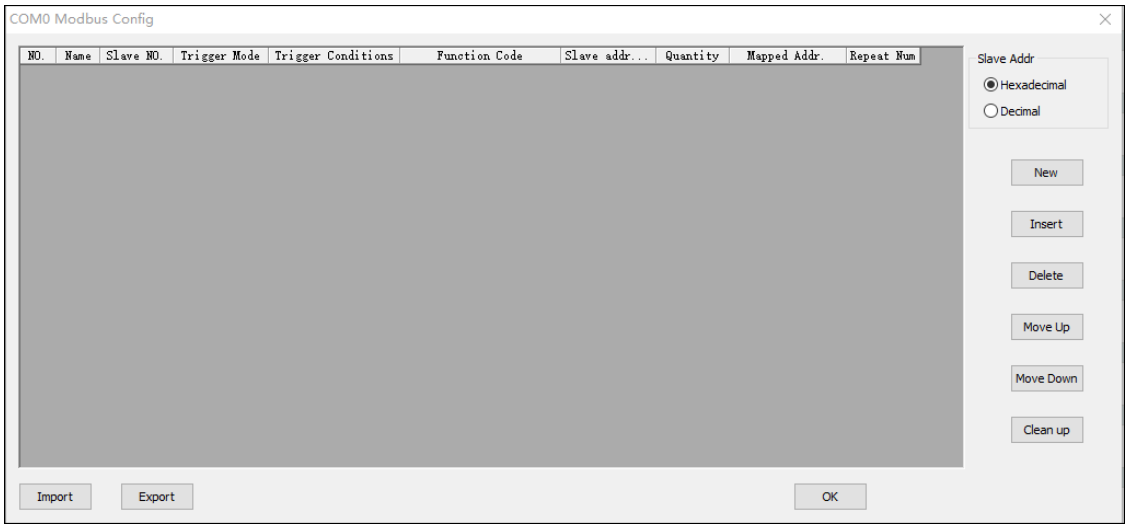
1. Open AutoShop, click **New Project**, check that **Series and models** is **H5U**, and click **OK** to enter the programming interface.



2. Click COM in the left pane to go to the PLC configuration interface, select the protocol and data format, and click **OK**. Note that the data format should be consistent with the AC drive setting.



3. Click COM0, then click **Add Modbus Config** and **OK**. is displayed. Double-click COM0 Modbus Config and click Add on the displayed interface to access a variable of the AC drive.

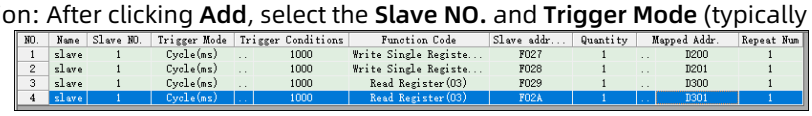


4. Write operation: After clicking **Add**, select the **Slave NO.** and **Trigger Mode** (typically **Cycle**).
   As shown in the figure, take writing the multi-reference value 0 of station 1 as the example. Slave NO. is 1, indicating that the operation will be performed on slave 1. Set Trigger Mode to **Cycle** and Function Code to **Write single register (06)**. Set the **Quantity** to 1, otherwise the write operation may fail. The register address of the multi-reference value 0 in the AC drive is 0xF027.



NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions	Function Code	Slave addr...	Quantity	Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	1000	Write Single Registe...	F027	1	D200	1

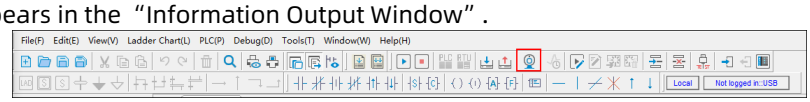
5. Read operation: After clicking **Add**, select the **Slave NO.** and **Trigger Mode** (typically **Cycle**).



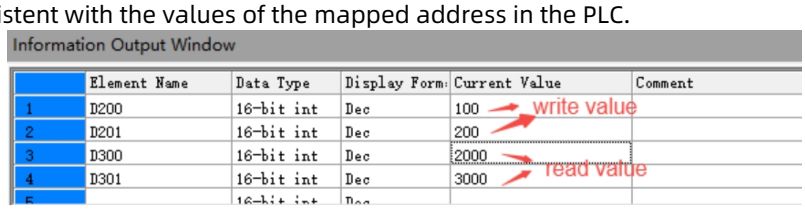
NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions	Function Code	Slave addr...	Quantity	Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	1000	Write Single Registe...	F027	1	D200	1
2	slave	1	Cycle(ms)	1000	Write Single Registe...	F028	1	D201	1
3	slave	1	Cycle(ms)	1000	Read Register(03)	F029	1	D300	1
4	slave	1	Cycle(ms)	1000	Read Register(03)	F02A	1	D301	1

   As shown in the preceding figure, take writing the multi-reference value 2 and 3 of station 1 as the example. **Slave NO.** is **1**, indicating that the operation will be performed on slave 1. Set **Trigger Mode** to **Cycle** and **Function Code** to **Read Register**; otherwise, the read operation will fail. Set **Quantity** to **1**, indicating only read a register. The register address of multi-reference 2 and 3 are 0xF029 and 0xF02A.

6. After the read and write operation settings, click **OK** to return to the programming interface.
7. Click the monitor icon at the PLC background software, and then the component monitoring interface appears in the “Information Output Window”.



8. Fill the component monitoring interface with the mapped address of each register in step 5. The background software of the AC drive reveals that the multi-reference values 0, 1, 2, and 3 are all 0, which is consistent with the values of the mapped address in the PLC.



9. In the background software of the PLC, change the current value of D200 to 100, and the current value of D201 to 200. Then in the software of the AC drive, the multi-reference value 0 and 1 are

written to 10.0 and 20.0 respectively (the parameter takes a value with one decimal place), indicating that the PLC write request has been received correctly.

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
F0-32	Main and auxiliary frequency operati...	0 [X+Y]	-	0	0	4	AnyModify	Decimalism	0xF020
F0-33	Additional frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF021
F0-34	Main frequency gain coefficient sour...	0 [100%]	-	0	0	9	AnyModify	Decimalism	0xF022
F0-38	Source of multi-reference 0	0 [F0-39]	-	0	0	6	AnyModify	Decimalism	0xF026
F0-39	Multi-reference 0	10.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF027
F0-40	Multi-reference 1	20.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF028
F0-41	Multi-reference 2	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF029
F0-42	Multi-reference 3	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF02A

10. In the background of the AC drive, change the multi-reference values 2 and 3 to 200 and 300 respectively. In the background of the PLC, you can see that D300 and D301 change to 2000 and 3000 respectively. This indicates that the AC drive has responded to the read operation of the PLC.

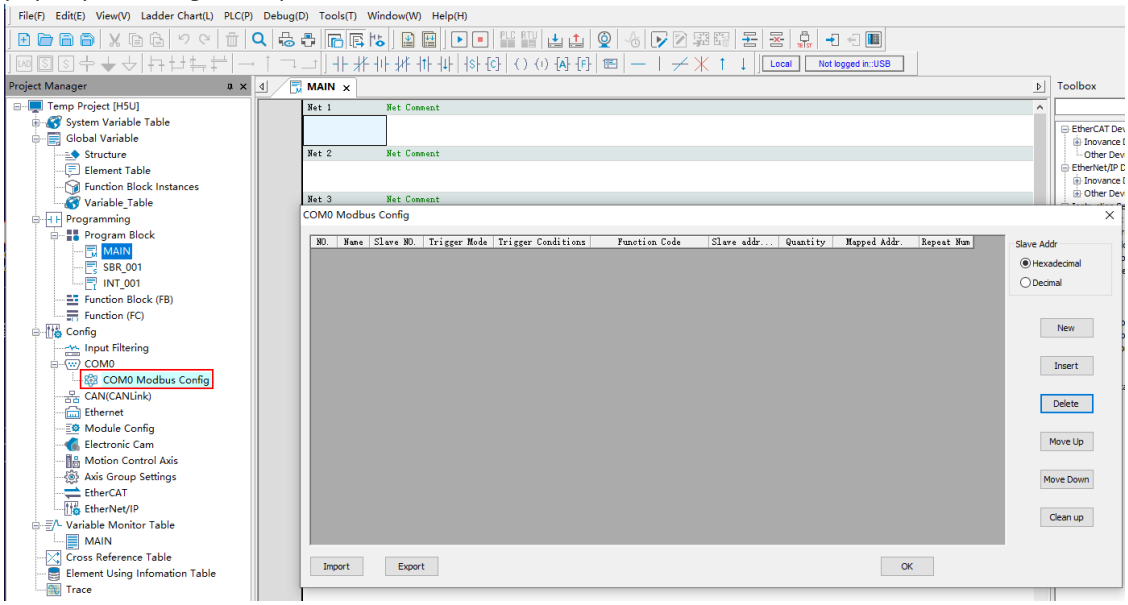
Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
F0-32	Main and auxiliary frequency operati...	0 [X+Y]	-	0	0	4	AnyModify	Decimalism	0xF020
F0-33	Additional frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF021
F0-34	Main frequency gain coefficient sour...	0 [100%]	-	0	0	9	AnyModify	Decimalism	0xF022
F0-38	Source of multi-reference 0	0 [F0-39]	-	0	0	6	AnyModify	Decimalism	0xF026
F0-39	Multi-reference 0	10.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF027
F0-40	Multi-reference 1	20.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF028
F0-41	Multi-reference 2	200.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF029
F0-42	Multi-reference 3	300.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF02A

Information Output Window

	Element Name	Data Type	Display Form:	Current Value	Comment
1	D200	16-bit int	Dec	100	
2	D201	16-bit int	Dec	200	
3	D300	16-bit int	Dec	2000	
4	D301	16-bit int	Dec	3000	
5		16-bit int	Dec		

Step 4: Control the AC drive through communication

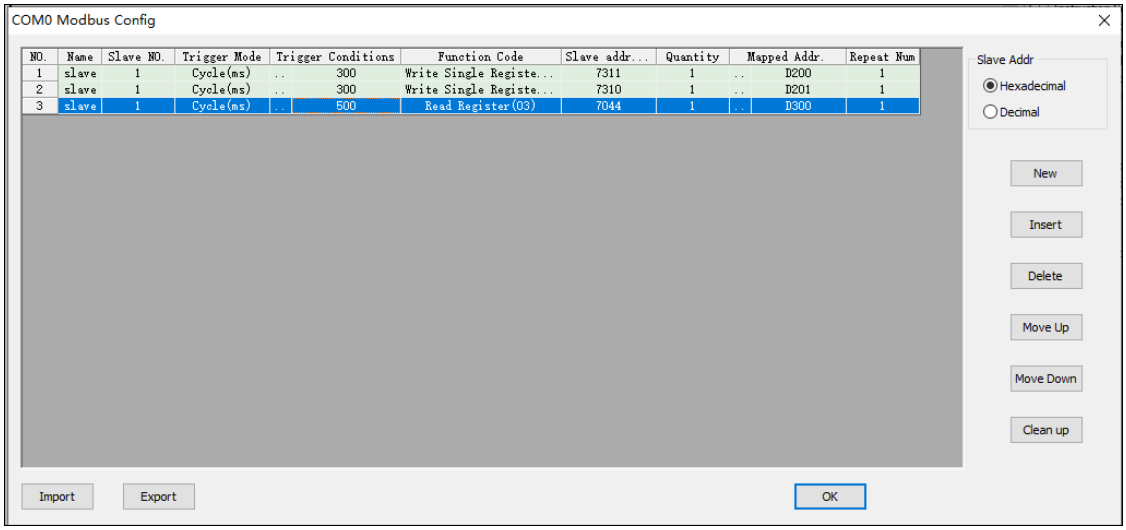
1. Click **COM0 Modbus Config** in Project Manager interface and the **COM0 Modbus Config** window pops up to configure request data of slave station.



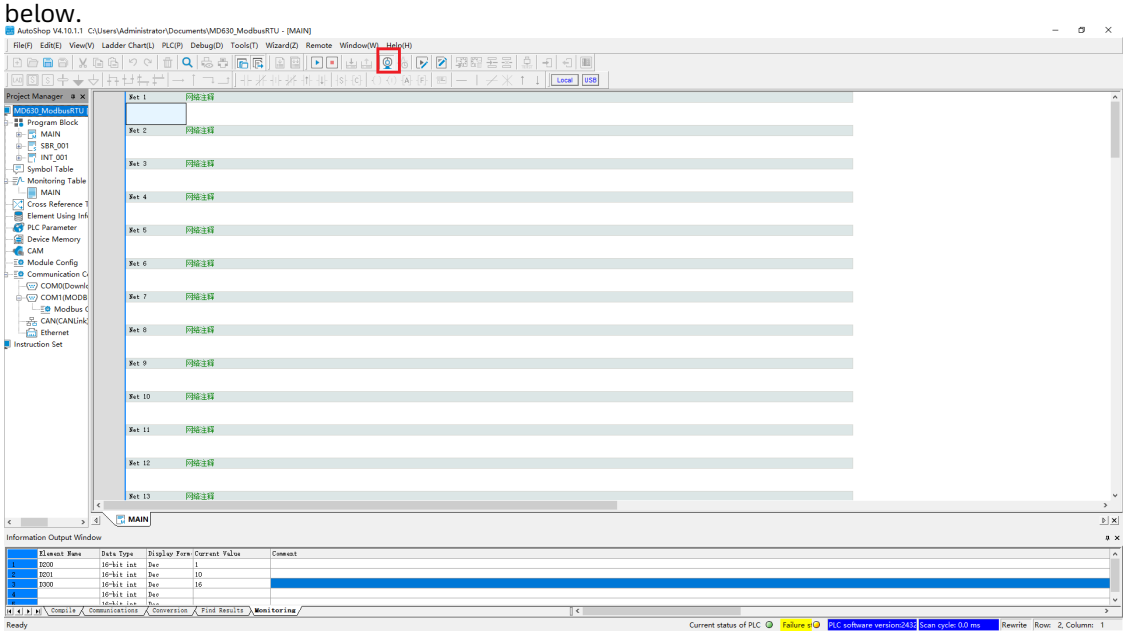
2. Configuration of request data

For start/stop control and setting frequency or torque using Modbus communication, read and write specific communication addresses of the AC drive. For start/stop control and setting frequency or torque, write request of addresses 7311H and 7310H need to be configured. In order

to know the operating state of the AC drive in time, you need to add 7044H read request configuration.



3. Click the motor monitoring icon and set the values of the control instructions in the Information Output Window, that is, add D200, D201, D300. These three registers correspond to the values of 7311H, 7310H, and 7044H parameter addresses. Observe the feedback value of D300 as set below.



Description of the communication address:

The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n014 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description of the communication address
AC drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit00: Running status. 0: Stopped; 1: Running Bit01: Running direction. 0: Forward; 1: Reverse Bit02: Fault state. 0: No fault; 1: Fault Bit03: Frequency reached. 0: Not reached; 1: Reached Bit04: Reserved Bit05: Reserved Bit06: Reserved Bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.7 EtherCAT Drive Control

6.7.1 Overview

EtherCAT communication is a real-time industrial fieldbus communication protocol based on Ethernet, with high performance, flexible topology, and low cost. High precision and simple application.

6.7.2 Communication Specifications

Table 6–7 EtherCAT communication specifications

Item	Specification
Communication protocol	EtherCAT protocol
Service supported	CoE (CANopen over EtherCAT) PDO (Process Data Object) SDO (Service Data Object)
Network setup time (Link)	Within 2s
Synchronization mode	DC-distributed clock (minimum synchronization time: 500μs)
Physical layer	100BASE-TX
Duplex mode	Full duplex
Topology	Linear, ring, star, and tree types
Transmission rate	100 Mbit/s (100Base-Tx)
Transmission medium	Shielded cables of Cat5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Communication terminals	/
Communication type	Ethernet protocol
EtherCAT frame length	44 bytes to 1498 bytes
Periodic process data	The total number of PDOs that can be mapped in a single direction does not exceed 16 and the length does not exceed 32 bytes.
Aperiodic service data	Supports: 1. Emergency message 2. SDO request 3. SDO response 4. TxPDO 5. RxPDO 6. Remote TxPDO transmission request 7. Remote RxPDO transmission request 8. SDO information
Minimum synchronous communication cycle	500μs
Max. cable length	100 m
Max. number of slaves connected	65535
Number of request messages received at the same time	/

6.7.3 Communication System Connections

Bus network topology

During communication in the bus networking topology, the master sends a data frame and passes through all the slave stations connected to the system in serial mode. Finally, return to the master station. When a message passes through a node, do not need to decode the entire Ethernet packet. Insert or read the process data in the corresponding position. The entire process message has a delay of nanoseconds. The following figure shows the data transmission.

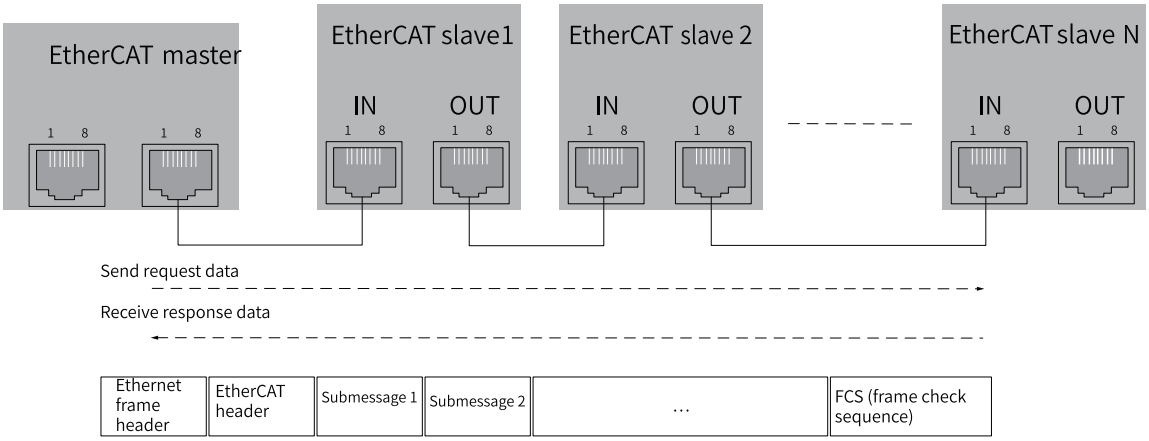


Figure 6-6 Data transmission diagram

Ring network topology

The ring network topology is a derivative of the bus topology. The difference is that the cables of the last-level devices are routed back to the redundant network ports of the master station. This topology inherits the advantages of a bus topology. Failure of a single node in the topology does not affect the entire topology.

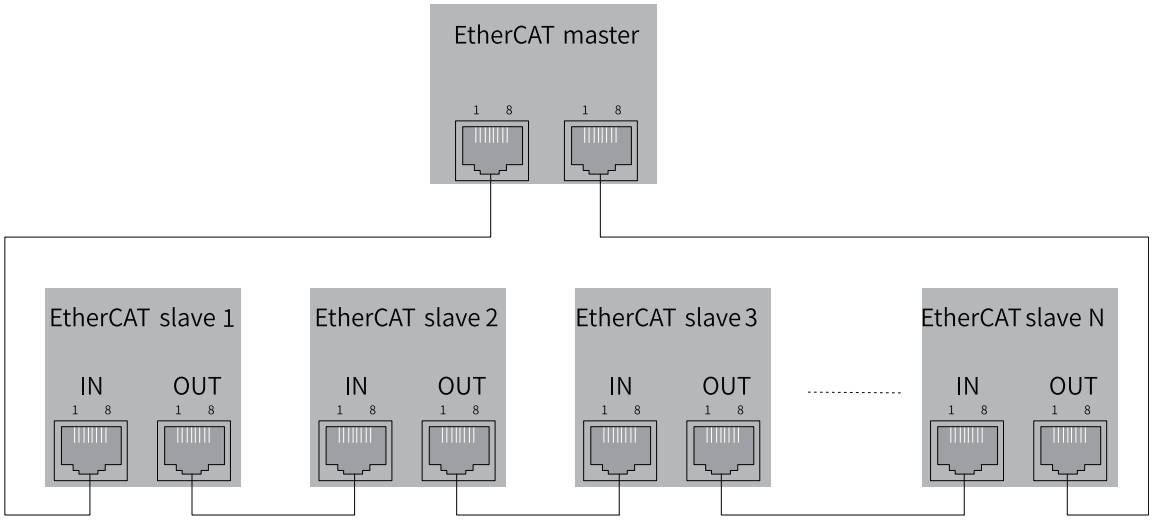


Figure 6-7 Ring network topology

Star network topology

In a star topology, cables are routed from the master station to the central hub ((splitter), and then connected to various devices through the central hub.

Compared with the bus topology, the star topology has an additional central hub, and failure in one node doesn't affect the rest. However, if the central hub is faulty, The communication of all devices is affected.

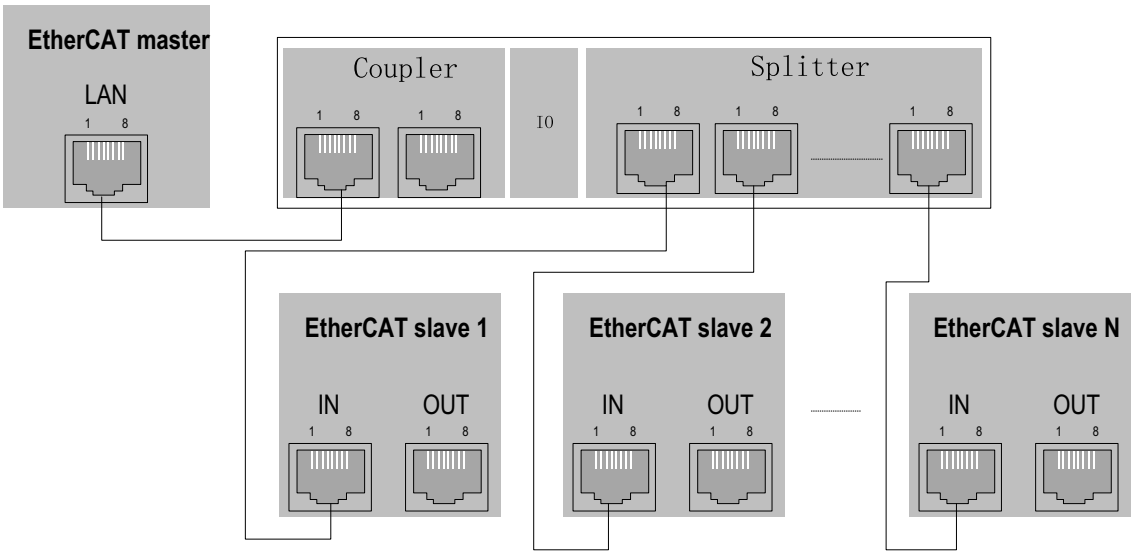


Figure 6-8 Star network topology

Tree network topology

The tree topology is a combination of star topology and bus topology, which makes field layout more flexible, but has the disadvantages of both topologies. When a central hub fails in the tree topology, all devices mounted to the central hub cannot communicate properly.

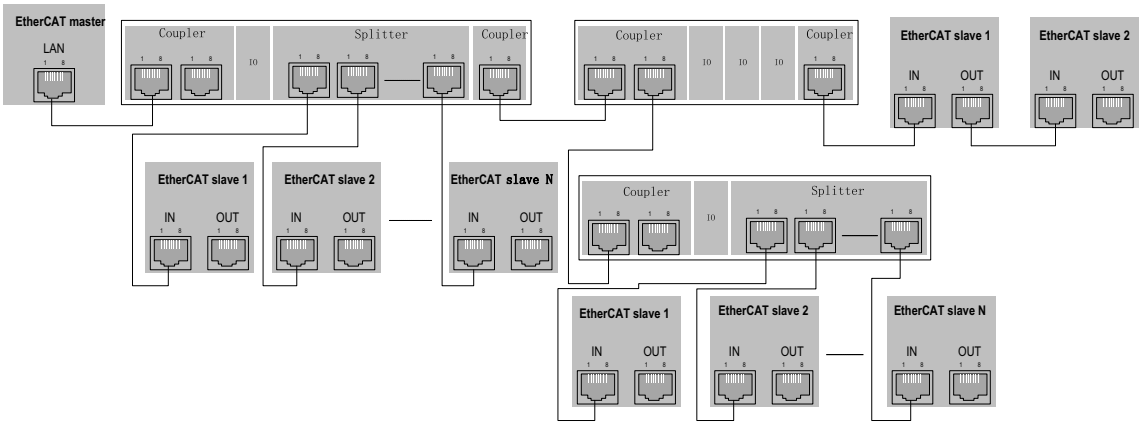


Figure 6-9 Tree network topology

6.7.4 Message

6.7.4.1 Diagnosis message structure

EtherCAT data is transmitted in the form of Ethernet data frames. The frame type used in the data frame is 0x88A4. EtherCAT data includes 2-byte data headers and 44 to 1498-byte data. The data area consists of one or more EtherCAT submessages, as shown in the following figure. Each sub-message corresponds to a separate device or slave storage area.

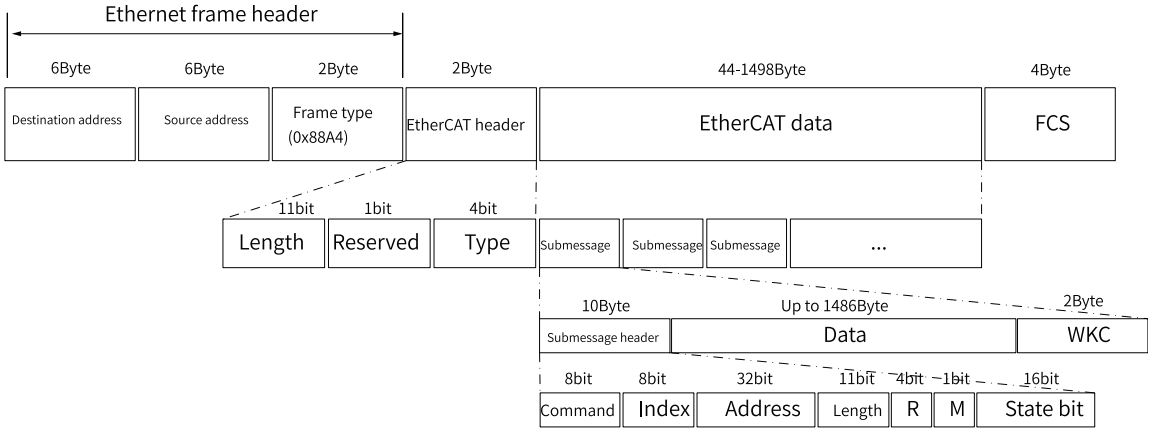


Figure 6-10 Diagnosis message structure

Table 6–8 EtherCAT data frame structure definition

Parameter Name		Meaning
Destination address		MAC address 1
Source address		MAC address 1
Frame type:		0x88A4
EtherCAT header	Length	The length of the EtherCAT data area, which is the sum of the length of all submessages.
	Type	1 indicates communication with the slave, and the rest of the data is reserved.
EtherCAT	Submessage 1	Each EtherCAT subpacket consists of a subpacket header, a data field, and a corresponding working counter (WKC, Working Counter). Subheader: Contains command, index, address area, length, Status and other key information. Data: User-defined data information. WKC: Records the number of times a submessage is operated by the slave.
FCS		FCS (Frame Check Sequence) frame check sequence

The structure of EtherCAT submessages is defined in the following table.

Table 6–9 Defines the structure of EtherCAT submessages

Parameter Name	Meaning
Command	Addressing mode and read/write mode
Index	Code
Address	Slave address
Length	Data area length
R	Reserved - Reset

Parameter Name	Meaning
M	Flag of subsequent message
State bit	Interrupt arrival flag[Note 1]
Data	Subpacket data structure (user-defined)
WKC	Counter

Note 1:

In EtherCAT, when the slave processes a cycle of process data exchange, it sends an interrupt character to the master to notify the master. This interrupt character contains important information, such as error flag and slave state.

In the EtherCAT master implementation, there is usually an ISR (Interrupt Service Routine) to handle this interrupt. When the hardware detects an interrupt signal (for example, through the MII or MAC interrupt pin of the EtherCAT slave), the interrupt service routine is triggered. In the ISR, the hardware state registers are read, interrupt characters are parsed, and the logic is processed based on the contents of interrupt characters.

6.7.4.2 Process data

The PDO data enables the master to modify and read AC drive data in real time and perform periodic data exchange with the AC drive. The data communication addresses are directly configured by the AC drive. The data mainly includes the following:

- The AC drive communication reference control word and communication reference frequency.
- Reading the current state and running frequency of the AC drive in real time
- Real-time exchange of function parameters and monitoring parameters between the AC drive and EtherCAT master station

The PDO is used for periodic data exchange between the master station and AC drive, as described in the following table.

Table 6–10 Interactive data

PDO (0x1600) Sent by the Master Station		
Fixed RPDO		Variable RPDO
Communication reference control word (0x2073:12) (0x2073/12)	Frequency set through communication (0x2073/11)	Real-time modification of AC drive function parameters
RPDO1	RPDO2	RPDO3 to RPDO16
PDO Responded by AC Drive (0x1A00)		
Fixed TPDO		Variable TPDO
Running state (0x2070/45)	Operating frequency (0x2070/46)	Real-Time Reading of AC Drive Parameters
TPDO1	TPDO2	TPDO3 to TPDO16

Caution

Fixed PDOs are not recommended to change. The fixed PDO meets the basic operating requirements of the AC drive. Otherwise, the device cannot operate normally.

6.7.4.3 Message Instances

6.7.4.3.1 Periodic process data communication

Cyclic process data communication usually uses FMMU for logical addressing. The master can use logical read, write, or exchange commands to operate multiple slaves at the same time. Several PDO mapping objects are included during EtherCAT cyclic data communication. The CoE defines the PDO mapping object list of the sync manager with 0x1C10 to 0x1C2F. The Sync manager PDO assignment objects describe how these PDOs are related to the Sync Manager. Take the cyclic output data as an example. The output data uses SM2 channel. The PDO assignment is defined by the object data 0x1C12. The message structure is shown in the following figure.

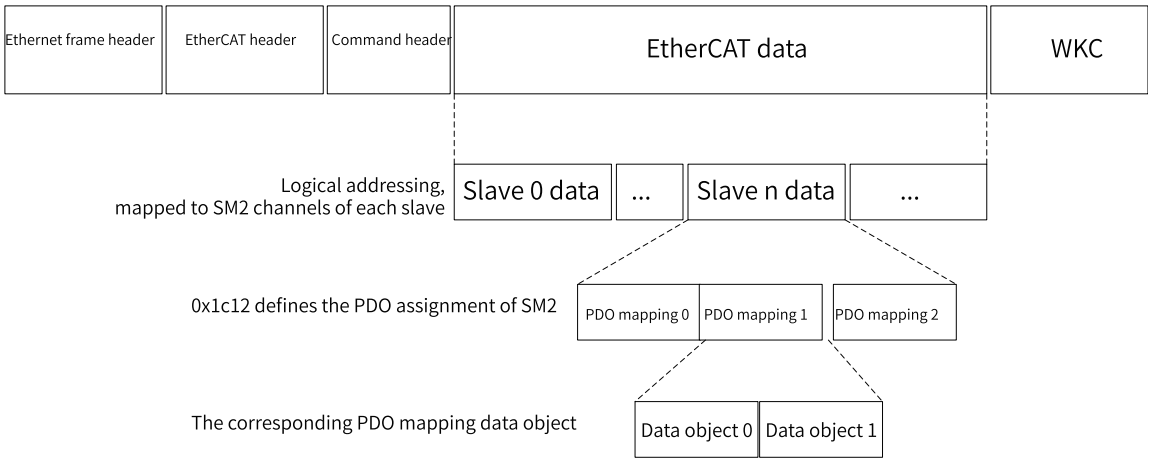


Figure 6-11 PDO data mapping assignment message structure

6.7.4.3.2 Non-periodic mailbox data communication

Non-periodic mailbox data communication can be conducted in both directions, from master to slave and from slave to master. Full duplex, two-direction independent communication, and multi-user protocols are supported. The master station is used as the router to manage the communication from the slave station to the slave station. The mailbox communication data header includes an address field to enable the master station to send the mailbox data again. Mailbox data communication is the standard method for parameter exchange. When you configure periodic process data communication or require non-periodic services, you use mailbox data communication.

The following figure shows the structure of the mailbox data message. Mailbox communication corresponds to only one slave station. Therefore, the message uses the device addressing mode. The following table defines the structure of the mailbox data header.

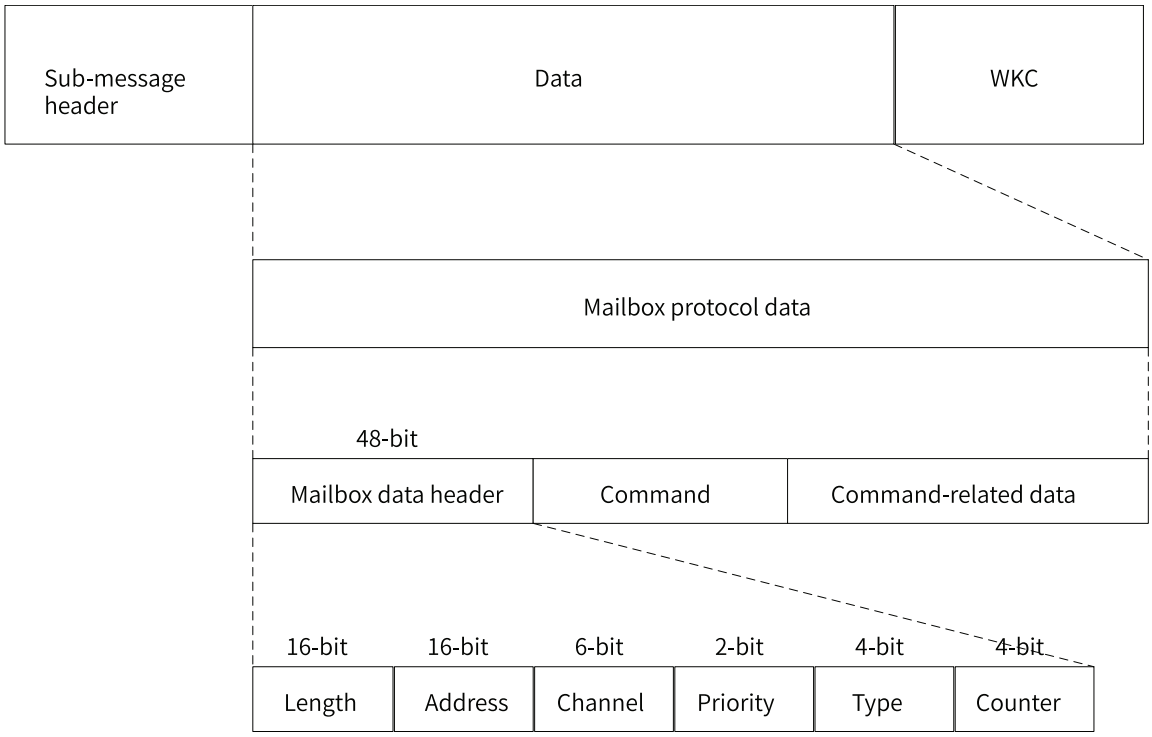


Figure 6-12 Mailbox data message structure

Table 6–11 Defines the structure of the mailbox data header

Parameter Name	Length (bit)	Description
Length	16	Invalid command code length
Address	16	The address of the data source slave is used for communication between the master and slave The slave address of the data destination is used for communication from the slave station to the slave station
Channel	6	Reserved
Priority	2	Reserved
Type	4	Mailbox type, protocol ID of the following data: Communication errors occur. 2: EoE (Ethernet over EtherCAT) CoE function block: CANopen over EtherCAT 4: FoE (File Access over EtherCAT) 5: SoE (Servo Drive over EtherCAT) 15: VoE (Vendor specific profile over EtherCAT)
Counter	4	Used to calculate the serial number of repeated detection. Add 1 to each new mailbox service

When mailbox communication error occurs, the response data is defined as follows:

Data element	Length (bit)	Description
Command	16	0x01 command
Data related to the command	16	0x01 mailbox syntax error 0x02 does not support the mailbox protocol 0x03 The mailbox channel is invalid 0x04 does not support mailbox service 0x05 The mailbox header is invalid 0x06 The mailbox data is too short 0x07 The mailbox service memory is insufficient 0x08 The number of mailbox data is incorrect

The EtherCAT master supports non-periodic data communication through the SM channel for reading/writing mailbox data. The following table describes the definition of mailbox data. The CoE protocol mailbox data structure is shown in the following figure.

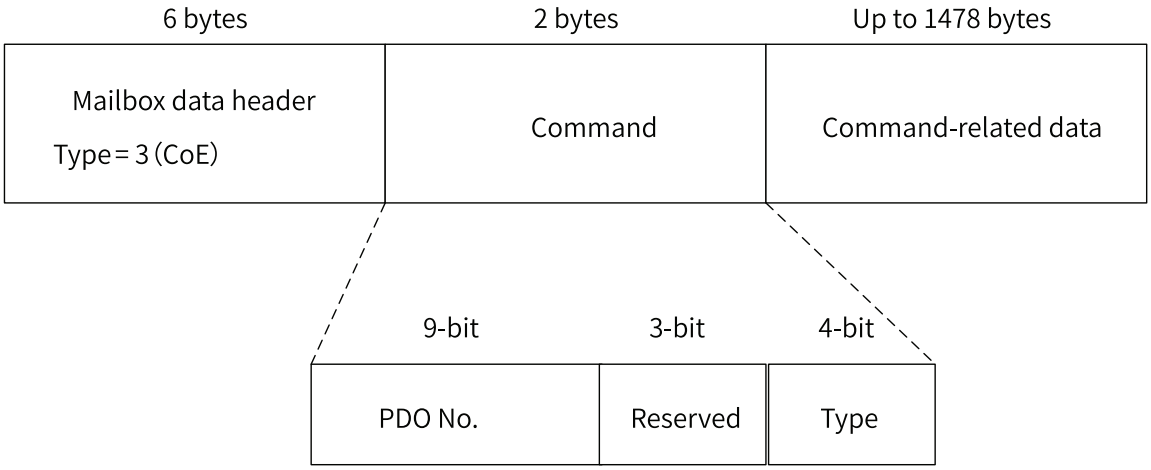


Figure 6-13 The SM channel implements the non-periodic data communication message structure

Table 6–12 Definition of mailbox data commands

Field	Status
PDO Number	The PDO serial number used for transmitting PDOs
Type	CoE service type. 0: Reserved Emergency message SDO request SDO response 4: TxPDO 5: RxPDO Remote TxPDO transmission request Remote RxPDO transmission request 8: SDO information service. You can read complete object dictionary information such as object dictionary list and data object description from the slave 9 to 15: Reserved

CoE communication service types 2 and 3 are SDO (service data object) communication services. The SDO data frame format is shown in the following figure. There are three transmission types of SDO communication services, namely, fast transmission service, regular transmission service, and segmented transmission service.

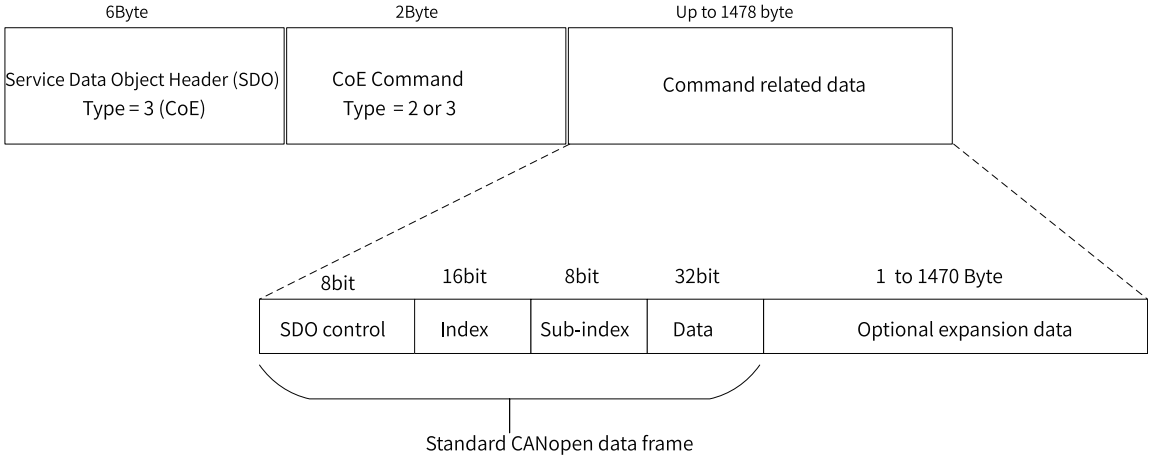


Figure 6-14 Structure of SDO data message

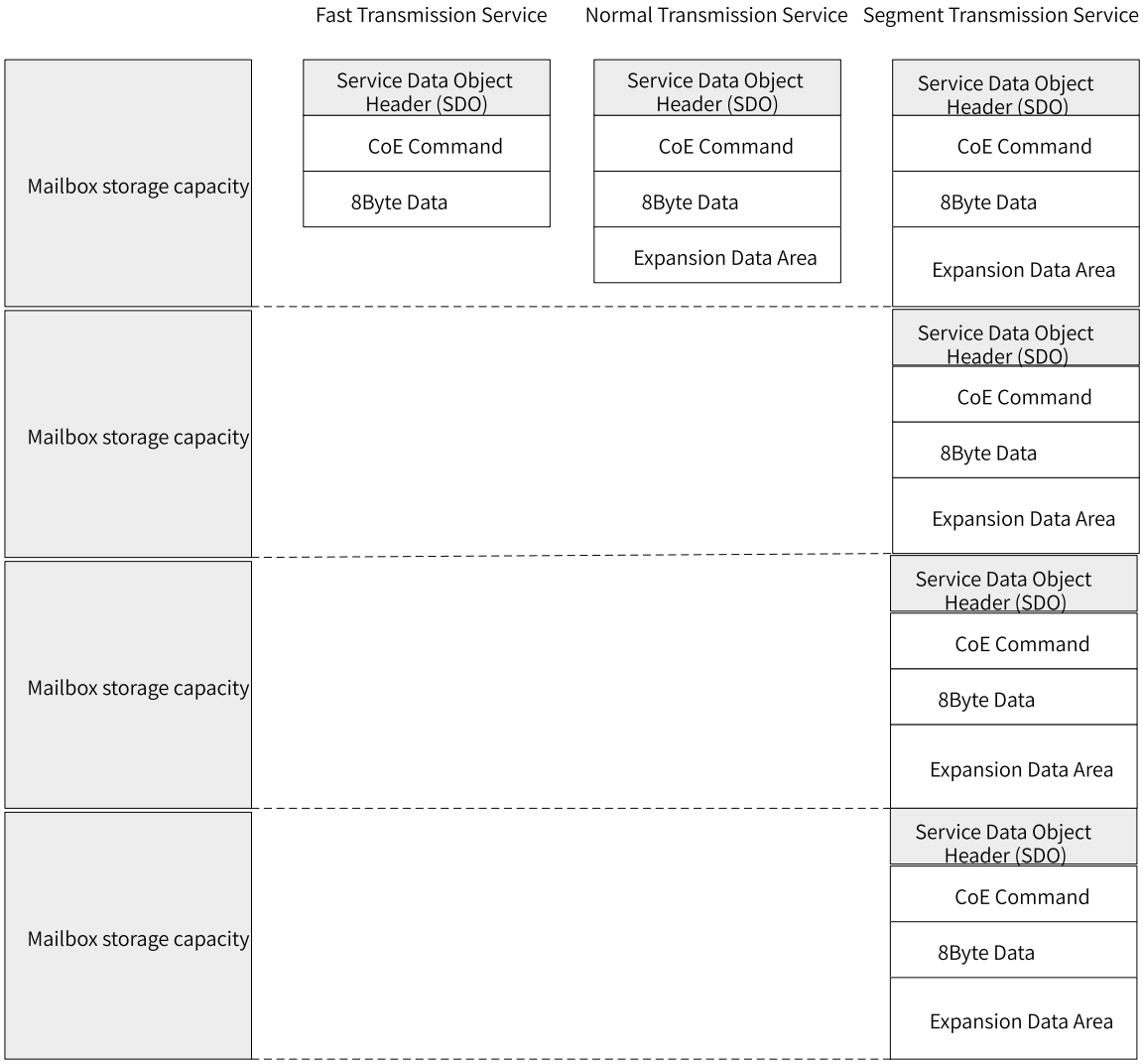


Figure 6-15 SDO transmission type

6.7.4.4 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 853*.

6.7.4.5 Mapping table (AC drive data)

For details, see *"6.5.3 Mapping Table" on page 854*.

Mapping relation between the mapping table and the EtherCAT protocol object dictionary:

For the EtherCAT protocol object dictionary, address offset processing is performed on the basis of this mapping table. The EtherCAT object dictionary address is 0x2000.

The high 8 bits of each address in the mapping table are converted to the low 8 bits of the object dictionary index. The lower 8 bits of each address in the mapping table are converted to a sub-index of the object dictionary after being added by 1.

Example:

The address 0x7001 in the mapping table corresponds to 0x2070:02 in the EtherCAT object dictionary.

Calculation method: (0x2000 + 0x0070): (0x0001 + 0x0001

6.7.5 Communication Terminals

The EtherCAT bus adopts standard RJ45 network port and standard registered jack. Use Cat 5e shielded twisted pairs and injection cables with iron housing. According to FastEthernet , when an EtherCAT bus is used, the length of the cable between the devices cannot exceed 100 m, exceeding which can attenuate the signal and affect communication.

The MD630-INT bus model supports the EtherCAT protocol. Use J9 (terminal mark IN) and J5 (terminal mark OUT) interfaces to communicate. For example, the RJ45 port facing the MD630N is the IN port on the left. The right side is the OUT port.

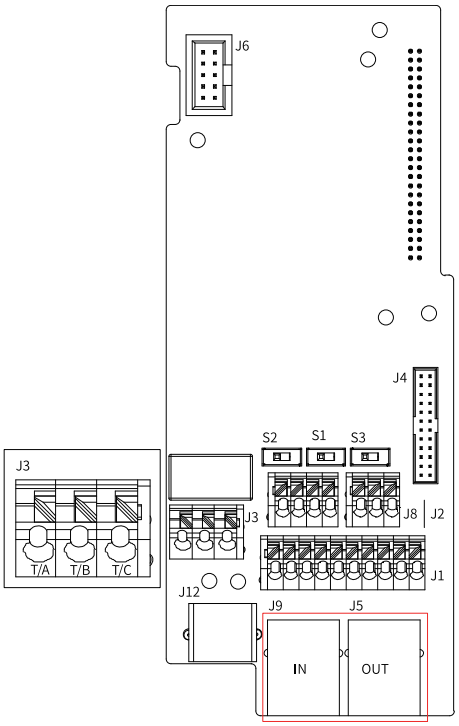


Figure 6-16 EtherNet/IP communication terminal location

EtherCAT communication terminal description:

External Interface	Terminal type	Transmission information type	Terminal identification	Name	Terminal function description
J9	RJ45 terminal	100M bus	IN	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. The protocol type is selected through N0-10. When ECAT is selected, it is the IN port. EIP/PN does not distinguish the direction.
J5	RJ45 terminal	100M bus	OUT	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. The protocol type is selected through N0-10. When ECAT is selected, it is the OUT port. EIP/PN does not distinguish the direction.

Indicator status of the network port light:

Indicator name	Status	Remarks
LED0 (green)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.
	Blinking	Data interaction between devices
LED1 (yellow)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.

6.7.6 Connect the AC drive to the bus system

The EtherCAT bus uses standard RJ45 network ports with standard registered jacks, and uses 100BASETX Category 5 cable, allowing a maximum cable length of 100 meters between two devices and supporting a maximum number of stations of 65535.

Connecting steps:

1. Disable system power supply of the AC drive.
2. Connect the EtherCAT master and EtherCAT slave with shielded network cables.
   *"6.7.3 Communication System Connections" on page 874*Connect the network cables to the network port terminals with metal shield and separate the input (IN) and output (OUT) interfaces, as shown in the following figure. See *"6.7.5 Communication Terminals" on page 882*section for communication interface specifications.

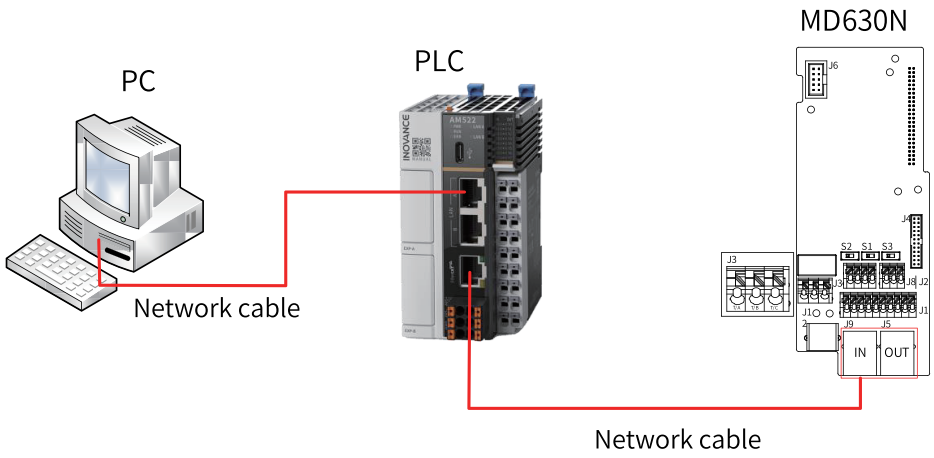


Figure 6-17 EtherCAT Communication Connection

Shielded twisted pairs are used as the EtherCAT bus for network data transmission. Cables with the following specifications are recommended.

Items	Specifications
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Standards compliance:	EIA/TIA568A, EN50173, ISO/IEC11801, EIA/TI Abulletin TSB, EIA/TIA SB40-A & TSB36
Cross sectional area	26AWG
Conductor type	Twisted pair
Number of pairs	4

3. Power on the AC drive after ensuring that connections other than communication connection are correct.

6.7.7 Configure Communication Between AC Drive and Controller

The MD630N-INT can serve as an EtherCAT slave and support communication with the standard EtherCAT master devices, such as Inovance, Beckhoff, and Omron. If the communication is not supported, contact technical support.

Procedure

1. Make sure that the wiring is correct as in *"6.7.6 Connect the AC drive to the bus system" on page 884*.
2. Switch the device communication mode to EtherCAT communication (n0-10 = 1), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for channel 1 (b0-03 = 0, b5-00 = 9). (You can operate through the operating panel or the software.)
3. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
4. Configure the communication between the master station (controller) and the slave station (AC drive). For details, see *"6.7.10.1 Communication Instance When the MD630N-INT Is Controlled by the Inovance AC801" on page 889*.

6.7.8 Communication Parameters

Group n4 of the AC drive parameters defines EtherCAT communication parameters.

Table 6–13 EtherCAT communication related parameter

Param.	Name	Default	Setting Range	Change Method	Description
n0-09	Active communication mode	0	0: Invalid 1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	Unchangeable	Displays the active communication mode.
n0-10	Communication type	1	1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	Change at stop	Sets the communication type: Value description: 1: EtherCAT - EtherCAT communication applies. 2: EtherNet/IP - EtherNet/IP communication applies. 3: PROFINET - PROFINET communication applies. 4: Modbus TCP - Modbus TCP communication applies.
n4-16 (Fd-39)	Station name	0	0 to 65535	Unchangeable	Displays EtherCAT slave name.
n4-17 (Fd-40)	Station alias	0	0 to 65535	Real-time change	Sets the EtherCAT slave alias. Note: 1. If n4-17 is set to 0, the slave alias is configured by the master. 2. If n4-17 is not set to 0, if the master does not set the slave alias, the slave alias is set by n4-17. If the master sets the slave alias, the slave alias is set by the master.
n4-18	Station alias backup	0	0 to 65535	Unchangeable	Displays the EtherCAT slave alias.
n4-33	XML file version	0	0 to 65535	Unchangeable	Displays the XML file version.

Param.	Name	Default	Setting Range	Change Method	Description
n4-34	Device synchronization mode	0	0 to 65535	Unchangeable	Displays the synchronization mode of MD630.
n4-35	Synchronization cycle	0	0 to 65535	Unchangeable	Displays the synchronization cycle of MD630.

6.7.9 Communication Fault Diagnosis

When communication is faulty, the operating panel of the MD630N displays the corresponding fault code. The following table describes EtherCAT-related communication faults and solutions.

Table 6–14 EtherCAT-related communication faults and solutions

Fault Code	Fault Name	Cause	Troubleshooting	Solution
E167.1	EtherCAT Sync lost	The slave hardware (such as the ESC register) causes the synchronization signal to be lost and the drive runs improperly.	Observe whether the indicator (difference between SYNC and IRQ phases) is larger than the synchronization cycle set by the master through the continuous oscilloscope function of Inovance software, If yes, it indicates a fault.	Replace the AC drive or contact technical support.
E167.2	EtherCAT link lost	The physical connection of the data link is unstable or the process data is lost due to plug-in/plug-out of the network cable.	When the device is not powered on again, view the value of the link loss register through the software tool of the master. If it is not zero or the value increases continuously, the process data is lost.	Check whether the network cable of the drive is connected reliably. Check whether the network cable is loose due to strong vibration in the field. Ensure that the network cable is connected securely.
E167.3	EtherCAT read-only memory loading fault	The information saved in EEPROM is incorrect.	The version number defined by n4-33 is not 0, but E167.3 is still reported.	Program the XML file again.
		The XML file is not programmed in Flash.	The version defined by n4-33 is 655.35.	Program the XML file again.
E167.4	EtherCAT initialization fault	Hardware fault (such as ESC chip fault)	EtherCAT cannot communicate properly, and the master cannot scan to recognize the slave device.	Replace the AC drive or contact technical support.
E167.5	ESC state switchover fault	During the application layer state switchover, the register of ESC is forcibly modified due to faults of the master or manual operation.	A master status switchover fault occurs.	Restart the device.
E167.6	Distributed clock not enabled in EtherCAT	The master is faulty or the master is operating improperly.	Check whether the master is configured correctly or analyze whether the master is faulty by capturing the packet.	Configure the master properly or ask for technical support.

Fault Code	Fault Name	Cause	Troubleshooting	Solution
E167.7	The number or length of EtherCAT PDO mapping exceeds the limit.	The master configuration information is incorrect.	Check whether the PDO is configured correctly.	Configure the number of mapped PDOs and bytes correctly. You can configure a maximum of 16 PDOs per group, and a maximum of 32 bytes per group of PDOs.
E167.8	EtherCAT process data reception timeout	The data frame is lost at the upstream station and the upstream station is faulty.	If master communication is not recovered, view the synchronous loss counter value (n4-30) of the drive. When a fault occurs, the value is not 0.	Check whether link loss occurs on the upstream station. Check that the wiring is correct.
		The performance of the master is poor, the jitter of the IRQ exceeds the set value x communication cycle.	Observe the SYNC and IRQ phases through the online oscilloscope function in the software tool of the drive. When a fault occurs, the phase is greater than or equal to the synchronization loss threshold x communication cycle.	Check whether the CPU operation load of the master is too large. You can optimize load reduction of the master by reducing the communication time and setting a high synchronization loss threshold.
E167.9	EtherCAT ESC port 0 reception fault	The data is lost due to EMC interference, poor quality of the network cable or improper connection.	View the fault counter values of port 0 and port 1 in the master software tool, or view the corresponding port parameter of the drive. The values of port 0 (n4-25) and port 1 (n4-26) are not 0.	Check whether proper grounding is performed and rectify EMC measures. Check whether the network cable used is provided by Inovance and whether the network cable is reliable.
E168.1	EtherCAT ESC port transfer and EPU processing fault	The data frame is damaged due to an upstream station fault or a link fault.	The values of the transfer fault counter (n4-27) and the processing unit fault counter (n4-28) change.	The upstream station may be disturbed, the link layer may be faulty, and the hardware is faulty. Replace the upstream station or contact technical support if necessary.
E168.2	EtherCAT MailBox setting fault protection	The master imports the wrong XML file.	Check whether the master imports the correct XML file. The XML file must meet the following conditions: 1. SM channel is enabled. 2. The read/write direction is configured correctly. 3. The mailbox mode (single buffer mode) is configured. 4. The length of the data received is within the set range. 5. The address of the data received is within the set range. 6. The memory of the read/write mailbox does not overlap.	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

Fault Code	Fault Name	Cause	Troubleshooting	Solution
E168.3	EtherCAT SM2 setting fault	The master imports the wrong XML file.	Check whether the master imports the correct XML file and check the following items: 1. Check whether the SM2 channel is configured correctly. The configuration must meet the following conditions: 1) The SM length and RxPDO length are 0 when SM2 is not enabled. 2) The SM2 channel is in write direction. 3) The memory of SM2 does not overlap with adjacent SM1 or SM3. 2. Check whether the index of the RxPDO mapping object dictionary is out of the limit (the maximum index is 0x0A). The following conditions must be met: 1) The length of the RxPDO is matched. 2) In the preop state, the address of RxPDO is in the set address field (maximum and minimum addresses), or in a non-preop state, the address of SM2 is not equal to the starting address of RxPDO. 3) PDO mapping object dictionary index does not exceed the set maximum (0x1600 to 0x170A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.
E168.4	EtherCAT SM3 setting fault	The master imports the wrong XML file.	Check whether the master imports the correct XML file and check the following items: 1. Check whether the SM3 channel is configured correctly. The configuration must meet the following conditions: 1) The SM length and TxPDO length are 0 when SM3 is not enabled. 2) The SM3 channel is in read direction. 3) No overlap occurs among the memory of SM2, SM3, SM0, or SM1. 2. Check whether the index of the TxPDO mapping object dictionary is out of the limit (the maximum index is 0x1A). The following conditions must be met: 1) The length of the TxPDO is matched. 2) In the preop state, the address of TxPDO is in the set address field (maximum and minimum addresses), or in a non-preop state, the address of SM3 is not equal to the starting address of TxPDO. 3) PDO mapping object dictionary index does not exceed the set maximum (0x1A00 to 0x1B0A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

Fault Code	Fault Name	Cause	Troubleshooting	Solution
E168.5	EtherCAT PDO watchdog setting error	The master is configured incorrectly or the attempt to configure the master failed.	The value of ESC state register 0x0134 read through the master software tool is 0x001F.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.
E168.6	EtherCAT does not have sync signal	During the switchover process from SAFEOP to OP, DC is enabled but not operating due to the following reasons. 1. The DC startup time and DC activation time are set incorrectly. 2. No pulse signal input.	The value of ESC state register 0x0134 read through the master software tool is 0x002D.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.
E168.7	EtherCAT Phy initialization configuration fault	1. ESC is not working before reading the phy ID. 2. The phy chip is damaged. 3. Data is interfered. 4. The model configured is different from the actual model of phy.	Check the hardware to see whether the PHY chip is working properly.	Replace the AC drive and contact technical support,
E168.8	The pulse length of the synchronous data signal configured in the EtherCAT read-only memory is abnormal.	1. The master incorrectly writes EEPROM configuration data. 2. There is a difference between the XML file imported by the master and the information in the slave.	Check whether there is any difference between the XML file information saved in the slave device (which can be read through the master software tool) and the XML file information imported to the software tool.	Reset the ESI file by setting n4-41 to 1 or re-program the XML file. If the fault persists, contact technical support.

6.7.10 Communication Configuration Examples

6.7.10.1 Communication Instance When the MD630N-INT Is Controlled by the Inovance AC801

Prerequisite

Ensure that all equipment is correctly wired, see *"6.7.6 Connect the AC drive to the bus system" on page 884*.

Operation steps:

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Import the device description file (XML) of the MD630N-INT to the host controller software (otherwise, the slave cannot be added later) and add the MD630N-INT device.
4. Open the host controller software InoProShop and select “**New Project**” . Select the PLC model in the pop-up interface, and click "**OK**". Save the project to the specified path (path can be modified).

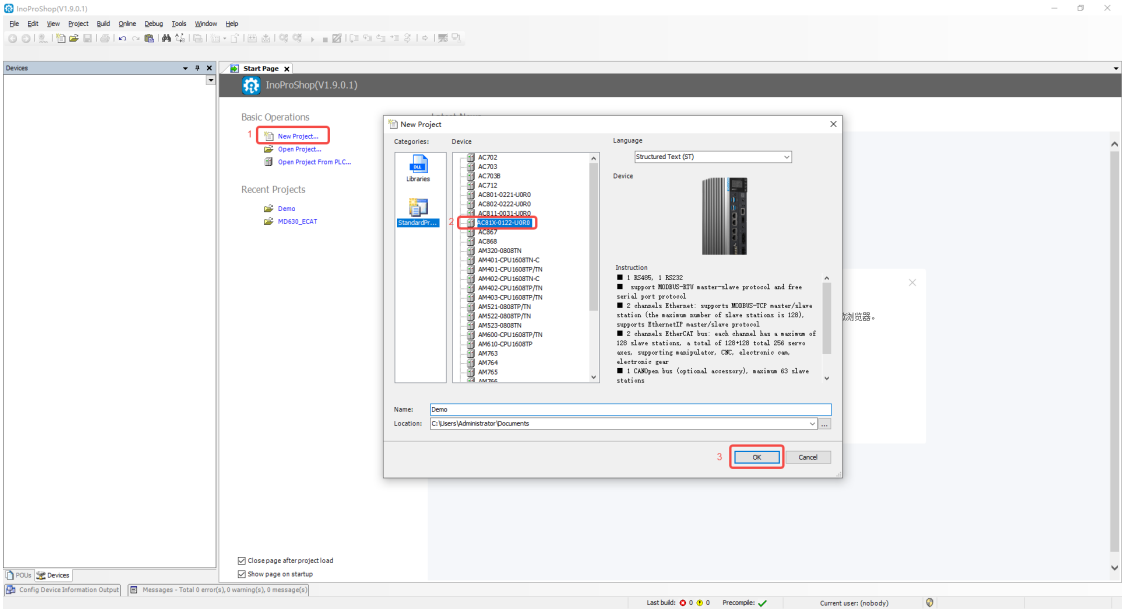


Figure 6-18 Create a project

5. Import the device description file (XML) of the AC drive; otherwise, the AC drive cannot be identified.
   Click “**Tools**” -> “**Device Repository**” . Then after the pop-up interface appears, click **Install**.

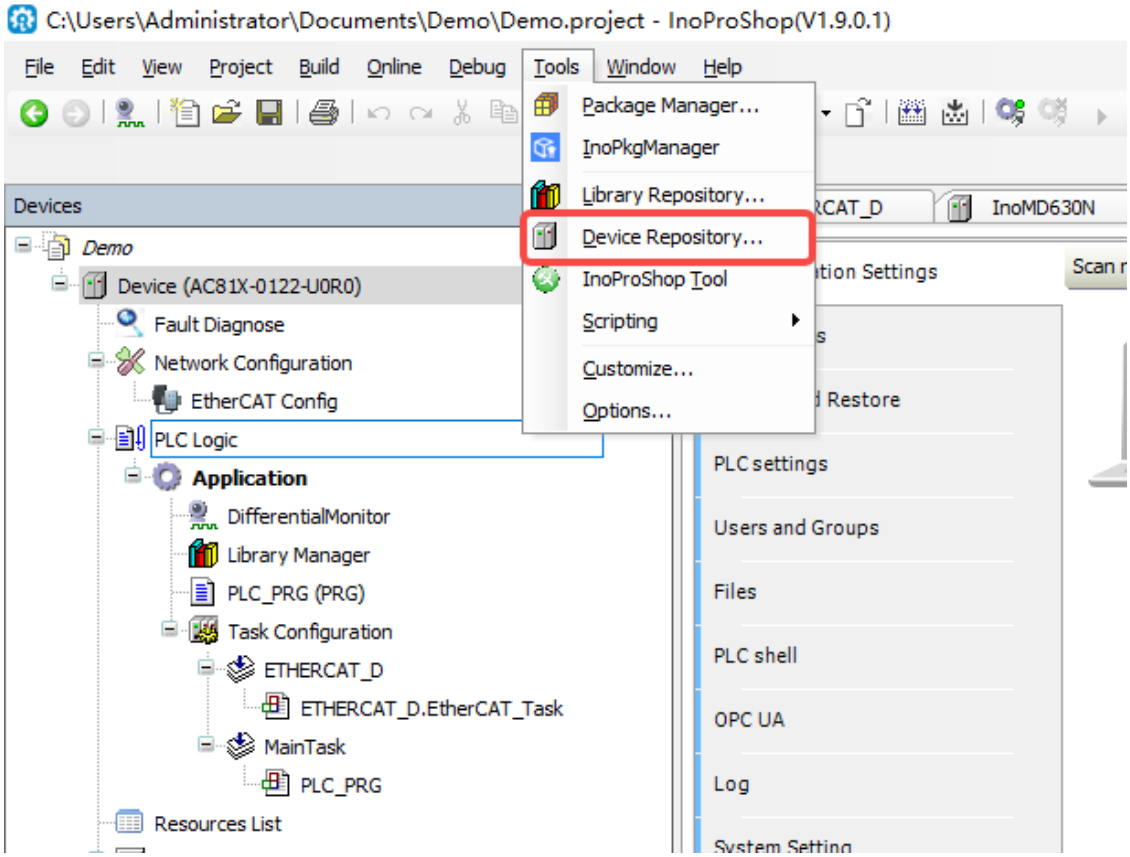


Figure 6-19 Add a device description file

6. After clicking **Install**, the "**Install Device Description**" interface appears. Select the file in "*.xml" format. Otherwise, the XML file of the device cannot be displayed. Click "**Open**" and wait for a few seconds. Then the installation is completed.

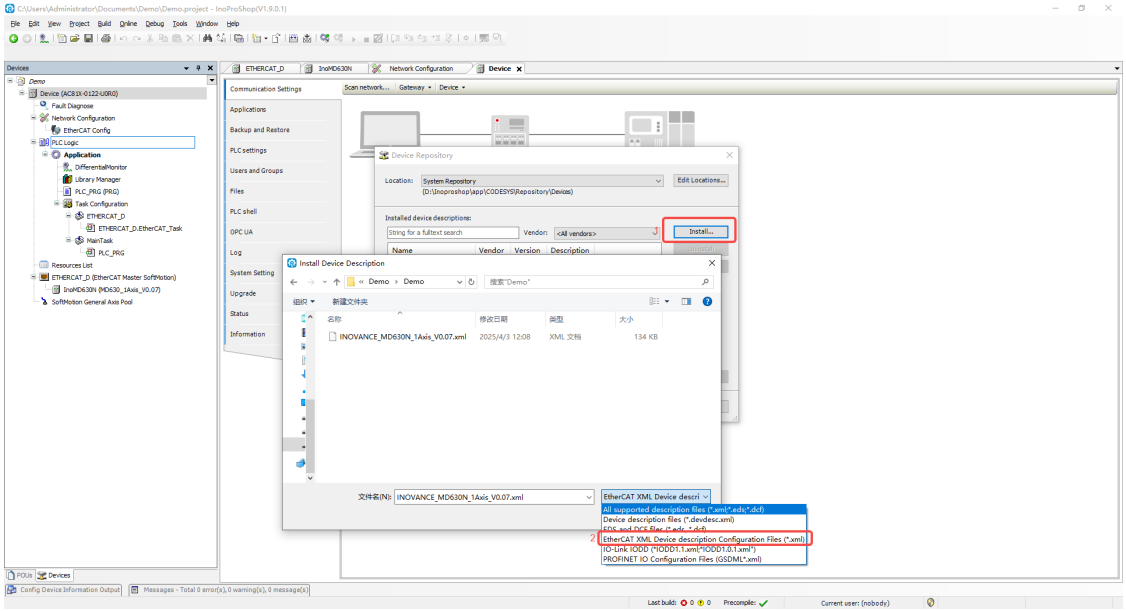


Figure 6-20 Install the device description file

7. After entering the interface, double-click "**Device**" and the blank area on the right displays detailed information. Then, click "**Scan network**" to pop up the "**Select Device**" window, and then scan the network to identify the PLC device.

Note

The IP address of the computer connected to the PLC should be set in the same segment as the PLC's IP which can be viewed through the panel.

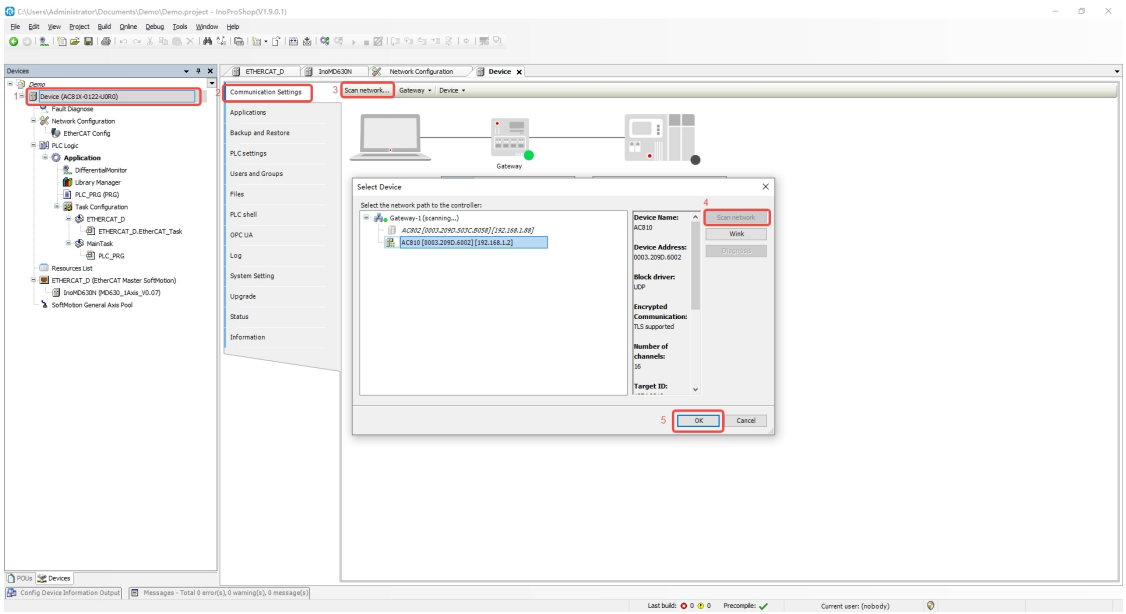


Figure 6-21 Scan and identify the master device

8. After identifying the correct PLC, click "**Network Configuration**" to select the supported communication interface. Check the "EtherCATMaster" box.

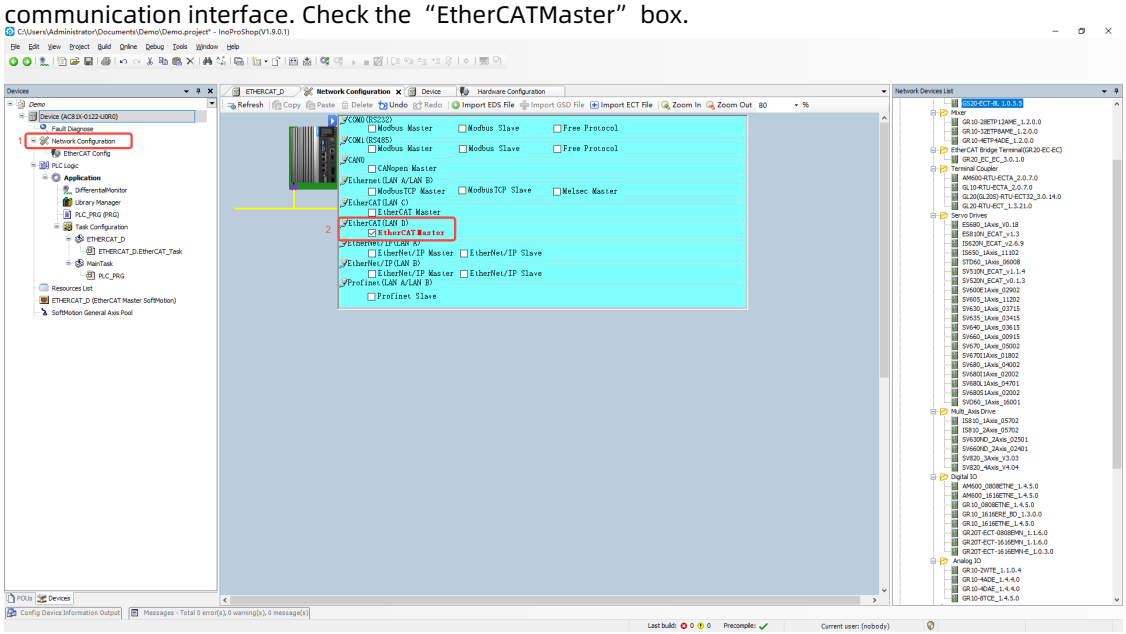


Figure 6-22 Configure master communication interface

9. Locate "**ETHERCAT_C (EtherCAT Master SoftMotion)**" in the device bar on the left. Right-click on the pop-up bar and select "**Scan Device**". The **Scan Devices** window will pop up. Click "**Scan Device**" below to scan the MD630N-INT.
   Click "Copy Scan Device" to complete adding the AC drive.

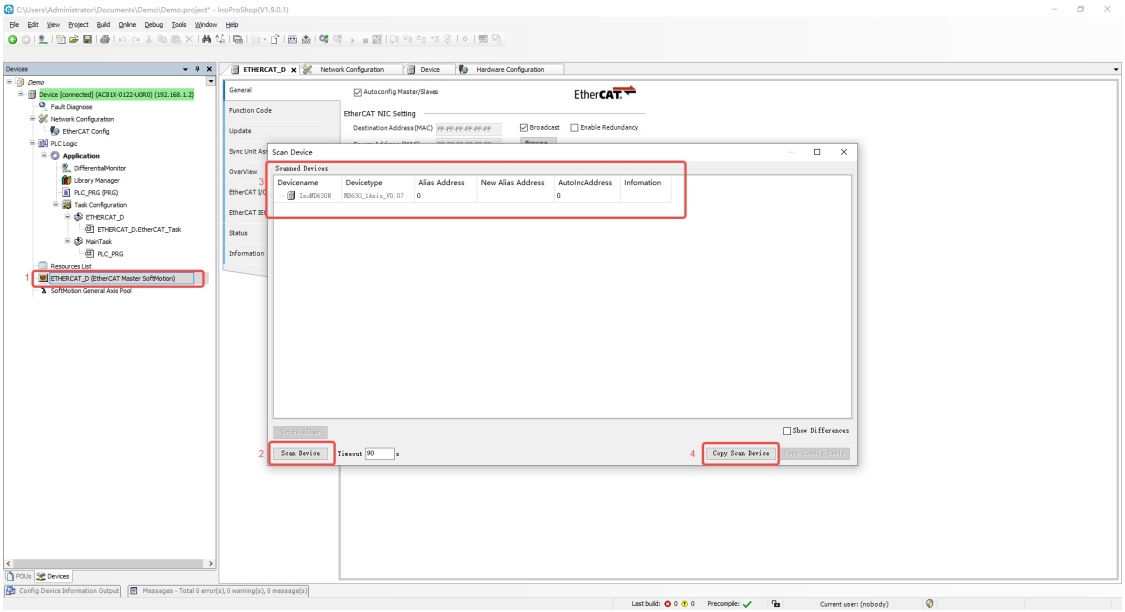
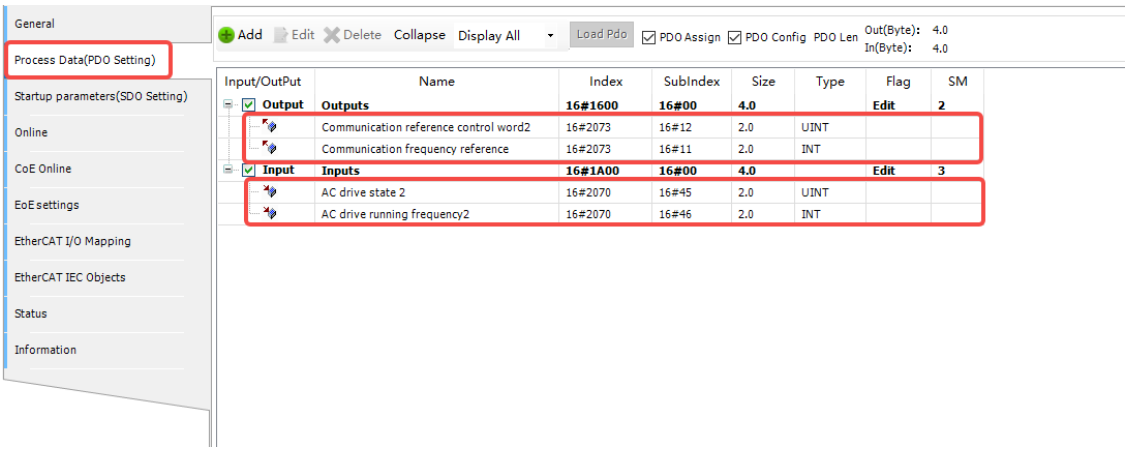


Figure 6-23 Scan the slave device

10. After adding the AC drive, the user can configure PDO on the slave device.
    The default fixed PDO mapping in the XML file meets basic motor control requirements. The following table lists the PDO interactive data description.

PDO (0x1600) Sent by the Master Station		
Fixed RPDO		Variable RPDO
Communication reference control word (0x2073:12)	Communication reference frequency (0x2073:11)	Real-time modification of AC drive function parameters
RPDO1	RPDO2	RPDO3 to RPDO16
PDO Responded by AC Drive (0x1A00)		
Fixed TPDO		Variable TPDO
Running state (0x2070:45)	Operating frequency (0x2070:46)	Real-time reading of AC drive function parameters
TPDO1	TPDO2	TPDO3 to TPDO16



11. Click "**Compile**". Wait until the compilation is complete, and then click "**Login**" to wait for the program to be downloaded to the PLC.

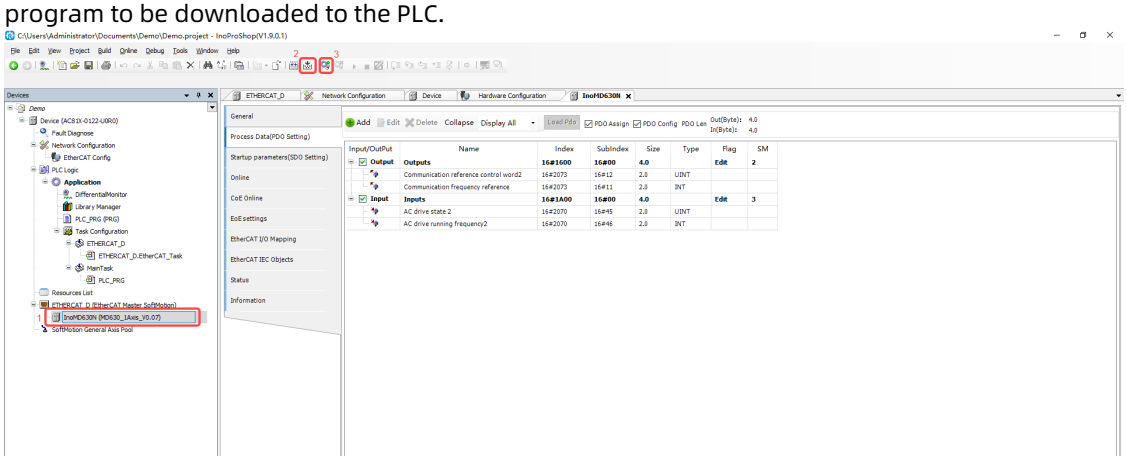


Figure 6-24 Login and download to PLC

12. After login and download are complete, click the start button. The green mark appears on the right side of the MD630N-INT device in the left column to indicate that the device is started and communication is established properly. In this case, the user can monitor the I/O variables of the configuration mapping, as well as online COE and state machine operations.

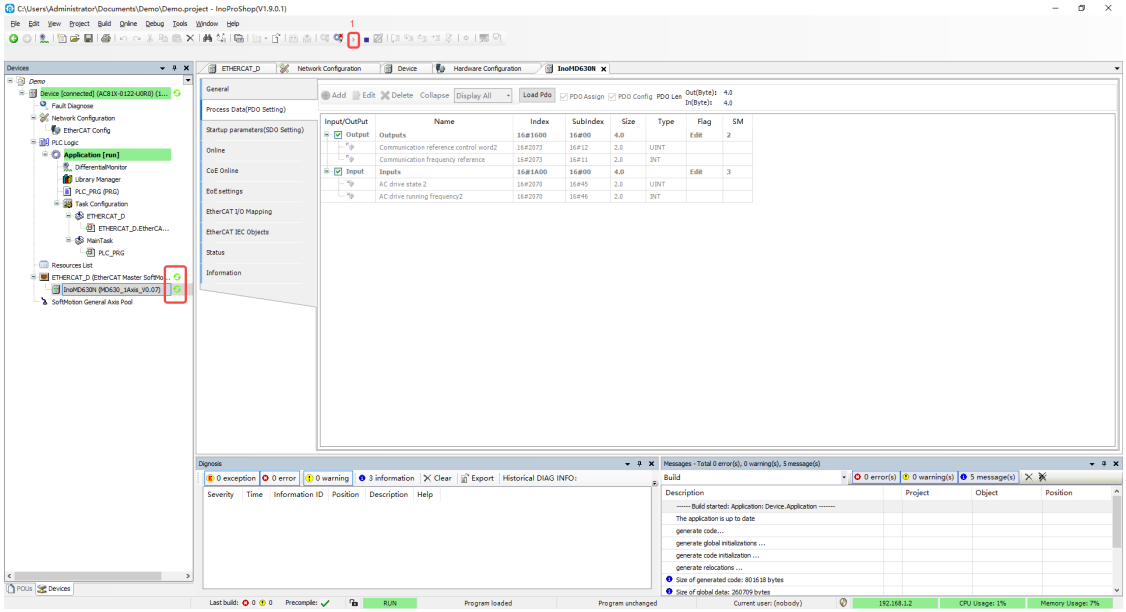
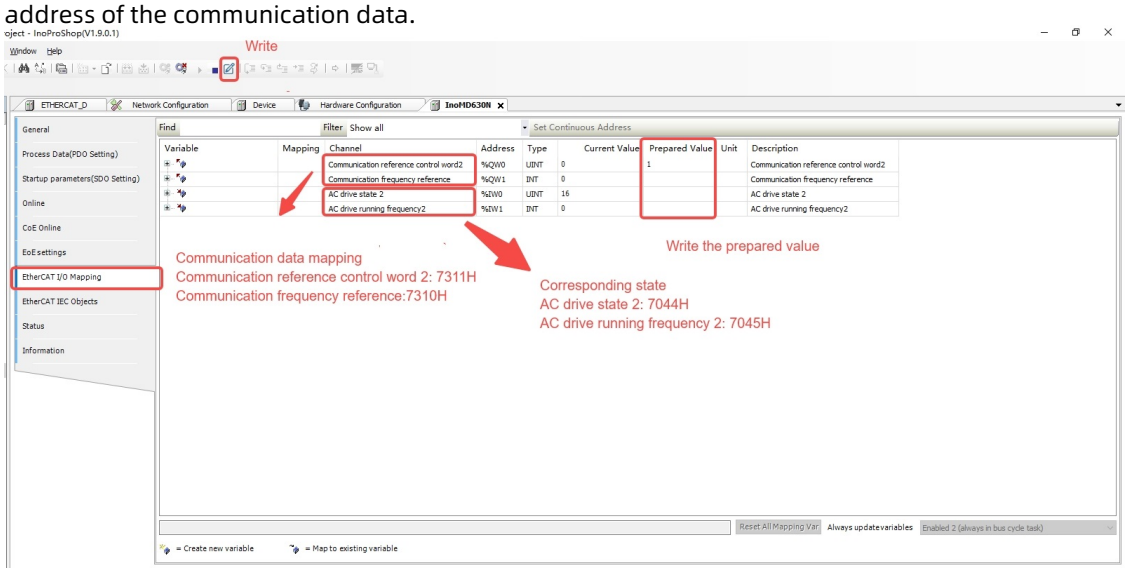


Figure 6-25 Establish communication successfully between the master and slave

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

   For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

   The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n014 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description of the communication address
AC drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit00: Running status. 0: Stopped; 1: Running Bit01: Running direction. 0: Forward; 1: Reverse Bit02: Fault state. 0: No fault; 1: Fault Bit03: Frequency reached. 0: Not reached; 1: Reached Bit04: Reserved Bit05: Reserved Bit06: Reserved Bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.7.10.2 Communication Instance When the MD630-INT Is Controlled by the Beckhoff Controller

Prerequisite

Ensure that all equipment is correctly wired, see *"6.7.6 Connect the AC drive to the bus system" on page 884*.

Operation steps:

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Open the installation directory of TwinCAT and copy the XML file to the directory shown in the following figure.
   After installing the Beckhoff TwinCAT software on the PC, you need to import the device description XML file of the EtherCAT slave device. Otherwise, the slave device cannot be scanned.

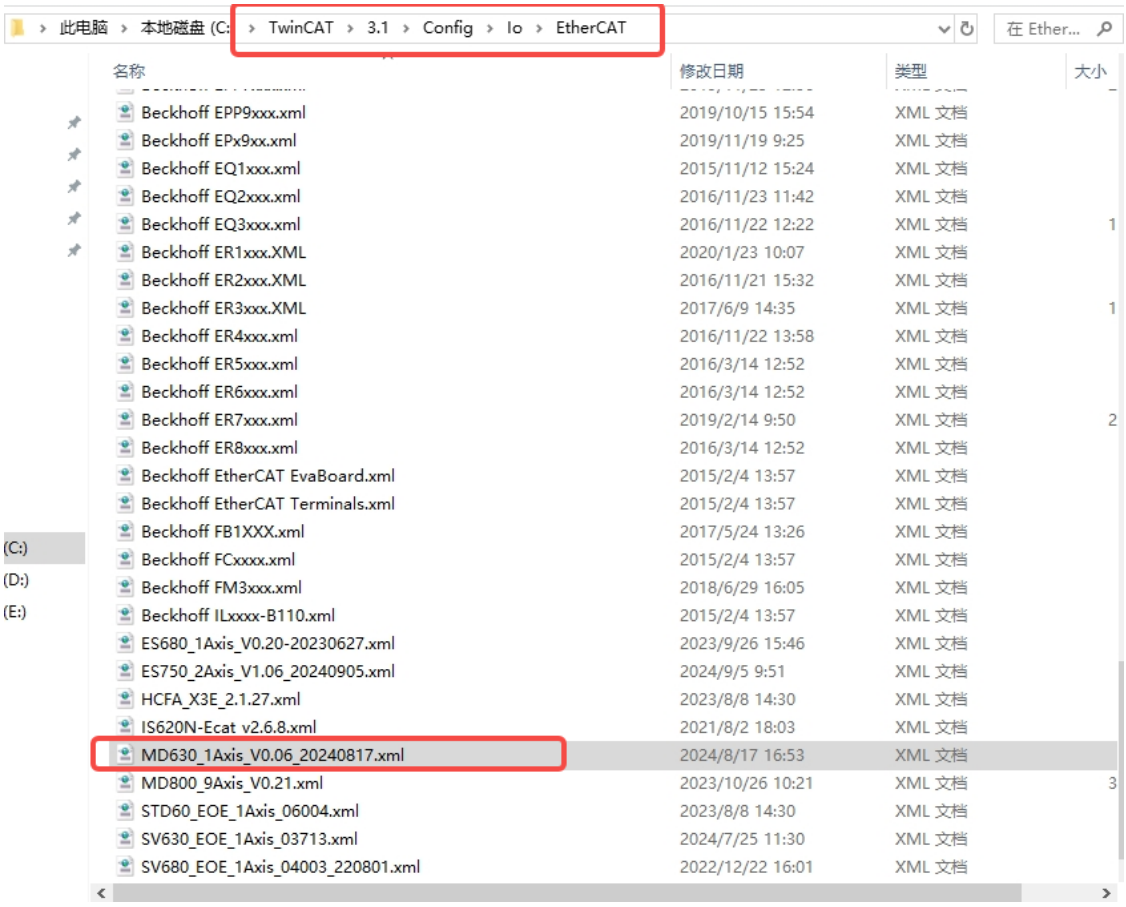


Figure 6-26 Add an XML file

4. Open TwinCAT XAE (TcXaeShell) to create a new project, as shown in the following figure.

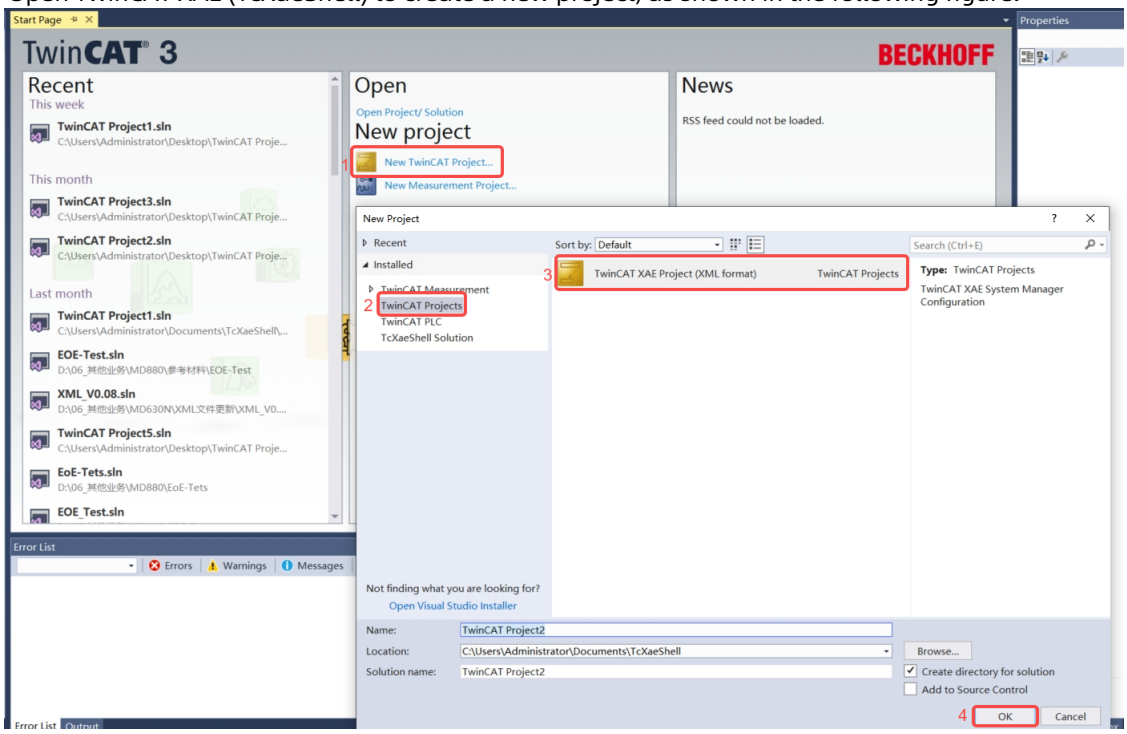


Figure 6-27 New project

5. To scan and add a Beckhoff PLC controller, ensure that the IP address of the PC and PLC ports are in the same network segment. Open the Ethernet properties of the corresponding network port in the computer settings, and then set the IP address.

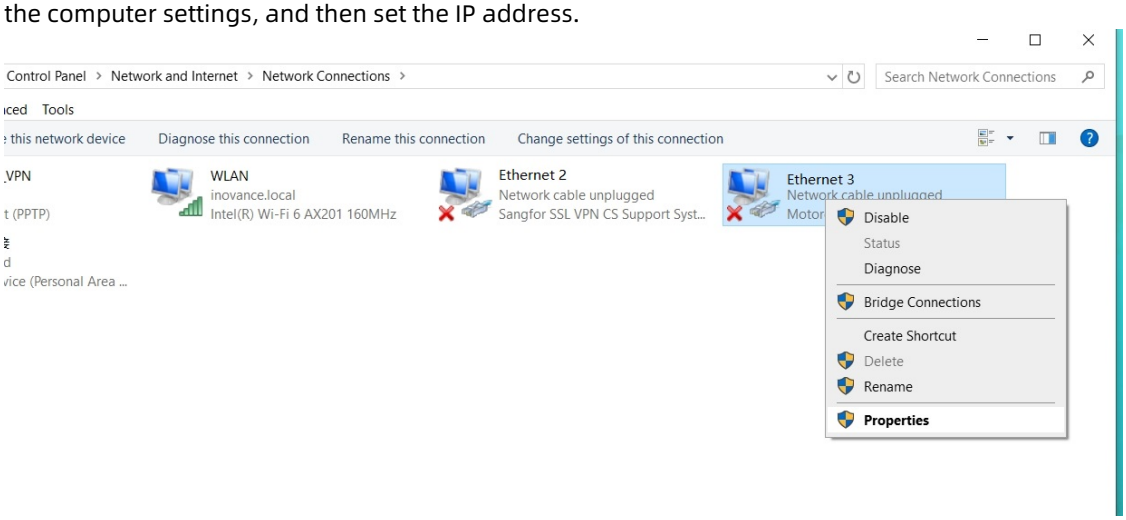


Figure 6-28 Open the Ethernet Properties setting

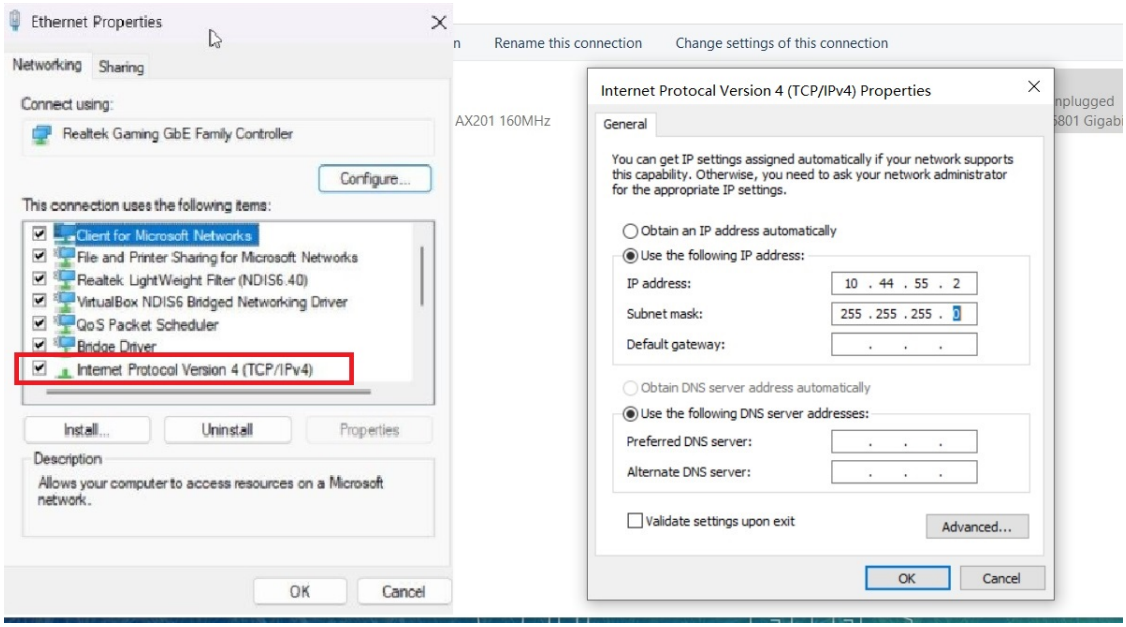


Figure 6-29 Set the IP

6. After the setting is complete, scan the PLC controller in the form of network segment broadcast, and click the drop-down box in the field. If the PLC has been added before, it will be displayed in the drop-down bar and can be used directly. If it is added the first time, you need to click **Choose Target System**. A pop-up window will appear; follow the steps in order.

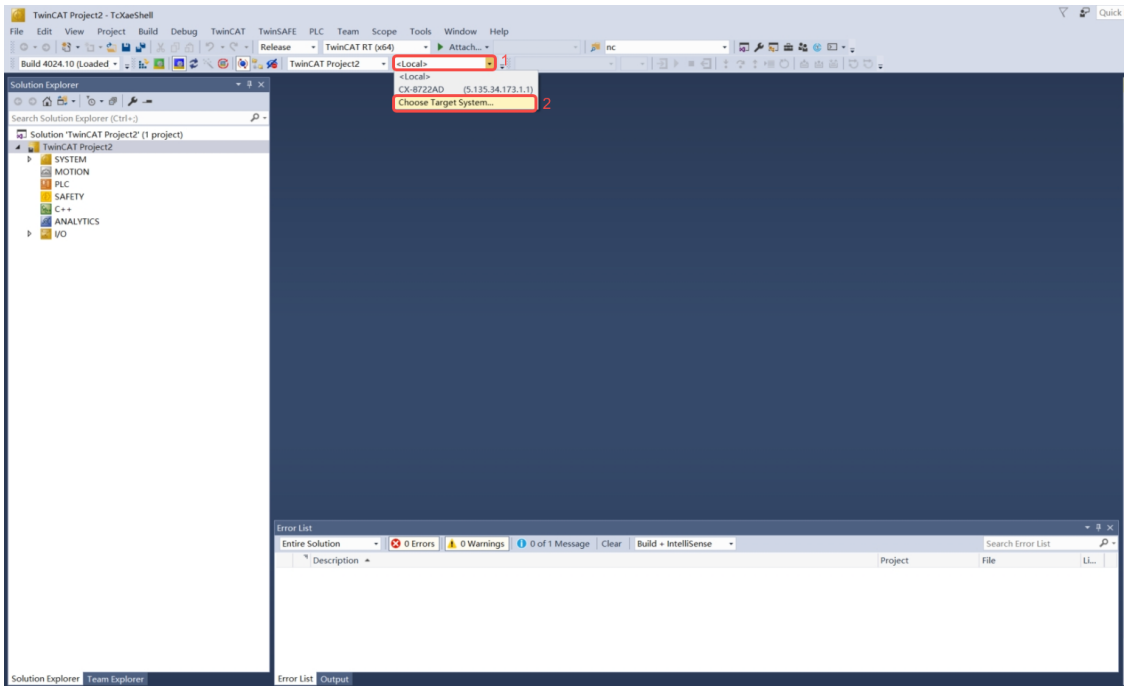


Figure 6-30 Select PLC device

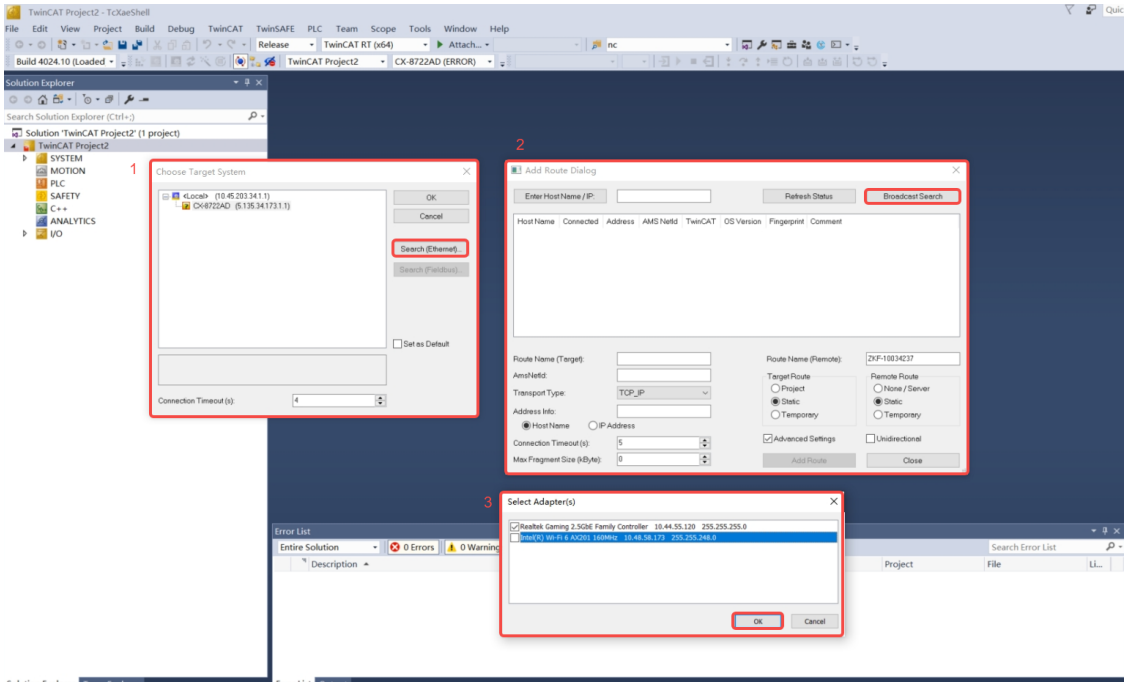


Figure 6-31 Scan PLC steps

After scanning to the PLC, information about the PLC will be displayed, and the password needs to be entered before it can be added to the project. The default password is usually 1.

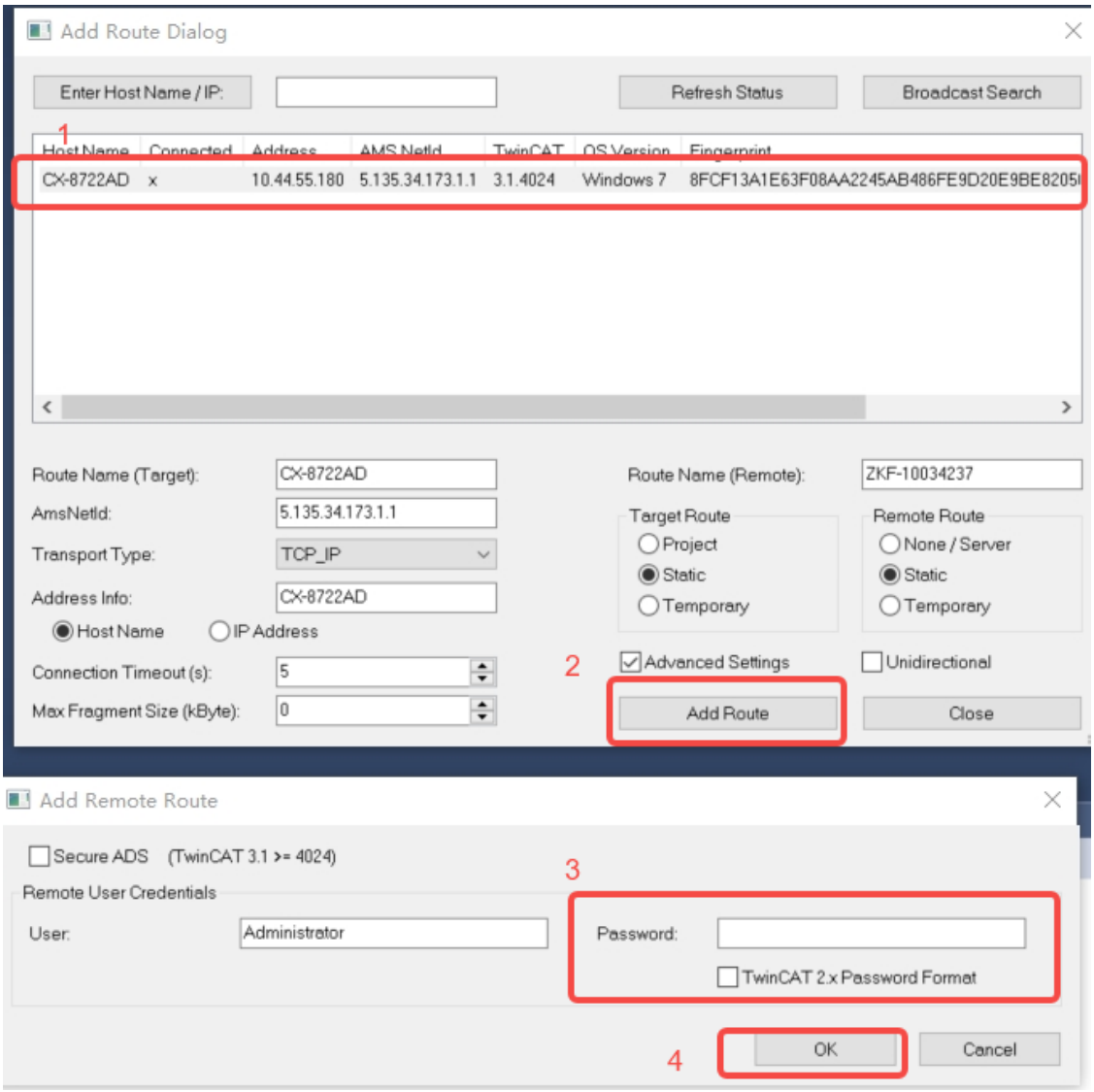


Figure 6-32 Add the scanned PLC device

7. After adding the PLC, scan to add the EtherCAT slave device. In the left column of the project, select **Devices** and right-click **Scan**. Select **Device 3** in the pop-up window and Click **OK**, and then click Yes to complete the scan of the slave device.

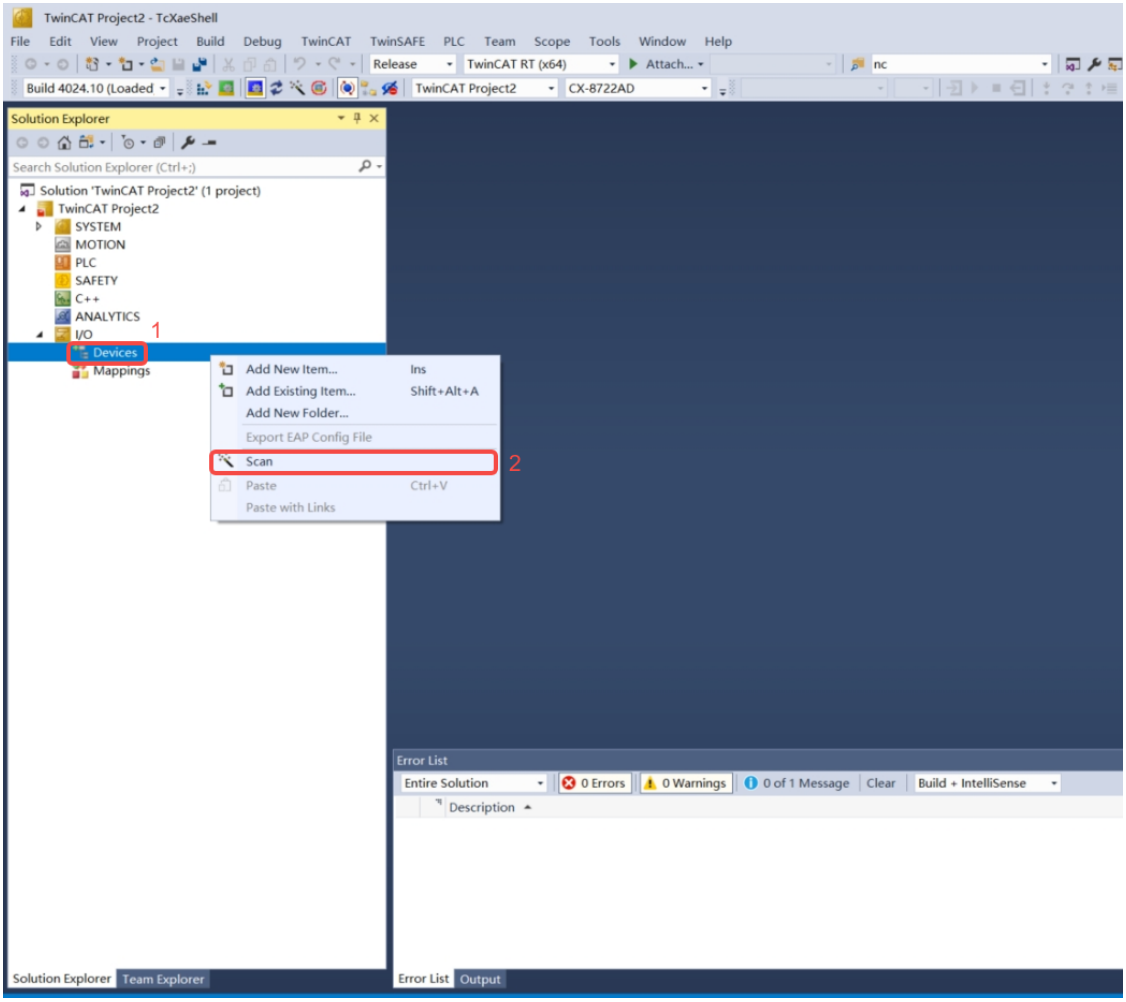


Figure 6-33 Scan the slave device

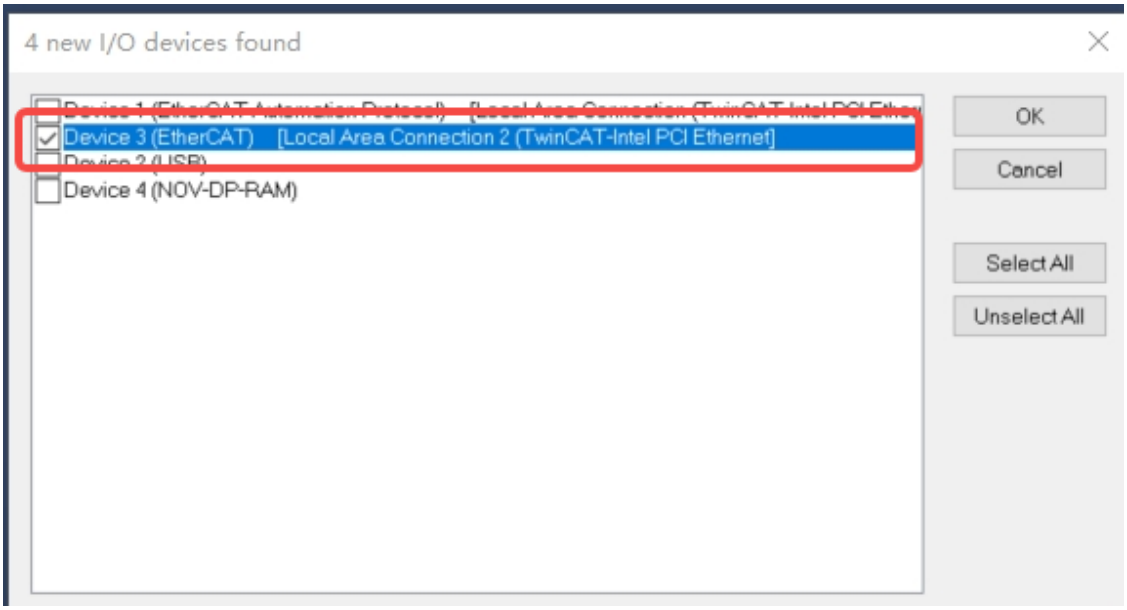


Figure 6-34 Select the corresponding port

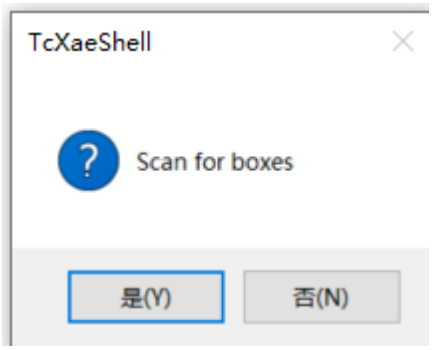


Figure 6-35 Confirm the scan

8. After you add the device, the corresponding EtherCAT slave device icon will be displayed in the left column of the project. Double-click the empty area to the right of the device to display the setup interface of the corresponding slave device , where you can configure PDO mapping, online CoE, status switching, synchronization modes, etc. Click the  icon in the preceding column to run the PLC master device. Click the  icon to stop the PLC master device.

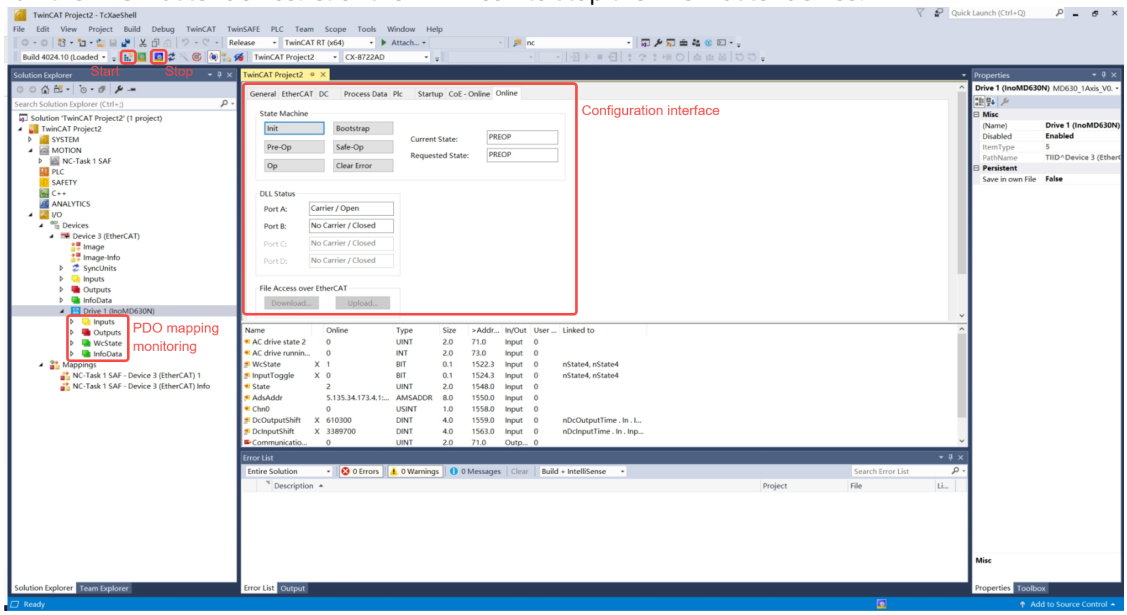
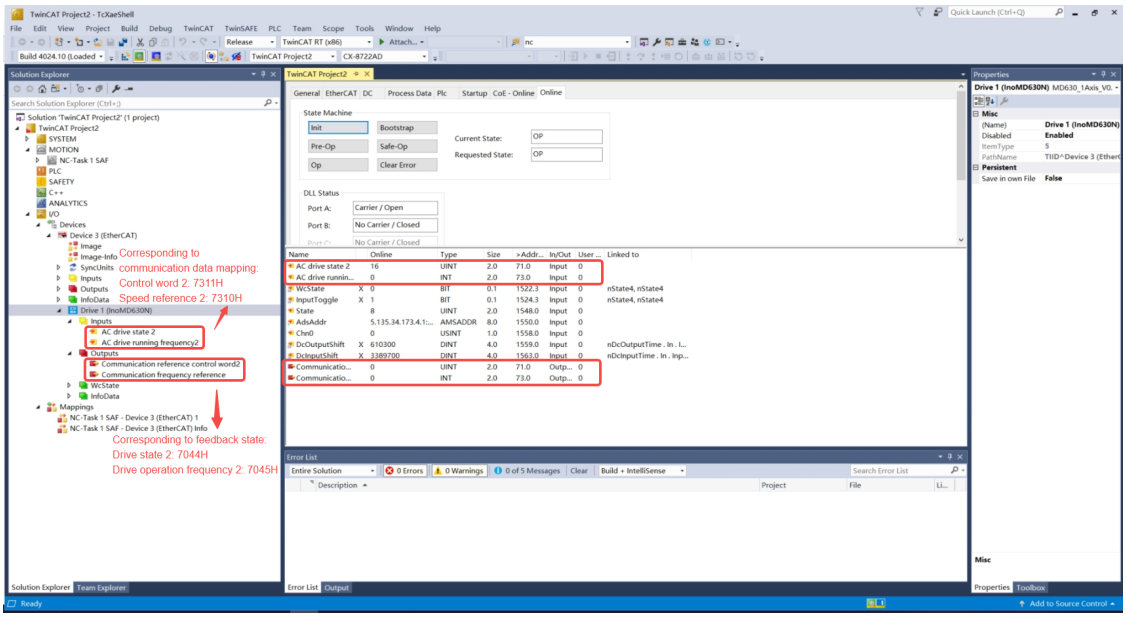


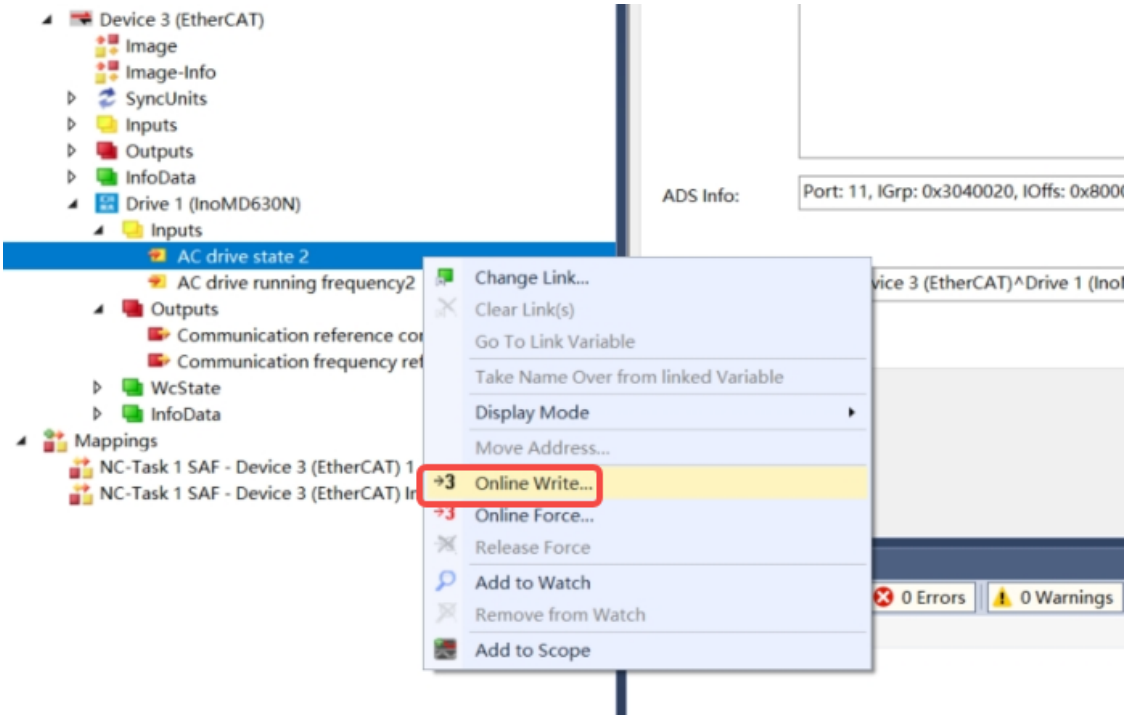
Figure 6-36 Overview interface

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



You can change the mapped value by right-clicking and selecting “Online Write,” as shown below.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n014 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description of the communication address
AC drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit00: Running status. 0: Stopped; 1: Running Bit01: Running direction. 0: Forward; 1: Reverse Bit02: Fault state. 0: No fault; 1: Fault Bit03: Frequency reached. 0: Not reached; 1: Reached Bit04: Reserved Bit05: Reserved Bit06: Reserved Bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.7.11 Replacing Faulty Device

When using EtherCAT, MD630N-INT supports directly replacing faulty device without having to reconfigure and assign the device.

The following conditions must be met to replace the failed device:

1. The alternative component and the component to be replaced are both the MD630N-INT;
2. If the master station is configured to use alias mode, ensure that the alias of the new device matches that of the replaced device, and then power on and power off the slave device to make the alias setting effective. If the configuration is not alias mode, replace the device directly;
3. During configuration, the topology was already defined and verified—every cable is mapped to its actual port.
4. Ensure that the parameters of the replaced device are set correctly, and then restart the PLC master station.

6.8 EtherNet/IP Drive Control

6.8.1 Overview

The EtherNet/IP protocol is based on the TCP/IP protocol stack and uses connection-oriented and connection-less communication. It defines two types of communication: Explicit communication and Implicit communication.

- Explicit communication: Data is transmitted through TCP (Transmission Control Protocol), which is suitable for high-accuracy and low-real-time data transmission. Explicit communication is divided into UCMM (Unconnected Explicit Messages) and Class3 (Connect Explicit Messages) based on the connection mode.
- Implicit communication: Data is transmitted through UDP (User DataDiagram Protocol), which is suitable for high-real-time data transmission. The only type of hidden message is Class1 "Implicit Message (I/O Messages)" or "Implicit Message (I/O Message)".

EtherNet/IP is a high-speed, real-time, flexible, and easy integration. An extensible and safe industrial automation network protocol is widely used in industrial automation control systems.

6.8.2 Communication Specifications

Table 6–15 Communication specifications

Item	Description
Communication Protocol	EtherNet/IP
Service supported	Process Data Object (PDO) Server Data Object (SDO)
Physical layer	10/100Base-TX
Communication mode	Half/full-duplex, Auto-negotiation
Topology	Linear, star, tree, ring
Transmission rate	10/100-Mbit/s adaptive

Item	Description
Transmission medium	Metal-shielded Category 5e or higher twisted pair cable
Transmission distance	< 100 m
Communication port	44818 (TCP), 2222 (UDP)
Communication type	UCMM, Class3, Class1
EtherNet/IP frame length	64 bytes to 1518 bytes
Periodic data	Fixed 32 bytes (16 status/control words)
Non-cyclic data	6 bytes to 512 bytes
Communication period	1 ms to 50000ms
Max. connections	1 (Proprietary connection)
Max. cable length	100 m
Max. number of slaves connected	/
The number of request messages can be received at the same time	/

6.8.3 Communication System Connections

EtherNet/IP must use a shielded twisted pair (Cat5e) or above that meets the TIA/EIA-568-B standard. The standard RJ45 interface must be a single cable shorter than 100 m.

The EtherNet/IP protocol does not limit the number of slaves in the network. The actual number of networks is determined by the master station or network address.

EtherNet/IP supports bus, star, ring, and tree topologies.

Bus topology

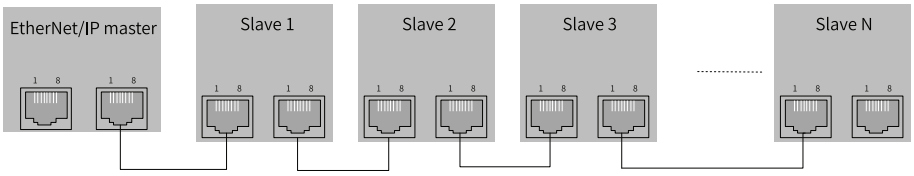


Figure 6-37 Bus topology

When the bus-type topology is used, the cable is routed from the master to any RJ45 port of the first device and then from another RJ45 port to the next device. and so on.

The bus-type topology is simple to connect, and the equipment cost is low. However, if a fault occurs on the equipment in the preceding class, the equipment beyond the fault point cannot communicate.

Star-type topology

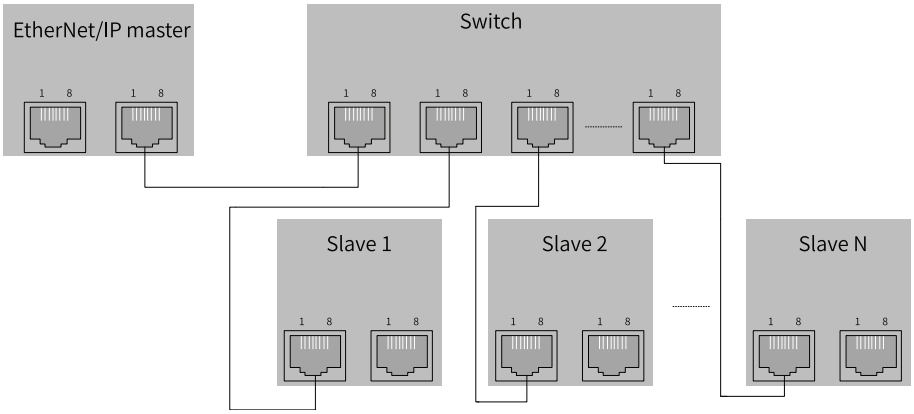


Figure 6-38 Star-type topology

In a star topology, cables are routed from the master station to the central hub ((splitter), and then connected to various devices through the central hub.

Compared with the bus topology, the star topology has an additional central hub, and failure in one node doesn't affect the rest. However, if the central hub is faulty, The communication of all devices is affected.

Tree topology

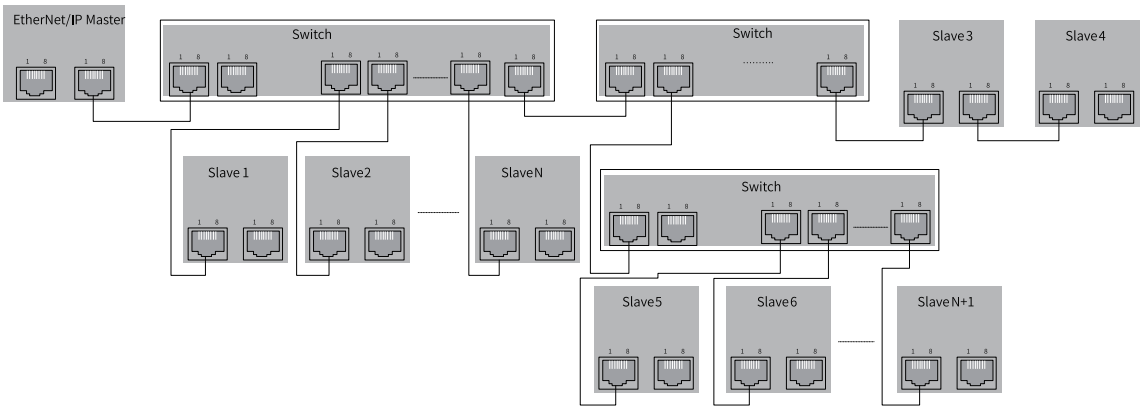


Figure 6-39 Tree topology

The tree topology is a combination of star topology and bus topology, which makes field layout more flexible, but has the disadvantages of both topologies. When a central hub fails in the tree topology, all devices mounted to the central hub cannot communicate properly.

Ring topology

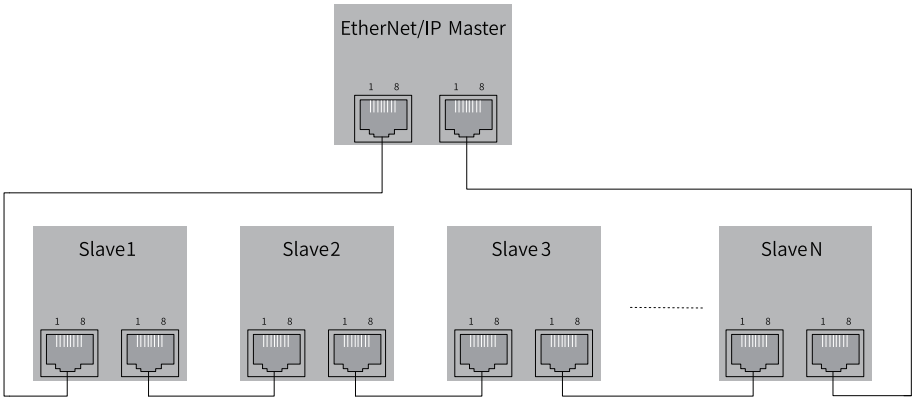


Figure 6-40 Ring topology

The ring network topology is a derivative of the bus topology. The difference is that the cables of the last-level devices are routed back to the redundant network ports of the master station.

This topology inherits the advantages of a bus topology. Failure of a single node in the topology does not affect the entire topology. However, this topology requires that the master supports and enables the function of managing the DLR or that there be a manager of the DLR in the topology. Otherwise, the entire topology will be crippled due to network storms.

6.8.4 Message

6.8.4.1 Diagnosis message structure

EtherNet/IP is based on the traditional TCP/IP protocol suite. The three common connection types are Class 1, Class3, and UCMM. Class3 and UCMM are explicit messages. Based on the TCP protocol, the overall frame format is EtherNet/IP explicit regression message. Class1 is an hidden message based on the UDP protocol. The overall frame format is EtherNet/IP.

In actual applications, non-periodic data is exchanged with explicit messages (UCMM, Class3) and periodic data with hidden messages (Class 1 data).

Note that because the EtherNet/IP protocol is based on the application layer in the TCP/IP four-layer network model and the TCP/IP protocol suite is very large, only EtherNet/IP protocol frames are expanded. The rest of the Ethernet header, IP datagrams, and TCP/UDP messages are not expanded.

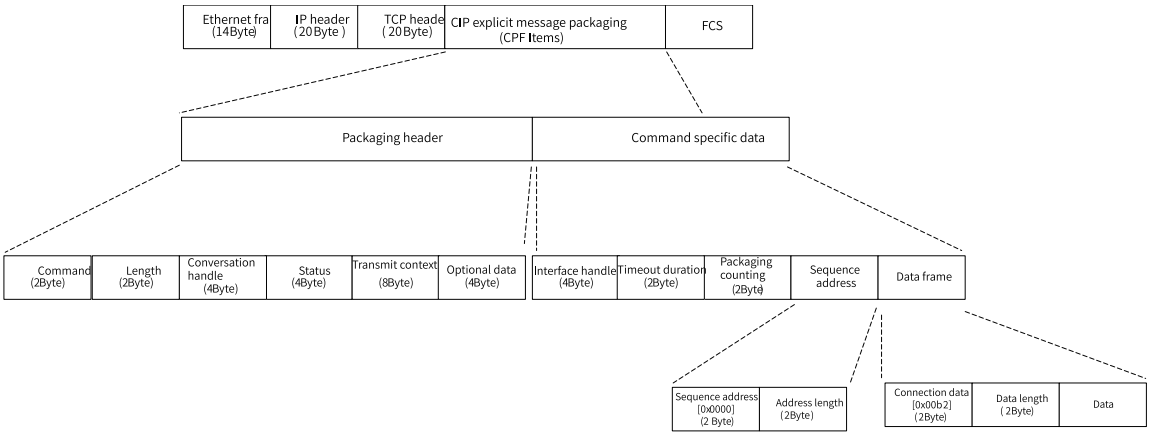


Figure 6-41 EtherNet/IP explicit resume message

The CIP encapsulation used to transmit non-cyclic explicit messages consists of the package header and command-specific data, as described in the following table.

Table 6–16 Explicit data frame definition

Field			Status
Ethernet frame header			Ethernet frame information
IP head			Packaging information
TCP head			Packaging information
Packaging	Command		UCMM: SendRRData command (0x6F Class3: SendUnitDta command (0x70
	Length		Command-specific data length
	Session handle		It is assigned by the device when the session is registered
	Status		0
	Send context		Generated during session registration
	Optional parameters:		0
Command-specific data	Interface handle		0
	Timeout		All
	Packaging	Encapsulating the Function	2 (one address encapsulation, one data encapsulation)
		Address	UCMM: 0 Class3: 0xa1
		Address length	UCMM: 0 Class 4
		Access address data	UCMM: None Class3: Generated when the session is opened
		Data	UCMM: 0x00b2 Class3: 0x00b1
		Data length	Length of non-cyclic data actually transmitted
		Data	Transmitted non-cyclic data

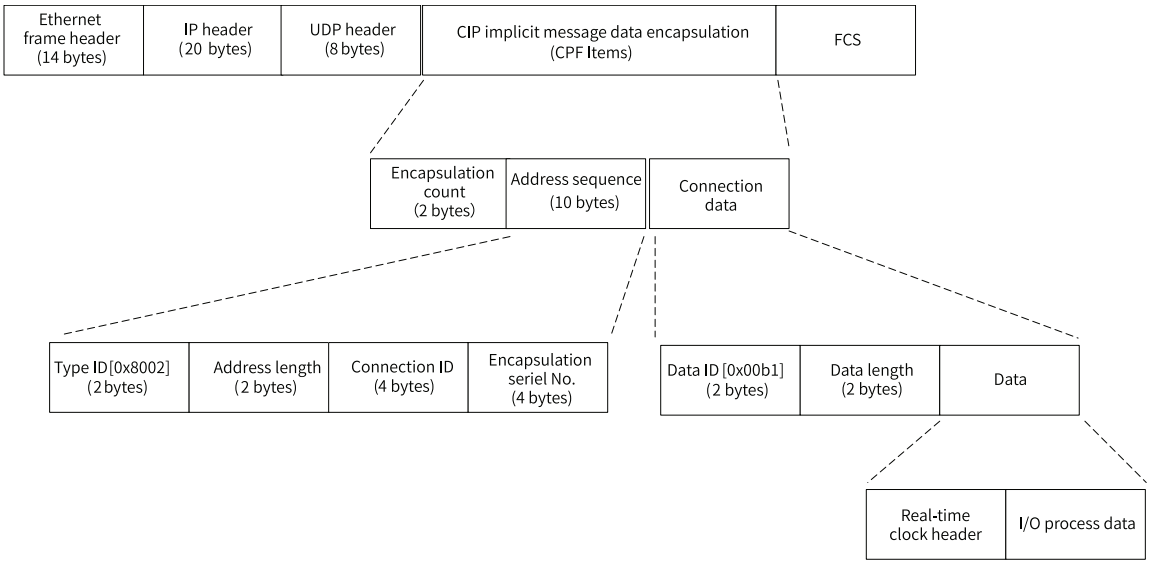


Figure 6-42 EtherNet/IP hidden resume message

The process data is transmitted in an encrypted message. The following table describes the encapsulation.

Field		Status
Ethernet frame header		Ethernet frame information
IP head		Packaging information
UDP header		Packaging information
Encapsulating the Function		2
Address sequence	Type	0x8002
	Length	8
	Connecting the ID	Generated when the session is registered
	Serial No.	The initial value is 1, and each packet is added by 1
Connection data	Data	0x000B1
	Data length	Process data length
	Data	Process Data

6.8.4.2 Process data

The process data supports transmission of up to 16 control words. The first two of the master stations to the device side (O-> T) are fixed as control commands and running frequencies, and the remaining ones are user-defined control words. The first two status words from the device to the master station (T-> O) are the current state and current operating frequency of the AC drive, and the rest are user-defined. See the following table for details of the message format.

Note

This section only displays the I/O process data. For the complete frame format, see the EtherNet/IP Class 1 message structure.

Table 6–17 Master process data format

Output Data[0]	Output Data[1	Output Data[2 to 15]
Communication control command 2 (0x7011)	AC drive running frequency (0x7010:46)	User-defined control word
1st control word (2 bytes)	2nd control word (2 bytes)	3rd to 16th control word (2 bytes each, total 28 bytes)

Table 6–18 Device process data format

Input Data[0]	Input Data[1	Input Data[2 to 15]
Equipment status	Current frequency (0x7045	User-defined
1st status word (2 bytes)	2nd status word (2 bytes)	3rd to 16th status word (each 2 bytes, total 28 bytes)

6.8.4.3 Instances

Process Data

The command source is set to communication (F0-29/b1-00 = 0, or b3-00 = 0), and the AC drive control motor is set to run forward at a frequency of 50 Hz.

Table 6–19 Example of master station process data

Output Data[0]	Output Data[1	Output Data[2	Output Data[3	...	Output Data[15]
0x0001	0x0032	0x0000	0x0000	-	0x0000
1: Control word	2: Control word	3: Control word	4: Control word	-	16: Control word

The device cycle returns to the state, and the motor rotates forward at 1500 r/min.

Table 6–20 Example of slave process data

Input Data[0]	Input Data[1	Input Data[2	.....	Input Data[15]
0x0011	0x05dc	0x0000	-	0x0000
1 (status word)	2 (status word)	3 (status word)	-	16 (status word)

Periodic data access

This example shows only the data content in the displayed message (that is, data of data items in CIP encapsulation), for example, to obtain the current device running time (control word 0xad03).

Request message:

Data	Length	Access type	Path length	Path type	Path	Path type	Path	Path type	Path
0x00b2 (UCMM access)	0x000a	0x0e (Request)	0x04	0x20 (Class)	0x93	0x24 (Instance	0x01	0x31 (Attribute)	0x00ad03

Response message:

Data	Length	Access type	Path length	Status	Data
0x00b2	0x0006	0x8e response delay	0x04	0x0000='Refresh succeeded'	0x07bd

6.8.4.4 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 853*.

6.8.4.5 Mapping table (AC drive data)

For details, see *"6.5.3 Mapping Table" on page 854*.

6.8.5 Communication Terminals

The MD630N-INT supports EtherNet/IP protocol. It adopts J9 (terminal mark IN) and J5 (terminal mark OUT) interfaces to communicate, such as the RJ45 directly facing the MD630N-INT. The two RJ45 interfaces are equivalent, regardless of direction.

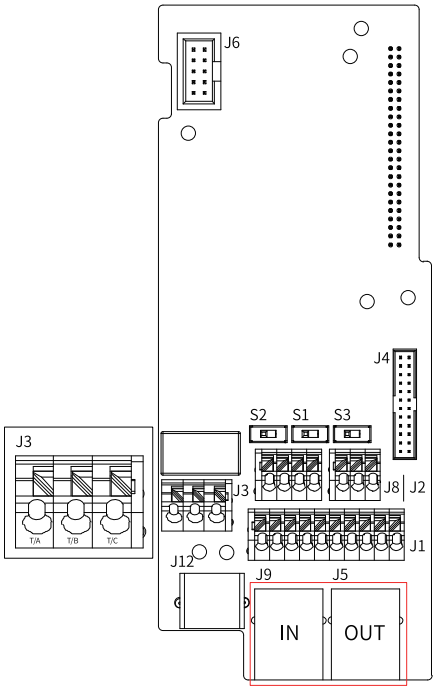


Table 6–21 EtherNet/IP communication terminals

External Terminal	Type	Transmission Information Type	Terminal Mark	Name	Function
J9	RJ45 terminal	100 M bus	IN	100 M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, the IN terminal is used. Direction is not distinguished for EIP/PN.
J5	RJ45 terminal	100M bus	OUT	100 M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, the OUT terminal is used. Direction is not distinguished for EIP/PN.

6.8.6 Connect the AC drive to the bus system

The EtherNet/IP bus uses a standard RJ45 interface. The cable must meet the TIA/EIA-568-B standard of twisted pairs with metal shield and above. The shield must be well grounded. The maximum cable length between the two devices is 100 m.

Steps for connecting to PC:

1. System power supply
2. *"6.8.3 Communication System Connections" on page 907*Connect the network cable to the network port terminal with metal shield *"Figure 6-43 EtherNet/IP Communication" on page 914*, as shown in. See *"6.8.5 Communication Terminals" on page 913*section for communication interface specifications.

Note

For EtherNet/IP communication, IN and OUT of the communication port are not different in the direction.

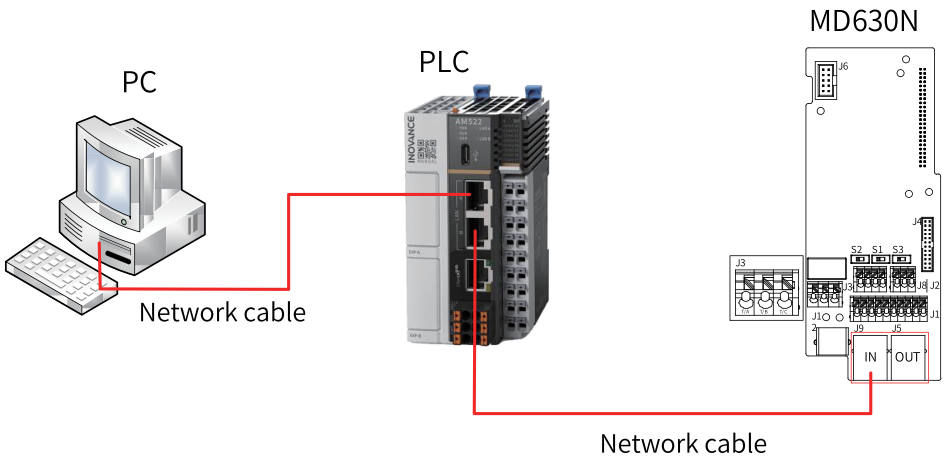


Figure 6-43 EtherNet/IP Communication

3. Configure function code n0-10 = 2.
4. Configure the IP addresses of n5-01 to n5-04, subnet masks of n5-05 to n5-08, and gateway addresses of n5-09 to n5-12.

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
n5-00	DHCP function	0 [Disable]	-	0	0	1	ShutdownModify	Decimalism	0x2500
n5-01	Most significant byte of the IP address	192	-	0	0	255	ShutdownModify	Decimalism	0x2501
n5-02	Second most significant byte of the IP address	168	-	0	0	255	ShutdownModify	Decimalism	0x2502
n5-03	Third byte of the IP address	1	-	0	0	255	ShutdownModify	Decimalism	0x2503
n5-04	Least significant byte of the IP address	8	-	0	0	255	ShutdownModify	Decimalism	0x2504
n5-05	Most significant byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2505
n5-06	Second most significant byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2506
n5-07	Third byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2507
n5-08	Least significant byte of the subnet mask	0	-	0	0	255	ShutdownModify	Decimalism	0x2508
n5-09	Most significant byte of the gateway	192	-	0	0	255	ShutdownModify	Decimalism	0x2509
n5-10	Second most significant byte of the gateway	168	-	0	0	255	ShutdownModify	Decimalism	0x250A
n5-11	Third byte of the gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x250B
n5-12	Least significant byte of the gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x250C

5. Perform a power cycle and start the device again.

6.8.7 Configure Communication Between AC Drive and Controller

When EtherNet/IP communication is used, the controller must support the EtherNet/IP protocol. It is recommended to use a EtherNet/IP brand-marked controller to avoid compatibility problems.

EtherNet/IP communication requires the following basic operations on the AC drive:

1. Make sure that the wiring is correct as in *"6.8.6 Connect the AC drive to the bus system" on page 914*.
2. Switch the device communication mode to EtherNet/IP communication (n0-10 = 2), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for channel 1 (b0-03 = 0, b5-00 = 9). (You can operate through the operating panel or the software.)
3. Wait for a few seconds until LED 0 (green) and LED 1 (yellow) to be on. This indicates that the Ethernet link is established successfully.
4. Configure the communication between the master station (controller) and the slave station (AC drive). For details, see *"6.8.10.1 Configuration for EtherNetIP Communication Between AC Drive and AC801" on page 919*.

6.8.8 Communication Parameters

Table 6–22 EtherNet/IP communication parameters

Parameter code	Parameter name	Default value	Range	Change mode	Value
n5-00 (Fd-58)	DHCP function	0	0 to 1	At stop	This parameter sets whether to enable the Dynamic Host Configuration Protocol (DHCP). Value description: 0: Disable 1: Enable Remarks: After the DHCP is enabled, the IP address-related parameters n5-01 to n5-12 are invalid and the address is assigned by the DHCP server.
n5-01 (Fd-59)	Highest order byte of the IP address	0	0 to 255	At stop	This parameter specifies the highest order byte of the IP address. If the IP address is 192.168.1.2, the parameter displays as 192. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-02 (Fd-60)	Second highest order byte of the IP address	0	0 to 255	At stop	This parameter specifies the second highest order byte of the IP address. If the IP address is 192.168.1.2, the parameter displays as 168. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-03 Fd-61	Third highest order byte of the IP address	0	0 to 255	At stop	This parameter specifies the third highest order byte of the IP address. If the IP address is 192.168.1.2, the parameter displays as 1. Remarks: After this parameter is modified, restart the drive to make the settings take effect.

Parameter code	Parameter name	Default value	Range	Change mode	Value
n5-04 (Fd-62)	Lowest order byte of the IP address	0	0 to 255	At stop	This parameter specifies the lowest order byte of the IP address. If the IP address is 192.168.1.2, the parameter displays as 2. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-05 (Fd-63)	Highest order byte of the subnet mask	0	0 to 255	At stop	This parameter specifies the highest order byte of the subnet mask. If the subnet mask is 255.255.255.255, the parameter displays as 255. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-06 (Fd-64)	Second highest order byte of the subnet mask	0	0 to 255	At stop	This parameter specifies the second highest order byte of the subnet mask. If the subnet mask is 255.255.255.255, the parameter displays as 255. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-07 (Fd-65)	Third highest order byte of the subnet mask	0	0 to 255	At stop	This parameter specifies the third highest order byte of the subnet mask. If the subnet mask is 255.255.255.255, the parameter displays as 255. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-08 (Fd-66)	Lowest order byte of the subnet mask	0	0 to 255	At stop	This parameter specifies the lowest order byte of the subnet mask. If the subnet mask is 255.255.255.255, the parameter displays as 255. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-09 (Fd-67)	Highest order byte of the gateway IP address	0	0 to 255	At stop	This parameter specifies the highest order byte of the gateway IP address. If the IP address is 192.168.1.1, the parameter displays as 192. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-10 (Fd-68)	Second highest order byte of the gateway IP address	0	0 to 255	At stop	This parameter specifies the second highest order byte of the gateway IP address. If the IP address is 192.168.1.1, the parameter displays as 168. Remarks: After this parameter is modified, restart the drive to make the settings take effect.

Parameter code	Parameter name	Default value	Range	Change mode	Value
n5-11 (Fd-69)	Third highest order byte of the gateway IP address	0	0 to 255	At stop	This parameter specifies the third highest order byte of the gateway IP address. If the IP address is 192.168.1.1, the parameter displays as 1. Remarks: After this parameter is modified, restart the drive to make the settings take effect.
n5-12 (Fd-70)	Lowest order byte of the gateway IP address	0	0 to 255	At stop	This parameter specifies the lowest order byte of the gateway IP address. If the IP address is 192.168.1.1, the parameter displays as 1. Remarks: After this parameter is modified, restart the drive to make the settings take effect.

6.8.9 Communication Fault Diagnosis

Table 6–23 EtherNet/IP communication fault diagnosis

Fault Code	Fault Name	Fault Cause	Confirmation	Solution
E165.1	EtherNet/IP Ethernet communication timeout	The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. If the voltage is still unstable after preceding measures are taken, replace the power supply.
		A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
		The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.
E165.2	An Ethernet/IP hardware error occurs.	The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

Fault Code	Fault Name	Fault Cause	Confirmation	Solution
E165.3	The MAC address is not programmed for Ethernet/IP.	MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support personnel.
E165.4	Ethernet/IP IP conflict	IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

6.8.10 Communication Configuration Examples

6.8.10.1 Configuration for EtherNetIP Communication Between AC Drive and AC801

Prerequisite

Software acquisition and hardware connection:

1. Visit the Inovance official website http://www.inovance.com/support/download.html to download the AC801 programming software Inoproshop and the latest EDS file of MD630-INT.
2. Use a standard network cable to connect LAN A or LAN B port of AC801 to network port 1 or 2 of the AC drive. For details, see *"6.8.6 Connect the AC drive to the bus system" on page 914*.

Operation steps:

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.

0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherNet/IP communication

1. Set the value of n0-10 to 2 (through operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Create a project.
   Open InoProShop and create a project. Select the device model AC801-02-U0R0.

Figure 6-44 Choose the master device

4. Import the EDS file and add a slave.
   Click **Network Configuration** on the left, click the PLC, select **EtherNet/IP Master**, and click **Import EDS File** to import the EDS file of MD630-INT. And import the device on the right.

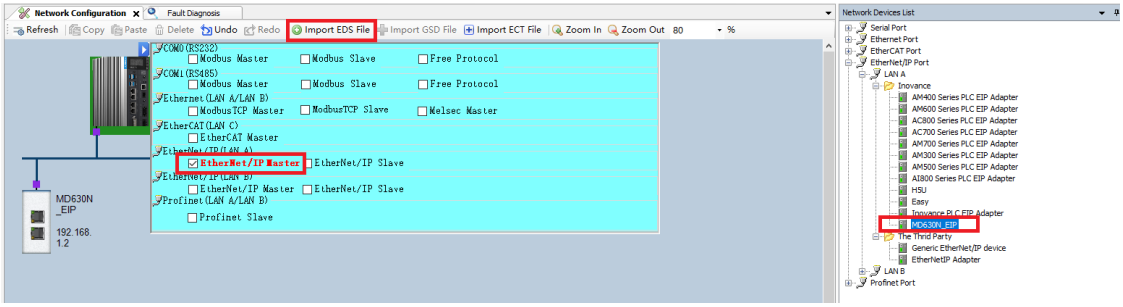


Figure 6-45 Choose the slave device

5. Configure the slave parameters.

   a. Select the MD630-INT device and fill in the IP address of the device.

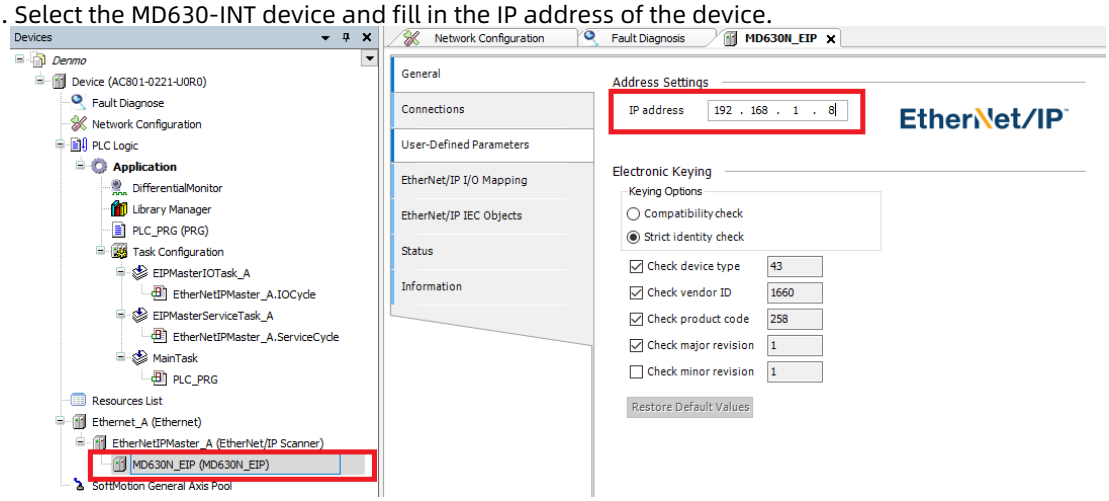


Figure 6-46 Configuring the IP address

   b. Click **Connection** at the left bar to configure the communication parameters and process data mapping address according to actual requirements.

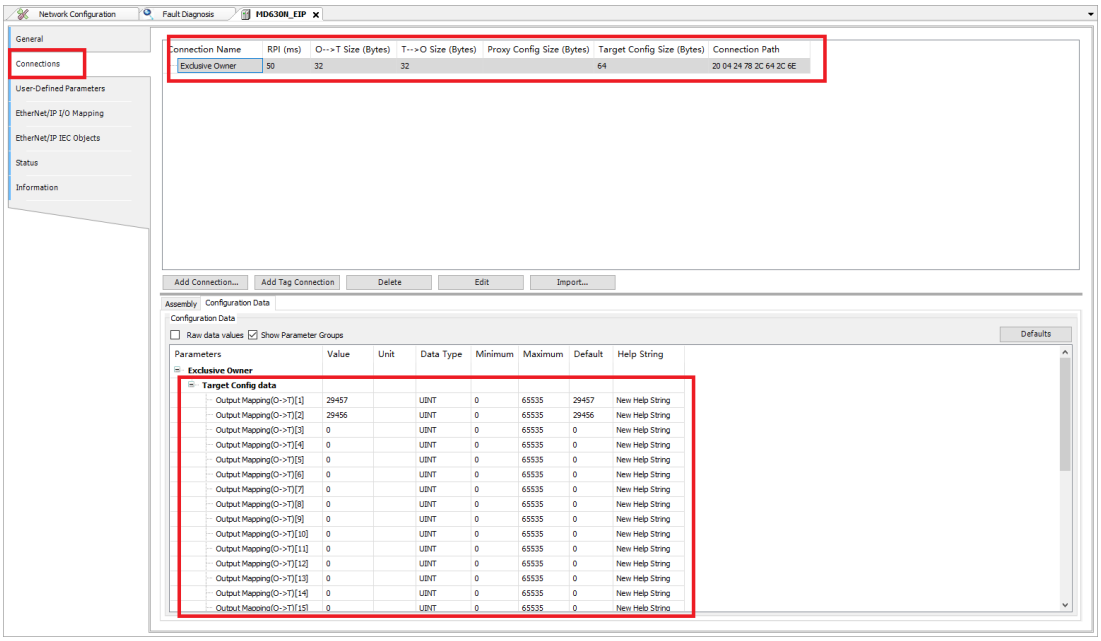


Figure 6-47 Configure the process data mapping

6. Compile the program, download it to the PLC, and let it operate, and then the PLC establishes the connection with the controller.

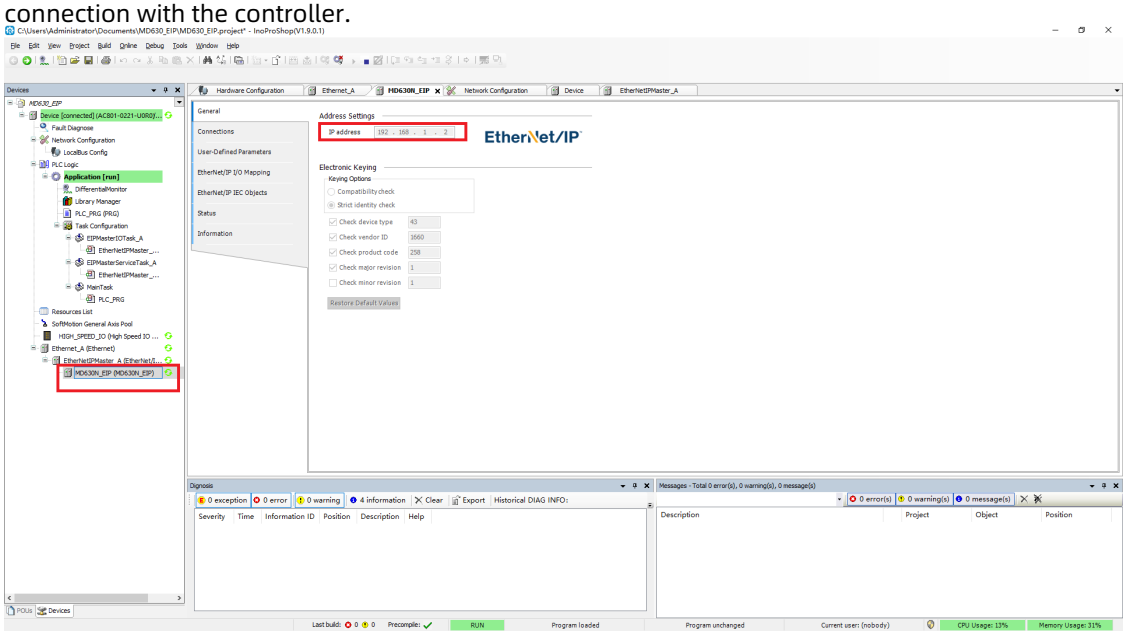


Figure 6-48 Download and start EtherNet/IP communication

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.

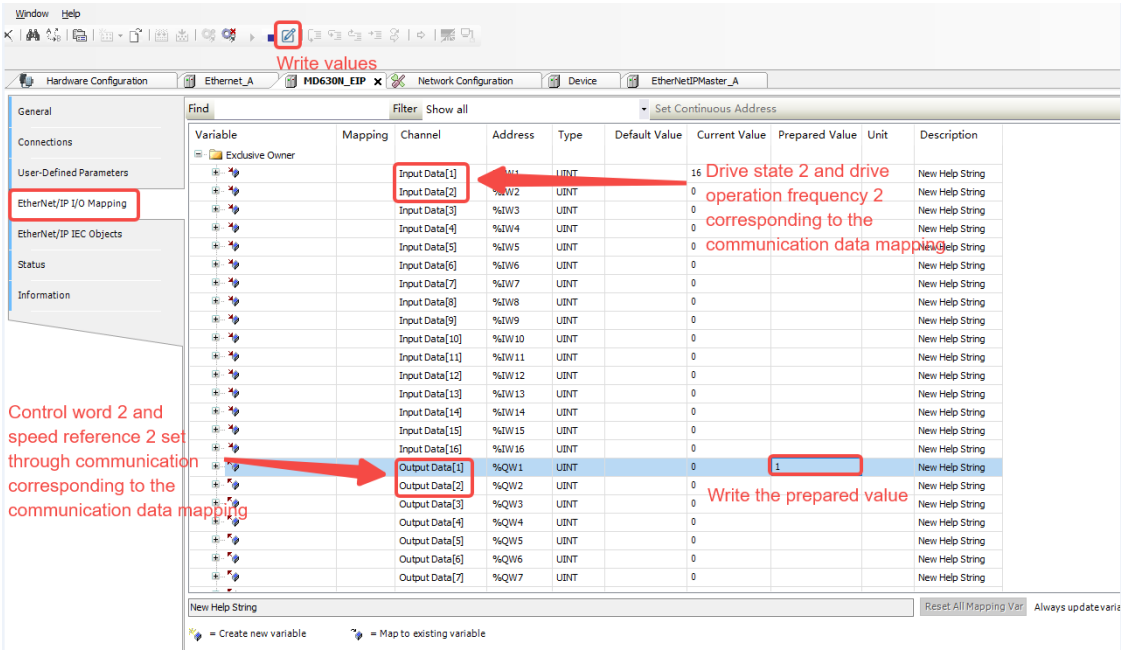


Figure 6-49 Configure the communication data mapping

2. For start/stop control and setting frequency or torque using EtherNet/IP communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherNet/IP.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

   For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

   The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

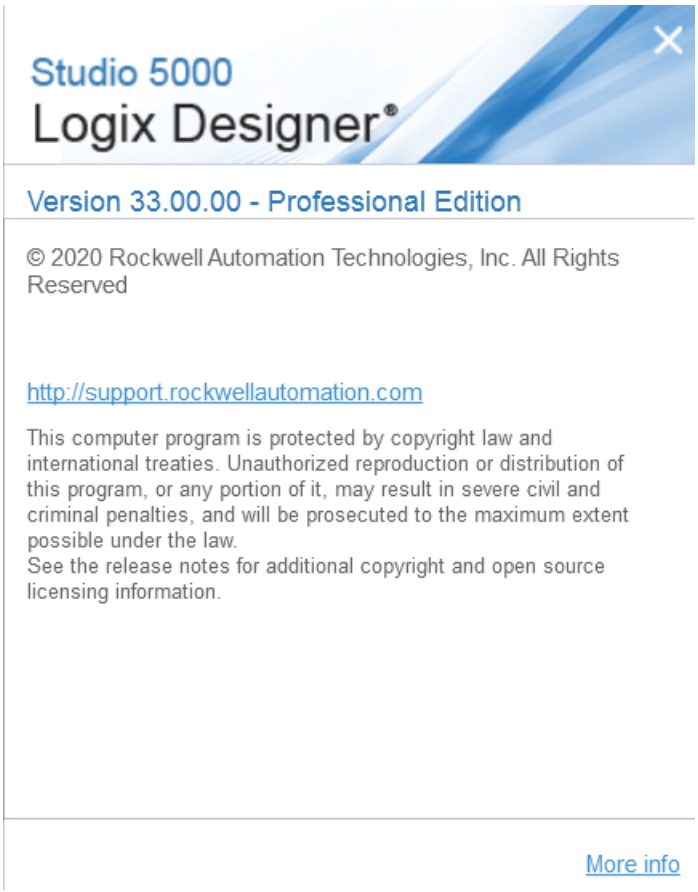
In default settings, when n014 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding feedback status is defined in the following table:

Address		Description of the communication address
AC drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit00: Running status. 0: Stopped; 1: Running Bit01: Running direction. 0: Forward; 1: Reverse Bit02: Fault state. 0: No fault; 1: Fault Bit03: Frequency reached. 0: Not reached; 1: Reached Bit04: Reserved Bit05: Reserved Bit06: Reserved Bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.10.2 Configuration for EtherNet/IP Communication Between Drive and Rockwell Master 1756-L82

This communication configuration example uses Studio5000 and Rockwell master 1756-L82.



Official address of Rockwell: support.rockwellautomation.com

Prerequisite

1. See *"6.8.6 Connect the AC drive to the bus system" on page 914* to complete the communication network connection.
2. Install the Rockwell PLC host controller Studio5000 on the PC.

Procedure

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

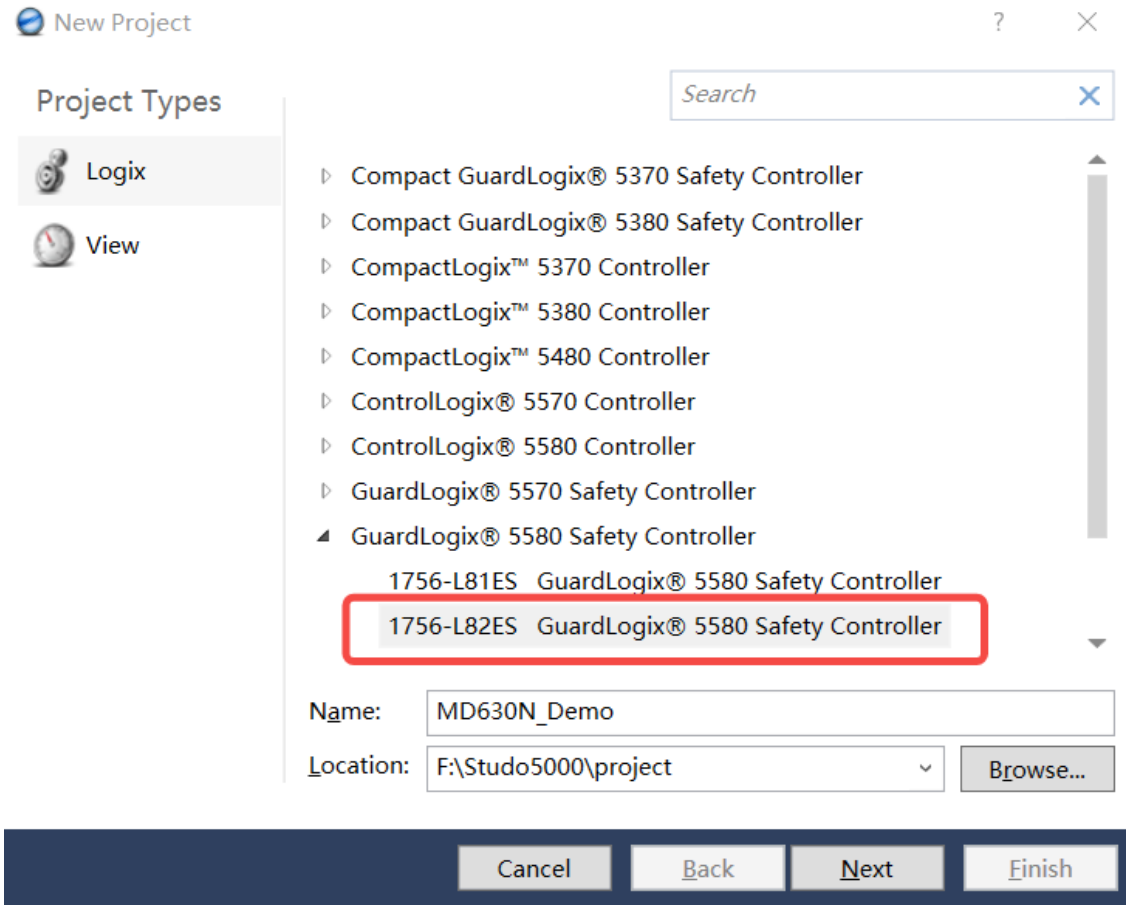
1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements: 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

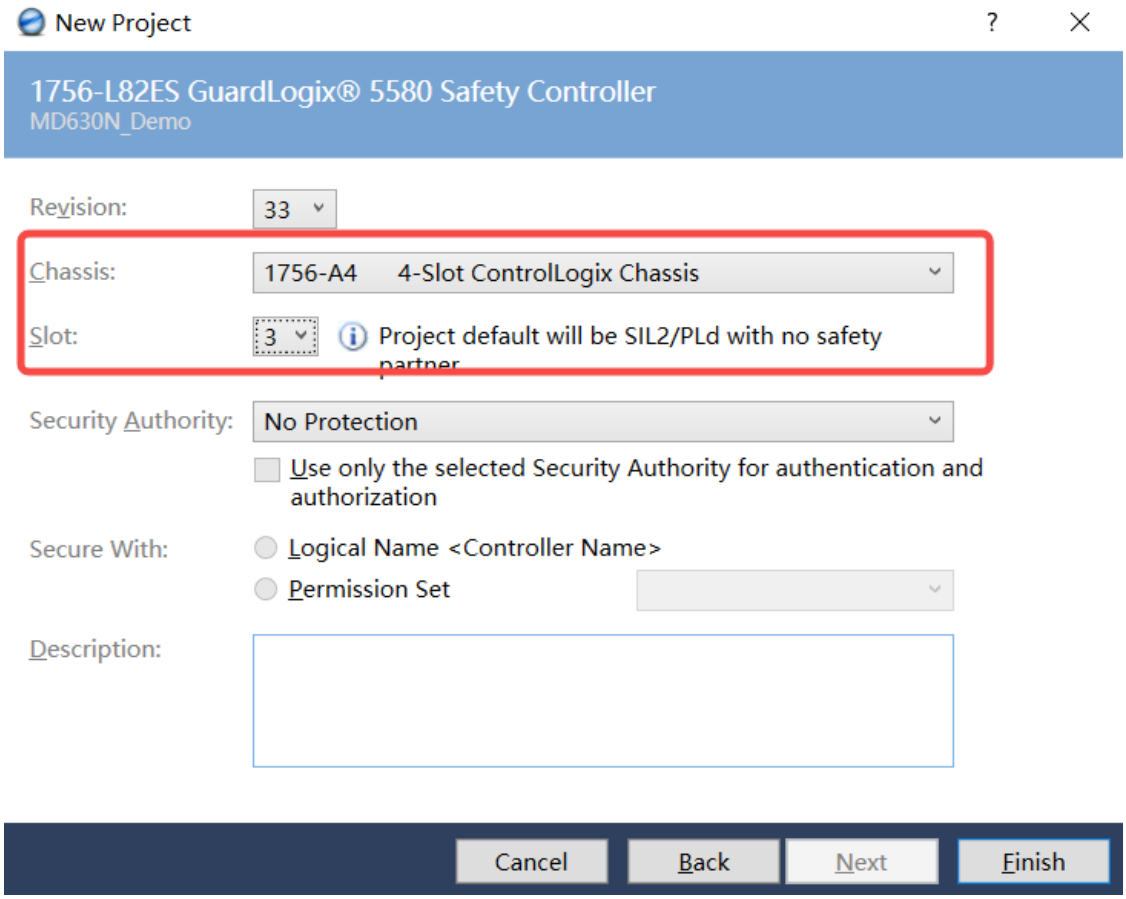
1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements: 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherNet/IP communication.

1. Set the value of n0-10 to 2 (through operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Create a project.
   Select 1756-L82 ES of the controller model "CompactLogix 5580 Controller" and click "Next".

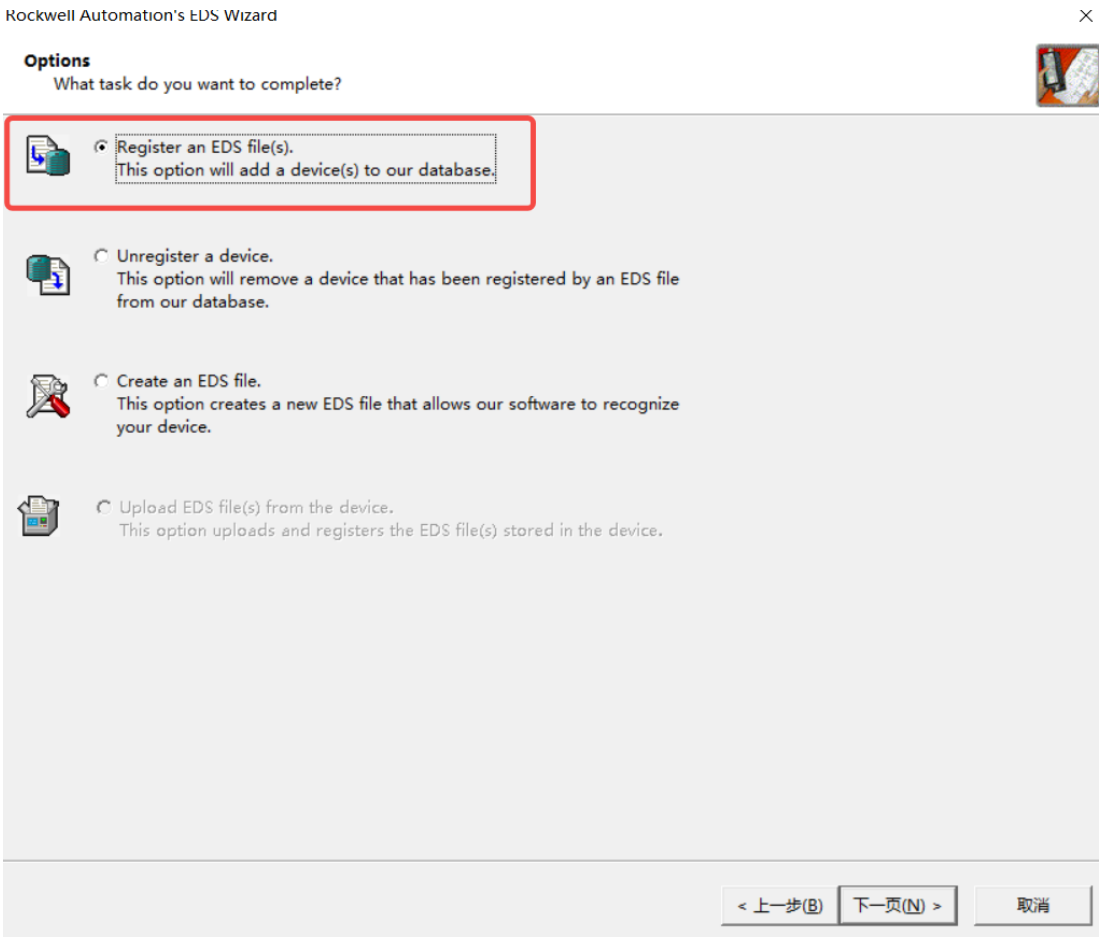


4. Select the chassis of the device and the slot number of the controller. In this example, the chassis model is 1756-A4 and the slot number of the controller is 3. Click "Finish" when the selection is done.

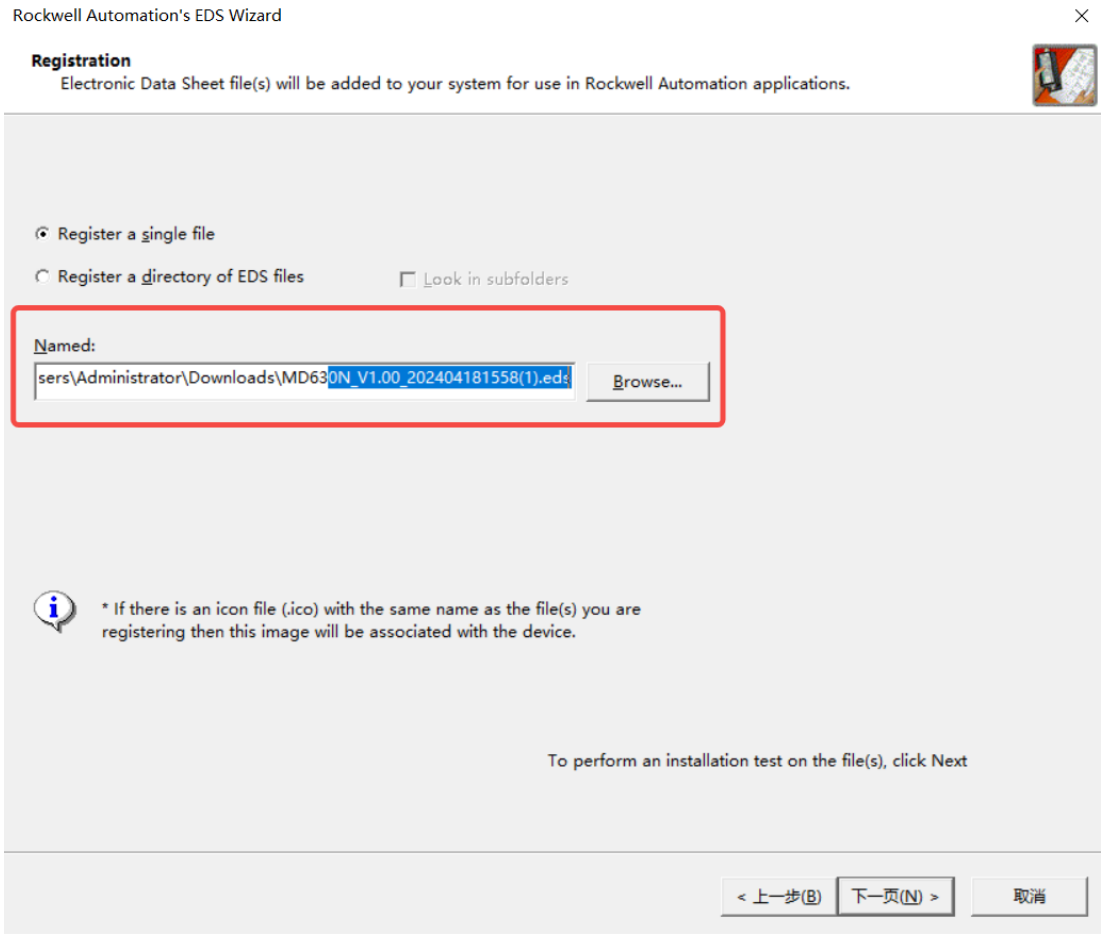


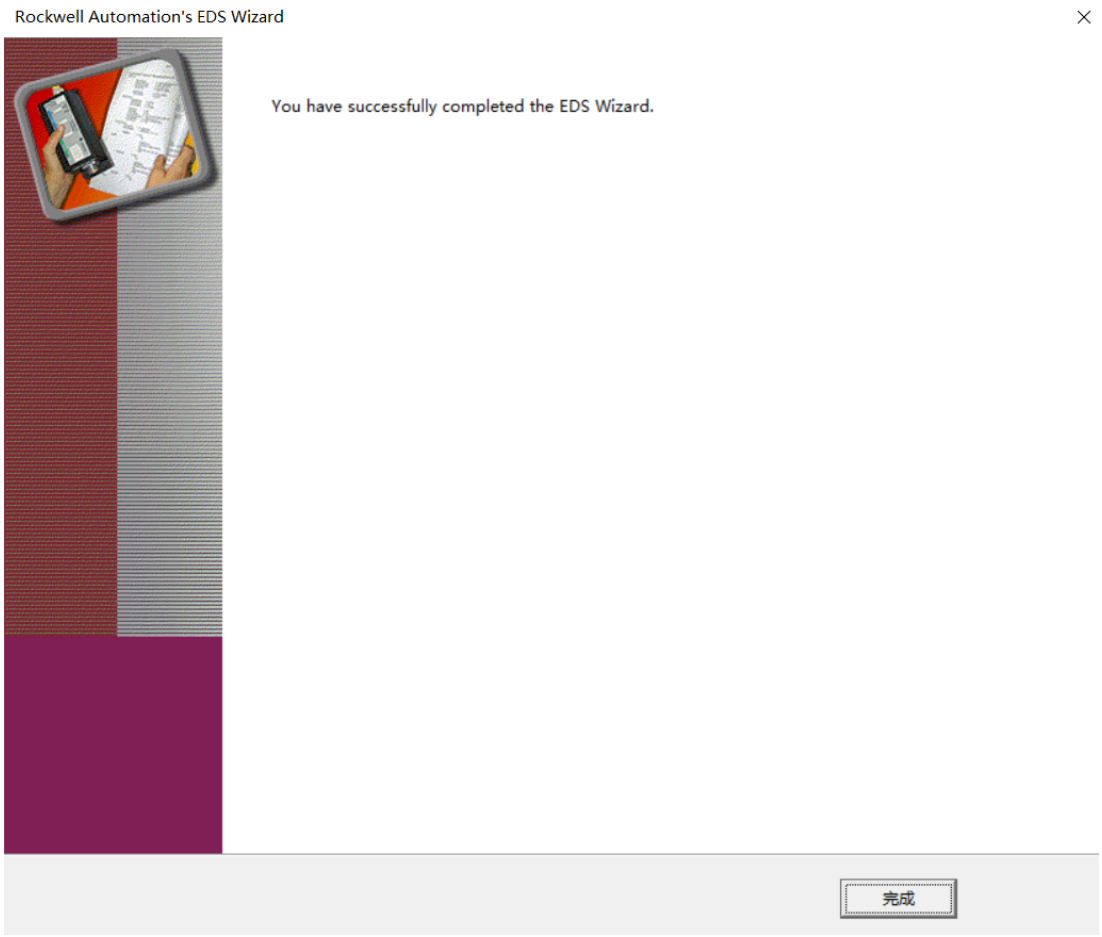
5. Import the EDS file

a. Click "Tools" > "EDS Hardware Installation Tool", and then click "Next" and select "Register an EDS file(s)".



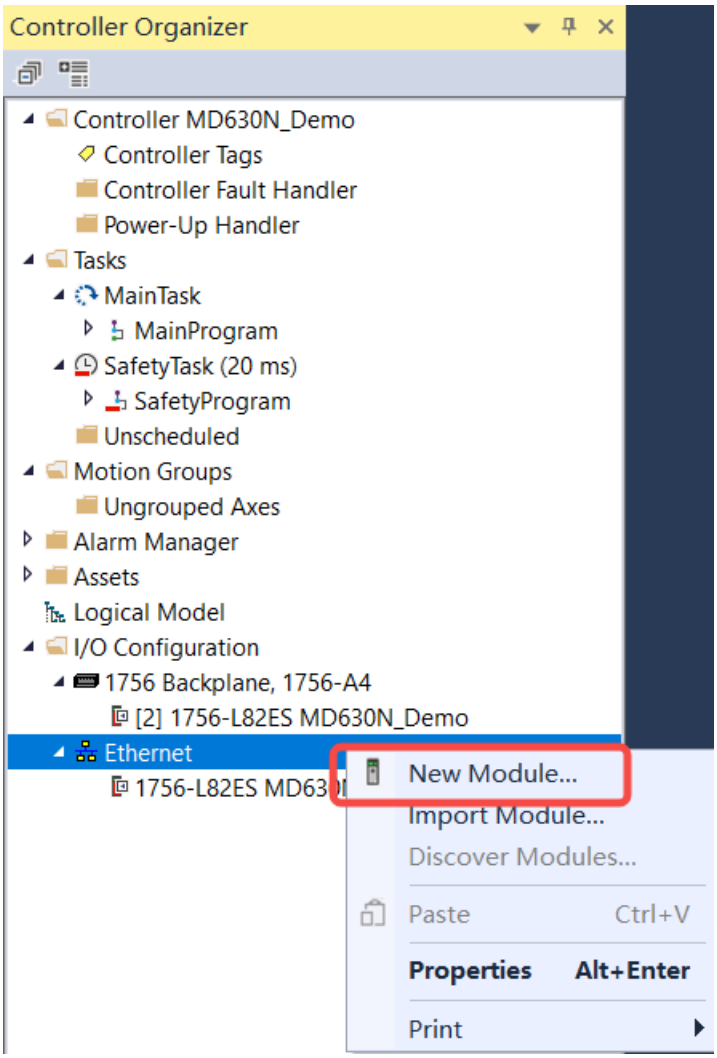
b. Select the corresponding EDS file and click Next until you finish.


Rockwell Automation's EDS Wizard
Registration
Electronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.
Register a single file
Register a directory of EDS files
Look in subfolders
Named:
sers\Administrator\Downloads\MD630N_V1.00_202404181558(1).eds
Browse...
* If there is an icon file (.ico) with the same name as the file(s) you are registering then this image will be associated with the device.
To perform an installation test on the file(s), click Next
< 上一步(B)
下一页(N) >
取消

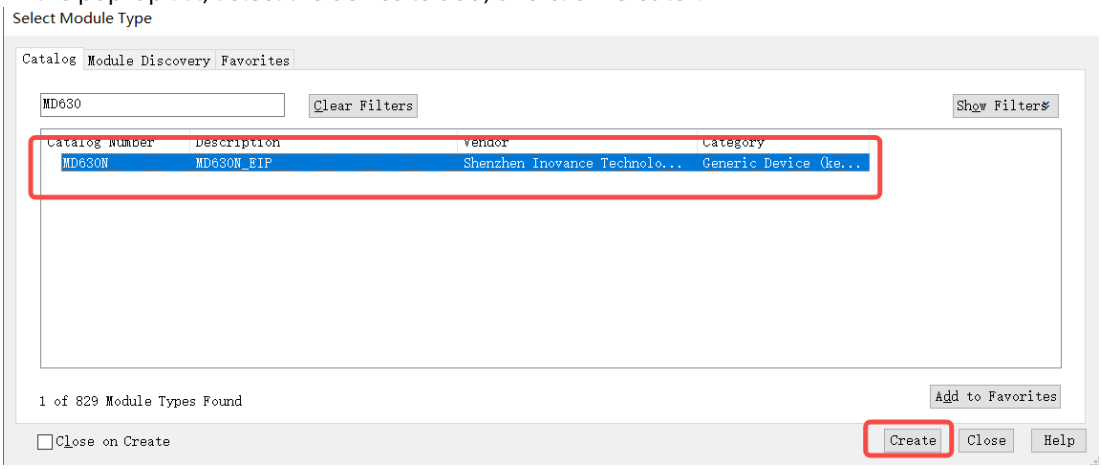


6. Add devices to the project.

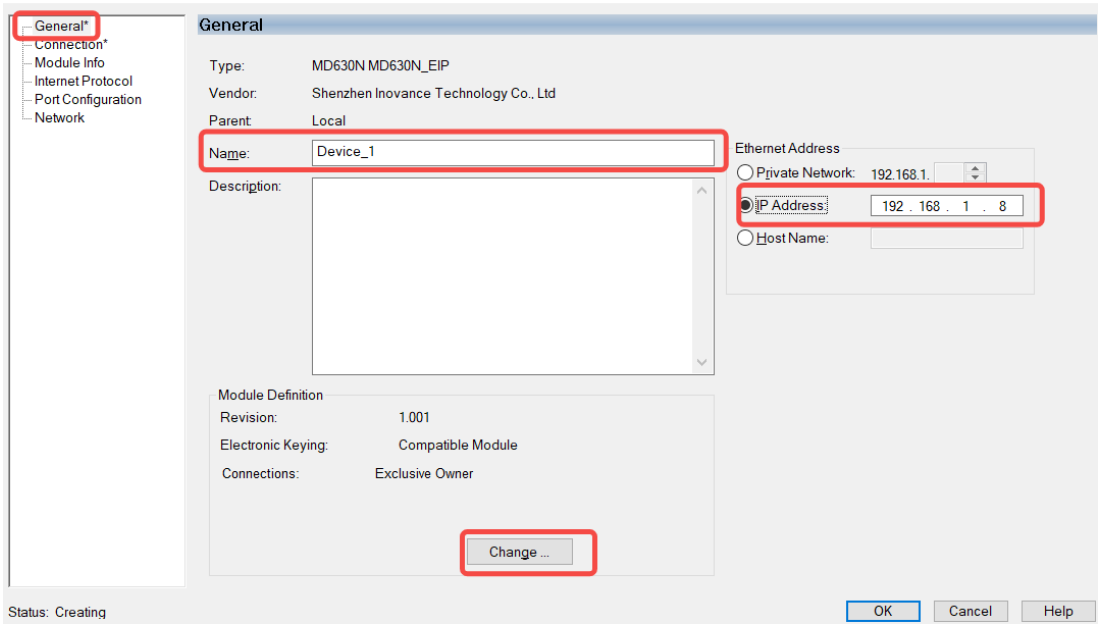
   a. Right-click "Ethernet" and select "New Module".



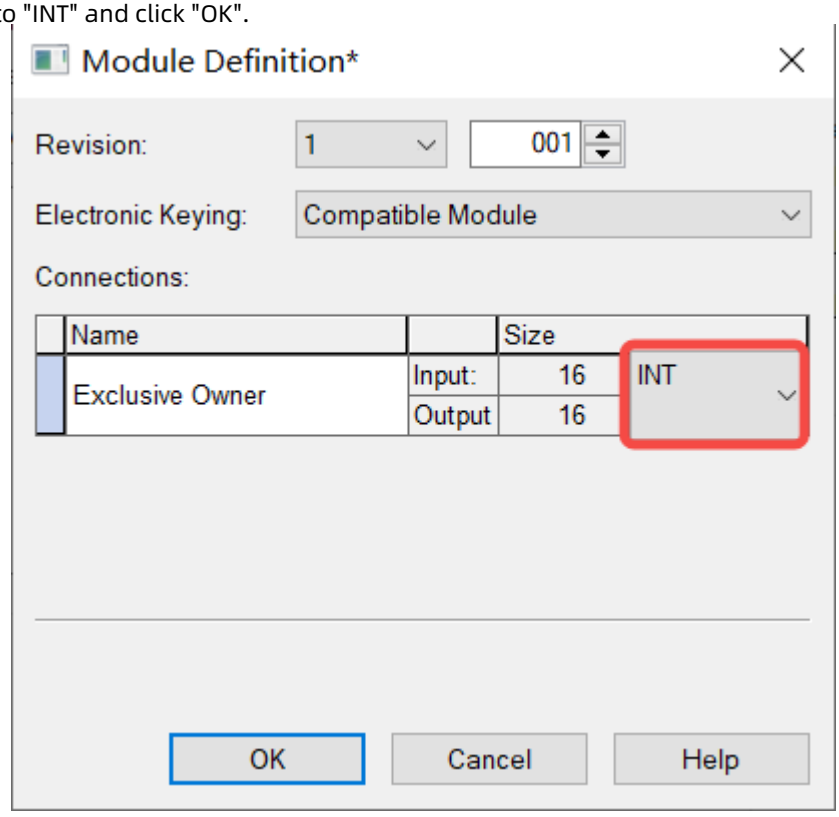
b. In the pop-up list, select the device to add, and click "Create".



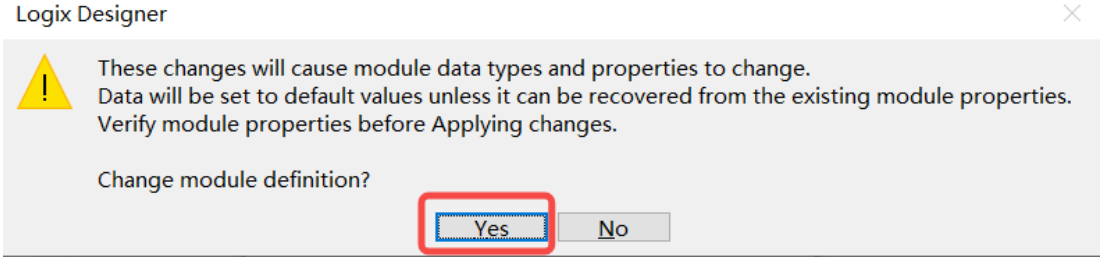
c. Select "General" on the left and set the "Name" and "IP Address" of the device. The IP Address needs to match the IP address in the device communication parameters. After settings are done, click "OK".



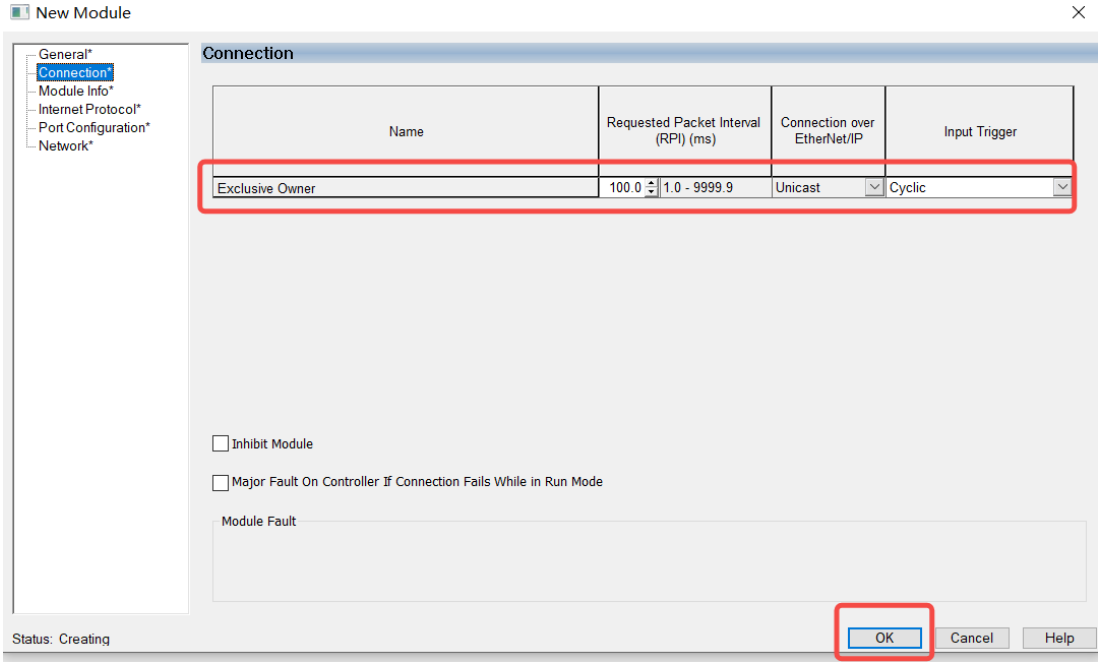
d. Set "Size" to "INT" and click "OK".



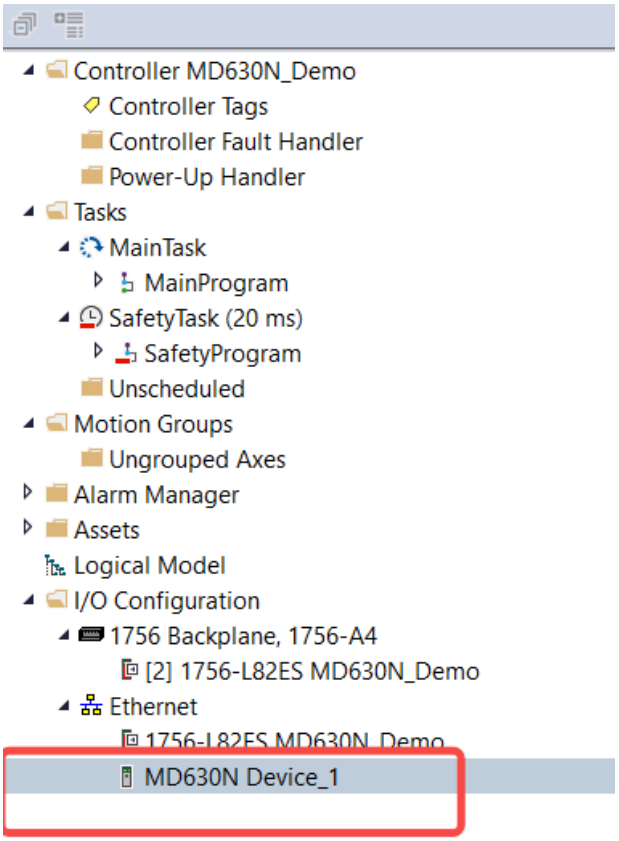
e. Click "Yes".



f. Click "Connection" on the left to set the connection parameters. Set the parameters according to the actual project requirements, and click "OK".

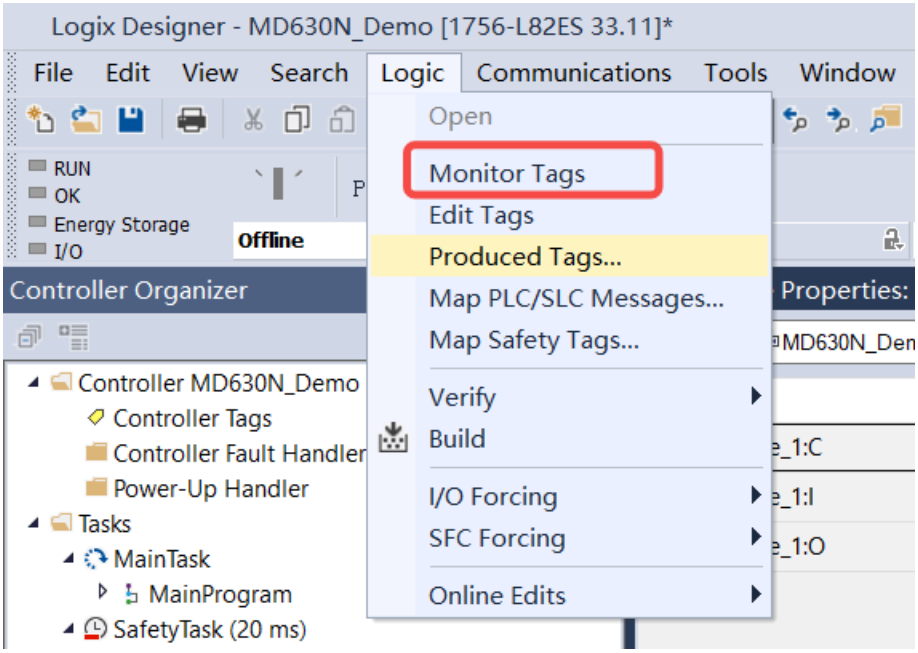


The added device can be viewed under the project status bar.

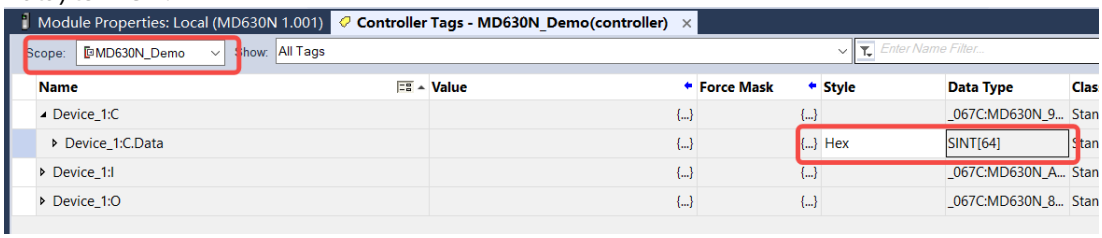


7. Configure the mapping data.

a. Select "Logic" > "Monitor Tags".

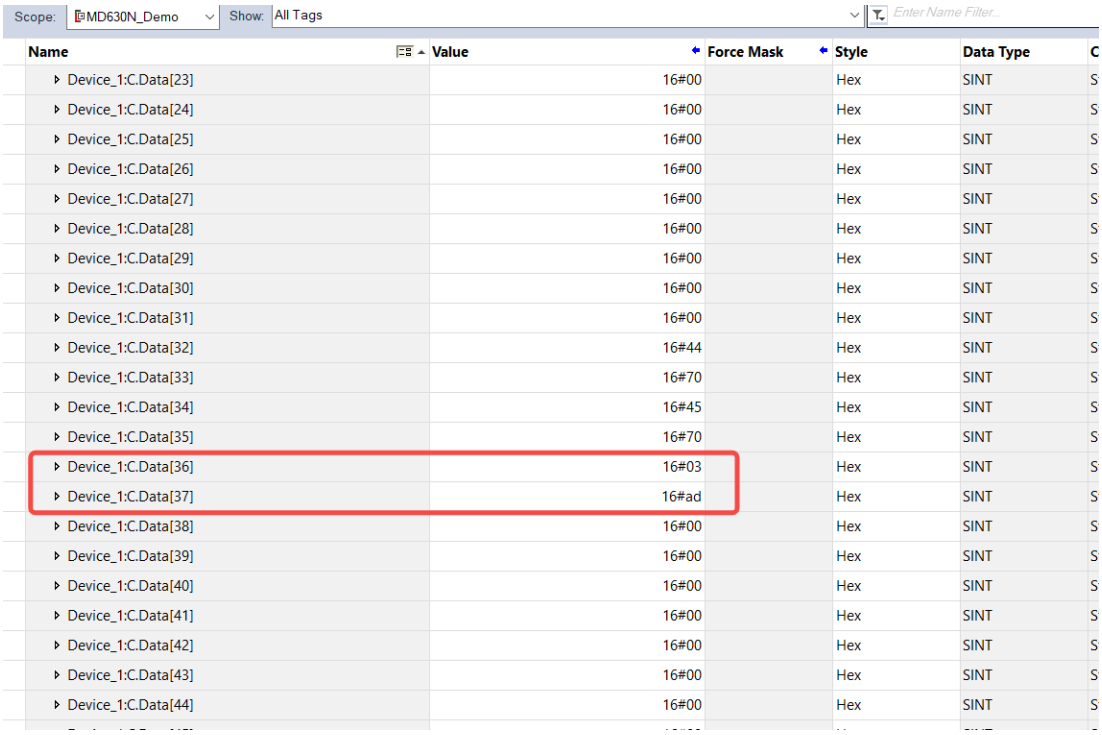


b. Select the current project and set the data format in the configuration data (that is, Device_1: C_Data) to "Hex".



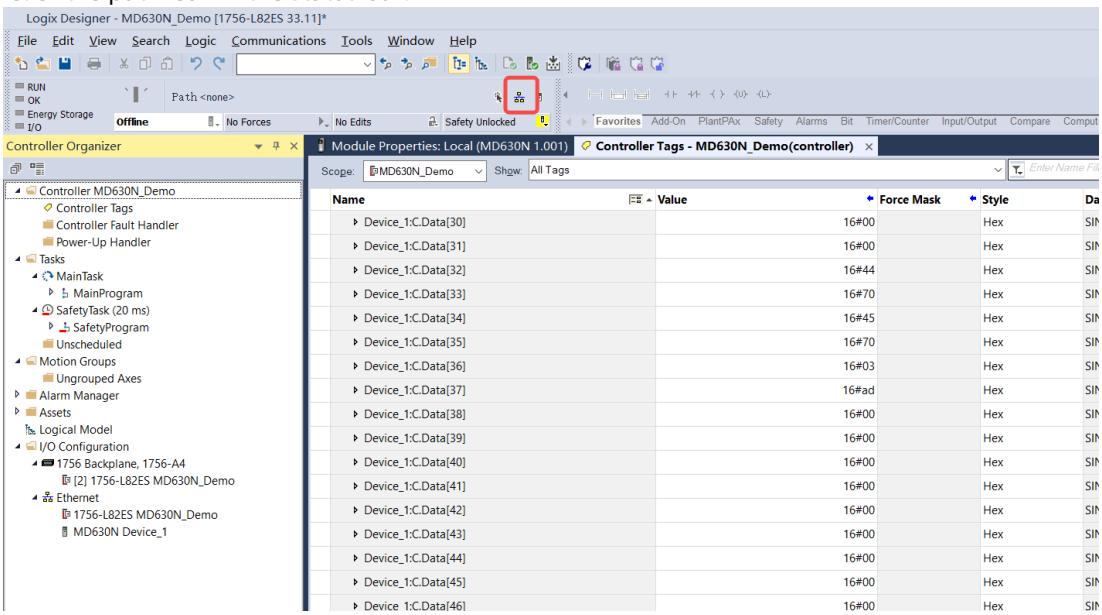
c. Expand the configuration data and fill in the table with the control and status word addresses that need to be mapped.

Each of the two parameters form a group of addresses, with the higher-order address after the lower-order address. In the example, the power-on time of the drive is obtained at the address 0Xad03, so the status word mapping is C:Data[36]=0x03 and C: Data[37] = 0xad.

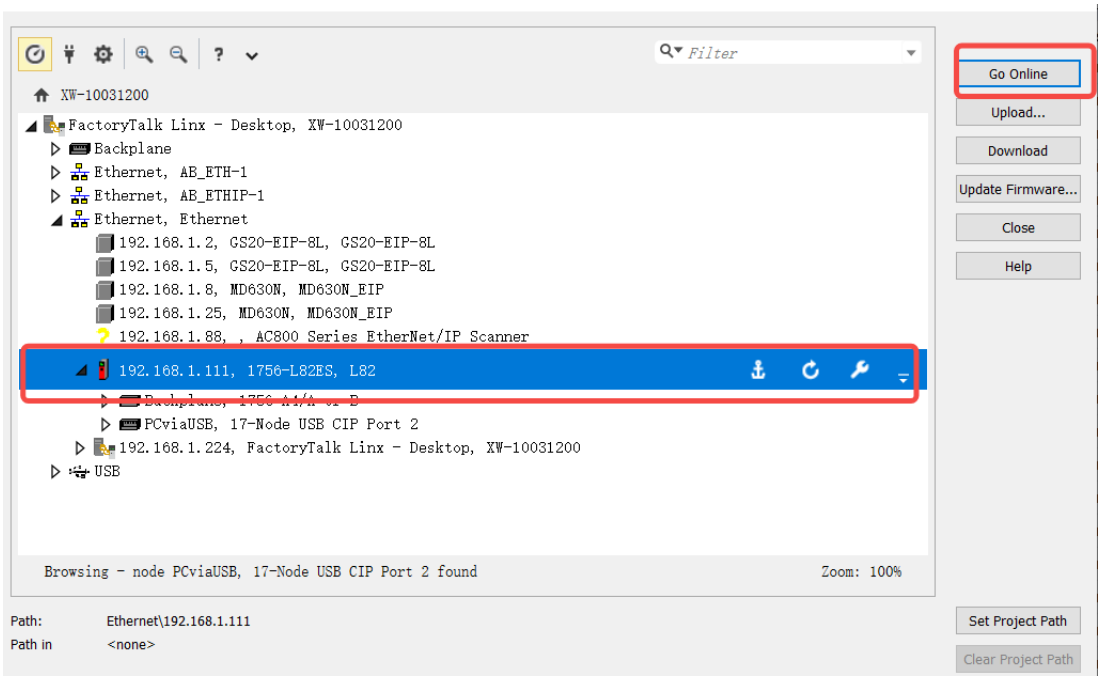


8. Download the project to the PLC.

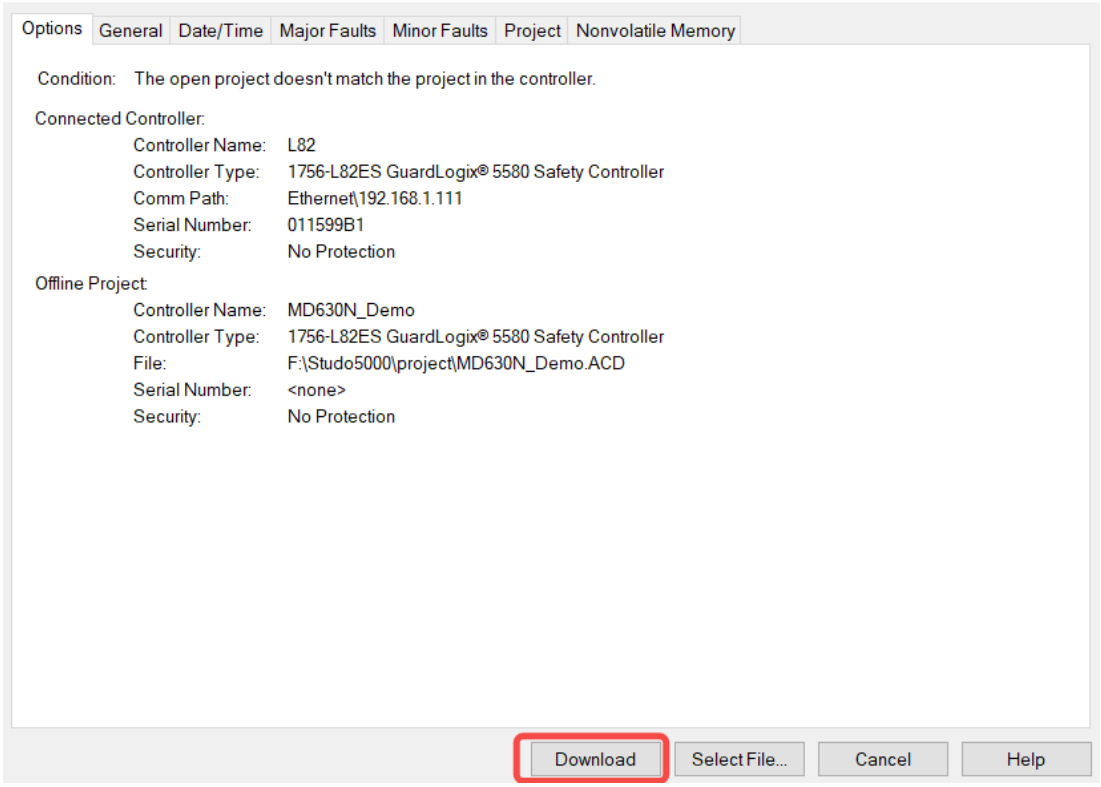
a. Click the path icon in the status bar.



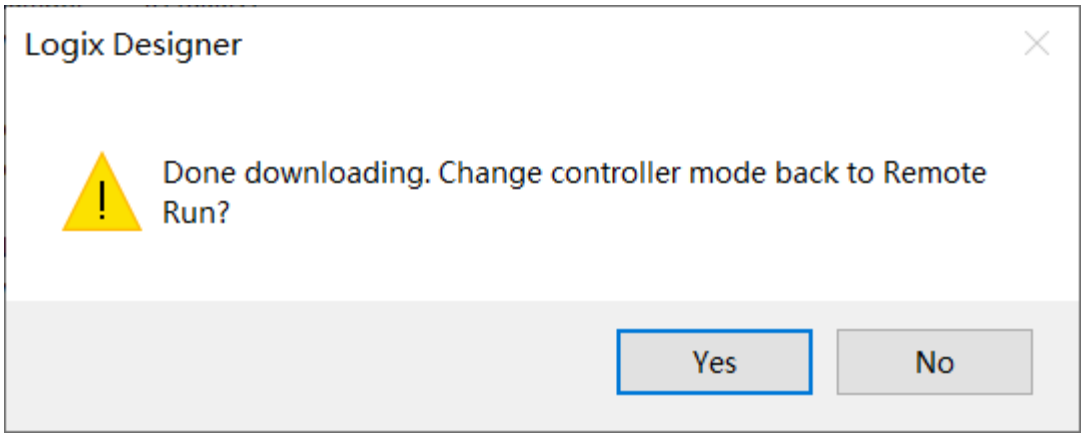
b. Select the master to download to, and click "Go Online".



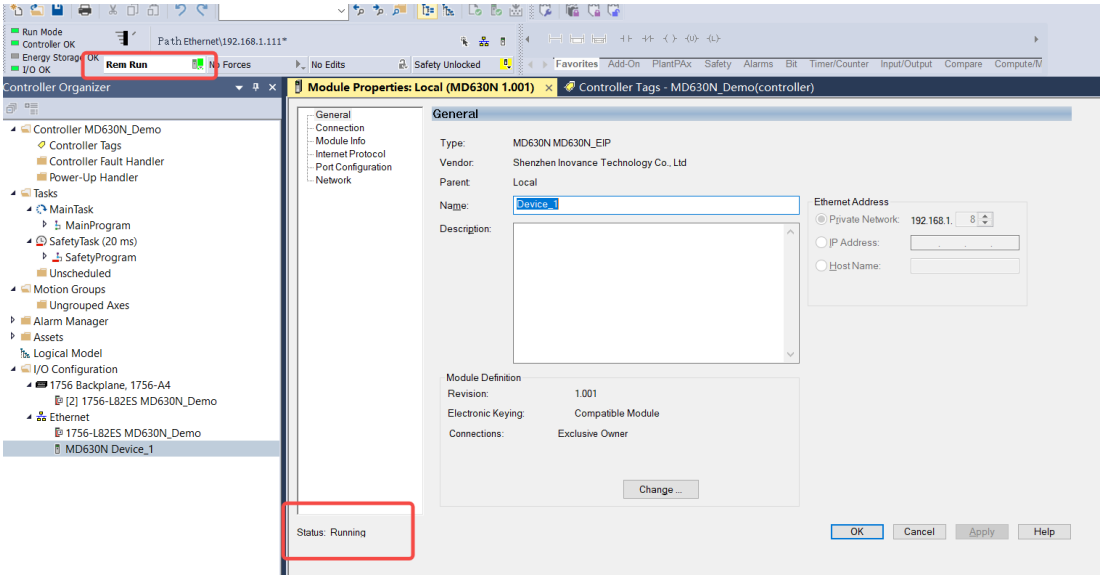
c. Click "Download".



d. Click "Yes".

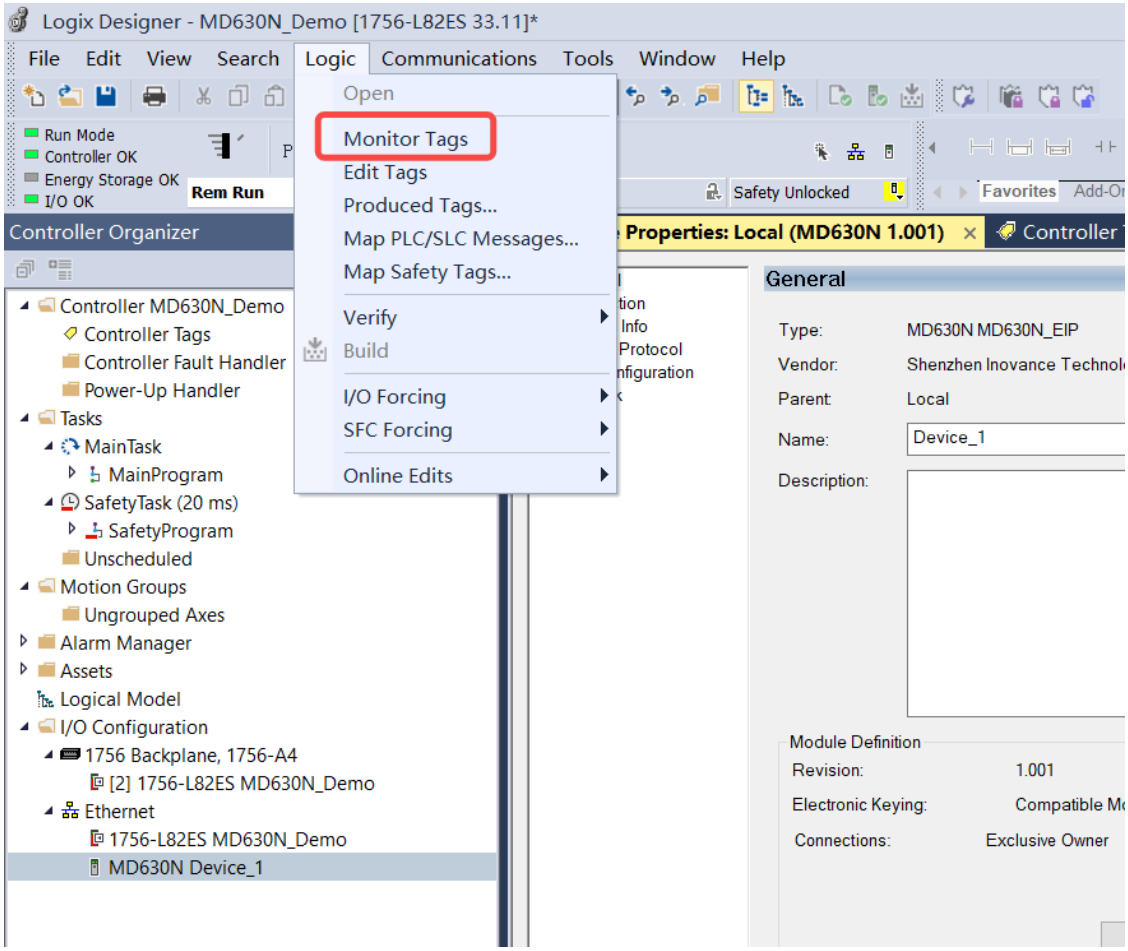


As shown in the following figure, the master is online and device interaction is normal.

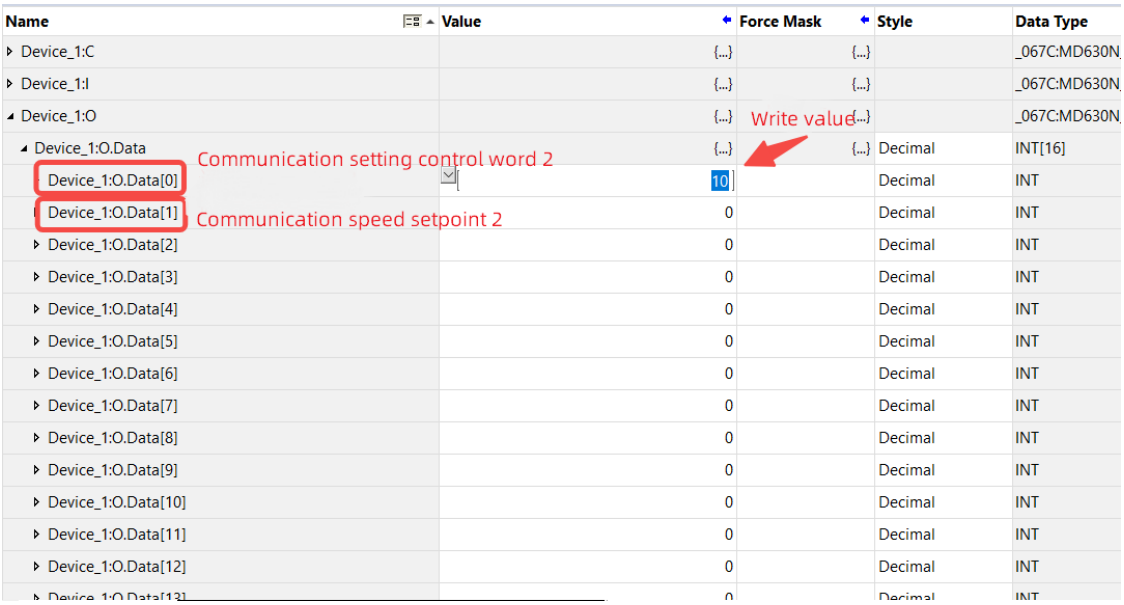


Step 4: Control the AC drive through communication

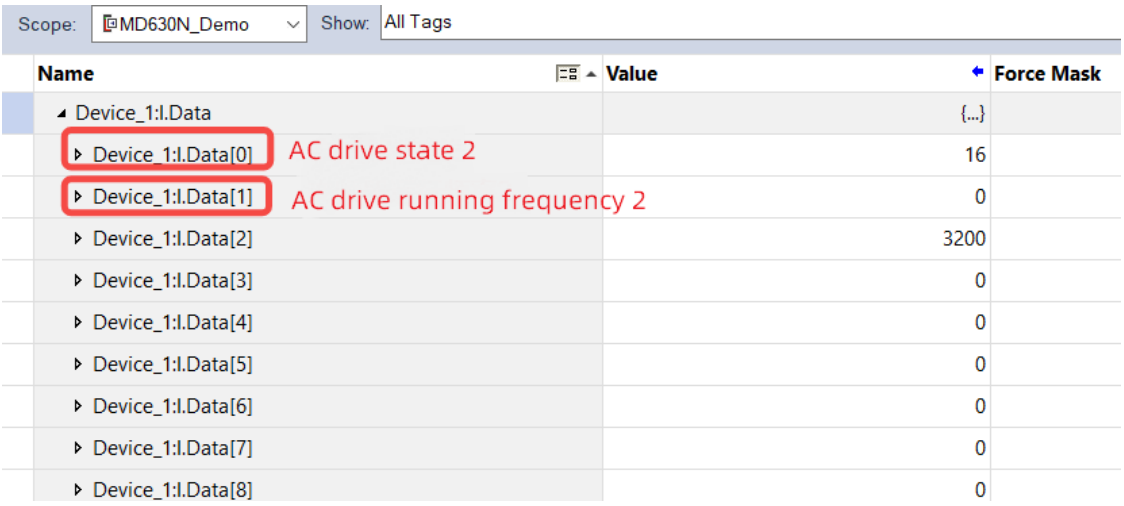
1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.
   Select "Logic" > "Monitor Tags". The communication data mapping table pops up.



Write the given parameter as shown in the following figure.



The communication feedback data is shown in the following figure.



2. For start/stop control and setting frequency or torque using EtherNet/IP communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherNet/IP.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the drive. It is defined as follows:

Address		Description
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

   For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

   The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H setting selection]. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/two decimal places)

In default settings, when n014 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write 1000 to set the main frequency to -10.00 Hz.

The corresponding feedback status is defined in the following table:

Address		Description
Drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit 0: Running status. 0: Stopped; 1: Running Bit 1: Running direction. 0: Forward; 1: Reverse Bit 2: Fault state. 0: No fault; 1: Faulty Bit 3: Frequency reached. 0: Not reached; 1: Reached Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.11 Replacing Faulty Device

When using EtherNet/IP, MD630-INT supports directly replacing faulty device without having to reconfigure and assign the device.

The following conditions must be met to replace the failed device:

The alternative component and the component to be replaced are both the MD630N-INT;

To replace the device, do as follows:

1. Record the communication parameters of the faulty device, unplug the cable from the faulty device, and remove the faulty device from the network.
2. Connect the new device to the network as it was physically connected.
3. See *"6.8.6 Connect the AC drive to the bus system" on page 914* to configuring communication paramters of the new device. The communication parameters of the new device must be consistent with the faulty device.

6.9 PROFINET Drive Control

6.9.1 Overview

PROFINET communication is a real-time industrial fieldbus communication protocol based on Ethernet, with high performance, flexible topology, and low cost. High precision and simple application.

6.9.2 Communication Specifications

Table 6–24 PROFINET protocol communication specifications

Item	Description
Communication protocol	PROFINET protocol
Supported services	Cyclic data exchange Acyclic data exchange Media Redundancy Protocol (MRP) Discovery and basic Configuration Protocol (DCP) Link Layer Discovery Protocol (LLDP) Prioritized startup (FSU)
Physical layer	100BASE-TX
Duplex mode	Full duplex
Topology	Linear, star, tree, and ring
Transmission rate	100 Mbps (100Base-TX)
Transmission medium	Shielded cables of Cat5e or higher
Communication terminal	RJ45
Communication type	RT Class1
PROFINET frame length	40 bytes to 1440 bytes
Cyclic data	Max. 1440 bytes for a single node (Max. 32 bytes for MD630N-INT)
Acyclic data	Max. 24 bytes
Communication cycle	≥1 ms
Max. cable length	<100 m (good environment and cables)
Maximum number of allowed slaves	65535 (depending on master station performance)
The number of request messages can be received at the same time	1

6.9.3 Communication System Connections

The PROFINET network supports three basic topologies: Bus-type, star-type, and ring-type. It also supports a hybrid topology such as tree-type topology.

Bus topology

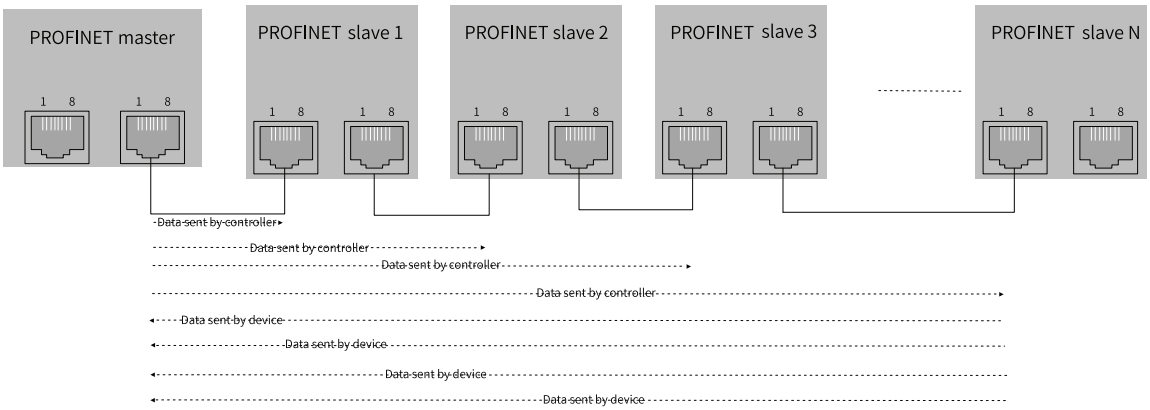


Figure 6-50 Bus-type topology

When bus-type topology wiring is used, it is routed from the PROFINET master station, connected to any RJ45 port of the AC drive, and then routed from another RJ45 port to the next AC drive.

PROFINET does not distinguish between IN/OUT ports. Any network port can be used as a port to connect to the master station. In general applications, the master station does not check the network connection. However, if a specific port connection is configured in the topology view, the connection must be performed in the order shown in the topology diagram. Otherwise, the master will report an error.

The bus-type topology is simple and low-cost. However, if the upstream device is abnormal (such as communication interruption or power-off), all the subsequent devices cannot communicate properly.

The PN master-slave interaction adopts the point-to-point interaction mode. Regardless of the topology connection, the device exchanges data only with the master station. For the format of the PN data interaction frame, see *"6.9.4.1 Message Structure" on page 942*.

Star-type topology

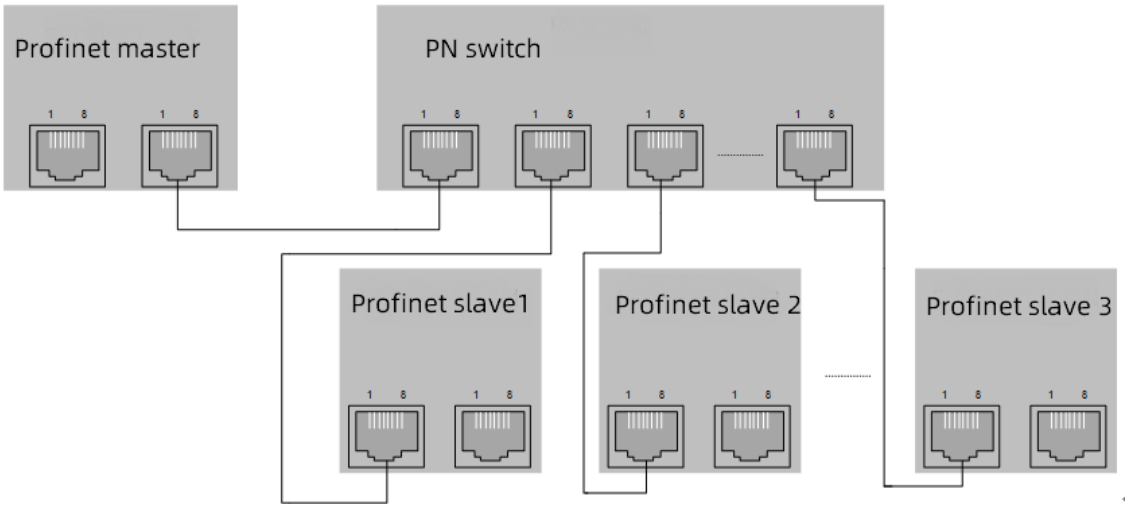


Figure 6-51 Star-type topology

When using a star topology, the network cables are routed from the master station to the PN switch and then to each slave station. The star topology does not affect the communication of other slave nodes when a single slave node fails, but increases the switch cost. If the switch is abnormal, All nodes will be interrupted.

Ring topology

The ring topology is a bus topology. The empty network port of the last device leads a network cable to the idle network port of the PLC to form a loop.

The ring topology eliminates the problem that a single node fault in a bus topology will interfere with other nodes, but requires that the PN master and all slaves in the topology support MRP.

Tree topology

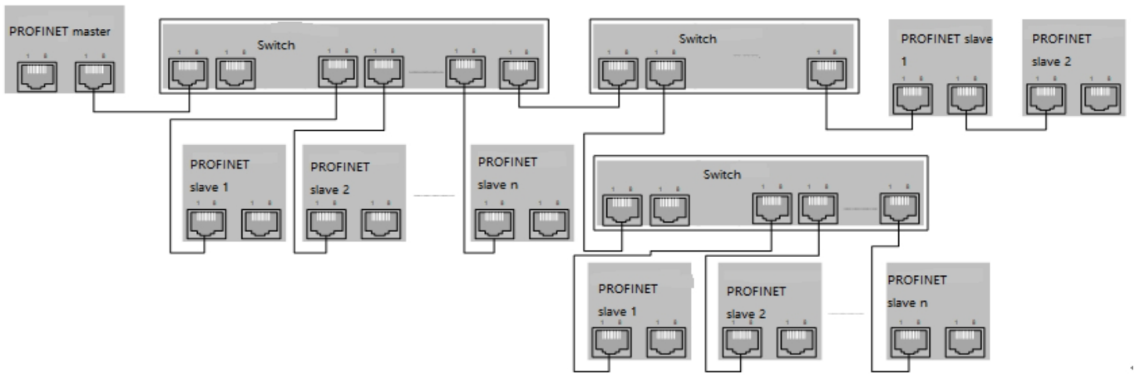


Figure 6-52 Tree topology

The tree topology is a combination of bus-type topology and star topology to make networking more flexible.

6.9.4 Message

6.9.4.1 Message Structure

PROFINET data is transmitted through Ethernet data frames in a format that complies with the IEEE802 standard, as shown in the following figure. The following table defines the PROFINET data frame structure.

Preamble	Frame Start Mark	Target MAC	Source MAC	Type and VLAN-ID	Ethernet Type	Frame ID	Data	APDU Status	Verification
7 bytes	1 byte	6 bytes	6 bytes	4 bytes	2 bytes	2 bytes	40-1440 bytes	4 bytes	4 bytes

IEEE802.3 IEEE802.1 Q

Figure 6-53 PROFINET message structure

Table 6–25 PROFINET frame structure definition

Field	Description
Preamble	It is used for time synchronization between the sender and the receiver. The seven bytes are fixed to 10101010.
Frame start flag (SFD, Start Frame Delimiter)	The Ethernet frame start flag, which is fixed to 10101011.
Destination MAC	The MAC address of the receiver.
Source MAC	The MAC address of the sender.
Type and VLAN_ID	TYPE: 0x8100 Priority: 3 bits Reserved (0): 1 bit VLAN_ID: 12 bits

Field	Description
Ethernet type	IP: 0x0800 ARP: 0x0806 VLAN: 0x8100 PN: 0x8892
Frame ID	0x0000 to 0x00FF: Reserved 0x0100 to 0x7FFF: RT Class 3 Frames (i.e. IRT frame) 0x8000 to 0xBFFF: RT Class 1 Frames (i.e. RT frame) 0xC000 to 0xFBFF: RT Class UDP 0xFC00 to 0xFCFF: High-priority non-cyclic transmission 0xFE00 to 0xFEFC: Low-priority non-cyclic transmission 0xFEFC to 0xFEFF: DCP
Data	Data area
APU (Application Protocol Data Unit) status	Cycle counter: 2 bytes Data status: 1 byte Transmission status: 1 byte
Check	FCS (Frame Check Sequence)

6.9.4.2 Process data

The PDO data enables the master to modify and read AC drive data in real time and perform periodic data exchange with the AC drive. The data communication addresses are directly configured by the AC drive. The data mainly includes the following:

- Communication setting control word and communication speed setting word of the AC drive.
- AC drive status, actual frequency of the AC drive motor.
- Exchange function parameters and monitor data between the AC drive and the PROFINET master station in real time.

The PDO is used for periodic data exchange between the master station and AC drive, as described in the following table.

Table 6–26 Interactive data

PDO data sent by master		
PZD by default.		Variable PZD
Control word 2 set through communication (7311H)	Communication speed setting value 2 (7310H)	Real-time modification of AC drive function parameters
PZD1	PZD2	PZD3 to PZD16
PDO Data Responded by AC Drive		
PZD by default.		Variable PZD
Drive state 2	Actual motor frequency	Real-Time Reading of AC Drive Parameters
PZD1	PZD2	PZD3 to PZD16

6.9.4.3 Message Instances

6.9.4.3.1 Stop process data communication

The periodic process data is transmitted through RT Class 1 Framess. The frame transmitted from the master station to the slave station contains all the written PZD data (out_data) of the node. The frame transmitted from the slave station to the master station also contains the PZD data (in_data) to be read by the master station. The frame structure is shown in the following table (some fields before and after Ethernet are omitted).

The following table describes the structure of the periodic communication frame.

Table 6–27 Frame structure of cyclic data transmission from the controller to the device

Vlan	Ethernet TYPE	Frame ID	IOCS	Data	IOPS	...	Data	IOPS	APU
4 bytes	2 bytes	2 bytes	Byte	Byte	1 bytes	...	Byte	1 bytes	4 bytes
-	0x8892	-	/	Terminal module 1		-	Submodule ModelB.pro:		-

Table 6–28 Frame structure of cyclic data transmission from the device to the controller

Vlan	Ethernet TYPE	Frame ID	Data	IOPS	...	Data	IOPS	IOCS	APU
4 bytes	2 bytes	2 bytes	Byte	1 bytes	...	Byte	1 bytes	1 byte	4 bytes
-	0x8892	-	Terminal module 1		-	Submodule ModelB.pro:		-	/

IOPS: Input output object provider status

IOCS: Input Output Object ConsumerStatus

6.9.4.3.2 Non-cyclic mailbox data communication

Aperiodic mailbox data communication is initiated by the PN master station. It is carried out in a question-and-answer manner. The following table shows the frame structure of the non-periodic transmission (excluding the Ethernet frame header).

See the following table for the structure of non-cyclic communication frames.

Table 6–29 Enquiry

...	Ethernet TYPE	IP/UDP	RPCs	NDR	Read Block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	/	/	/	/

Table 6–30 High response

...	Ethernet TYPE	IP/UDP	RPCs	NDR	Read Block	Read Data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	Byte	4 bytes
-	0x0800	-	/	/	/	/	/

Table 6–31 Enquiry

…	Ethernet TYPE	IP/UDP	RPCs	NDR	Write Block	Write Data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	Byte	4 bytes
-	0x0800	-	/	/	/	/	/

Table 6–32 High response

…	Ethernet TYPE	IP/UDP	RPCs	NDR	Write Block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	/	/	/	/

Field	Status
Ethernet TYPE	Ethernet type, non-cyclic fixed to 0x0800
IP/UDP	Standard IP/UDP segment, see the meaning of the protocol
RPCs	RPC (Remote Procedure Call) specifies the data format used for data transmission and identifies the target object more accurately
NDR	Defines the size of the data block to be addressed
Read Block	Contains the ARUID, API, slot number, sub-slot number, and index of the device to be read
Read Data	Read data value
Write Block	Contains the ARUUID, API, slot number, sub-slot number, and index of the device to be written
Write Data	Data to write
FCS	FCS (Frame Check Sequence)

6.9.4.3.3 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 853*.

6.9.4.3.4 Mapping table (AC drive data)

For details, see *"6.5.3 Mapping Table" on page 854*.

6.9.5 Communication Terminals

The PROFINET bus adopts standard RJ45 network port and standard RJ45 connector. Use Cat 5e shielded twisted pairs and injection cables with iron housing. The cable between devices cannot exceed 100 m when the PROFINET bus is used, exceeding of which may attenuate the signal and affect normal communication.

PROFINET does not distinguish between IN/OUT, that is, the master station can be imported from any port of the MD630N-INT and then routed from another port to the next slave device.

In the topology view or port configuration, two ports, Port1 and Port2, exist on the MD630N-INT, which is EtherCAT and PROFINET. For products with three protocols in EtherNet/IP, the terminal markings are only matched according to EtherCAT, and do not reflect the characteristics of PROFINET. In actual use, Port1 corresponds to J9 (terminal mark IN) and Port2 to J5 (terminal mark OUT), as shown in the following figure.

When the topology view is not configured (that is, whether to specify the corresponding port interconnection), the insertion of any port does not affect the use of the port or cause an error. However, when the topology view is configured, the port connection needs to be performed according to the configured connection relationship. Otherwise, the PLC will report a fault (communication is not affected).

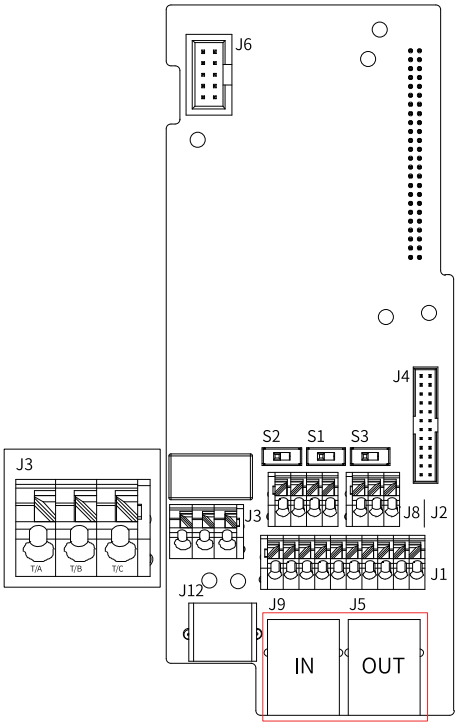


Figure 6-54 PROFINET communication terminal location

Table 6–33 Profinet communication terminal

External Interface	Terminal type	Transmission information type	Terminal identification	Name	Terminal function description
J9	RJ45 terminal	100M bus	IN	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, it is the IN port. The EIP/PN does not distinguish the direction.
J5	RJ45 terminal	100M bus	OUT	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, it is the OUT port. The EIP/PN does not distinguish the direction.

Indicator name	Status	Remarks
LED0 (green)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.
LED1 (yellow)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.

6.9.6 Connect AC Drive to Bus System

The PROFINET network cable is connected to the terminal of the network port with a metal shield. The maximum cable length between the two devices is 100 meters, and the theoretical maximum

number of stations is 65535. For the common connection topology, see *"6.9.3 Communication System Connections" on page 940*.

Connecting steps:

1. Disable system power supply.
2. Connect the PROFINET master and PROFNET slave with shielded network cables.
   Refer to the communication network topology in *"6.9.3 Communication System Connections" on page 940* and connect the network cable to the terminal of the network port with a metal shield. The IN and OUT of the MD630-INT communication port are not different in the direction. For communication interface specifications, see *"6.9.2 Communication Specifications" on page 940*.

Note

For PROFINET communication, IN and OUT of the communication port are not directional-sensitive.

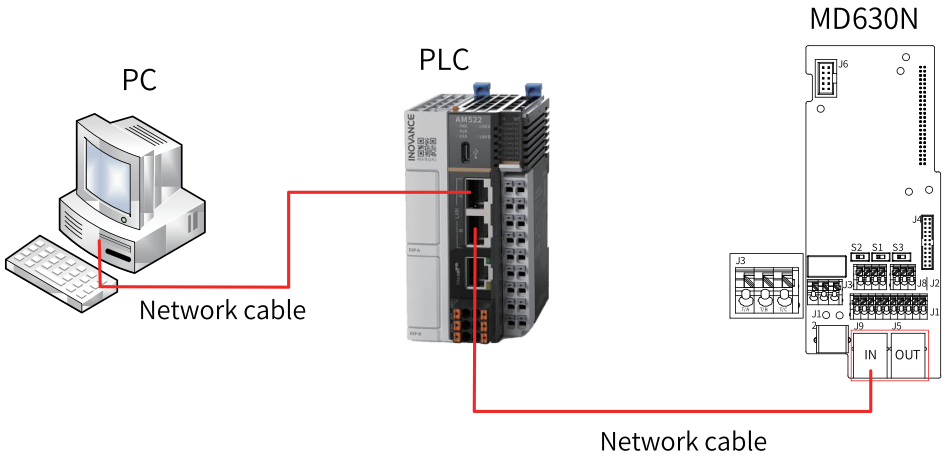


Figure 6-55 PROFINET communication connection

3. Power on the system after ensuring that connections other than communication connection are correct.
4. Power on the device again.

6.9.7 Configure Communication Between AC Drive and Controller

The MD630N-INT AC drive supports standard PROFINET master station equipment. Currently, it mainly includes Siemens S7-1200, S7-1500, S7-300, S7-400, SMART200, etc.

PROFINET communication requires the following basic operations on the AC drive:

1. Make sure that the wiring is correct as in *"6.9.6 Connect AC Drive to Bus System" on page 946*.
2. Switch the device communication mode to Profinet communication (n0-10 = 3), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for channel 1 (b0-03 = 0, b5-00 = 9). (You can operate through the operating panel or the software.)
3. Wait for a few seconds until LED 0 (green) and LED 1 (yellow) to be on. This indicates that the Ethernet link is established successfully.

4. Configure the communication between the master station (controller) and the slave station (AC drive). For details, see *"6.9.10.1 Example for Communicating with TIA PORTAL" on page 950*.

6.9.8 Communication Parameters

Group n6 of the AC drive function code defines PROFINET communication parameters.

Table 6–34 Parameters related to Modbus communication

Item	Name	Default	Value Range	Change Method	Parameter description:
n6-01 Fd-76	Highest order byte of the IP address	0	0 to 255	This is not modifiable.	The highest byte of the IP address. If the IP address is 192.168.0.2, the function code is displayed as 192. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-02 Fd-77	Second highest order byte of the IP address	0	0 to 255	This is not modifiable.	The second highest byte of the IP address. If the IP address is 192.168.0.2, the function code is displayed as 168. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-03 Fd-78	Third highest order byte of the IP address	0	0 to 255	This is not modifiable.	The third byte of the IP address. If the IP address is 192.168.0.2, this parameter is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-04 Fd-79	Lowest order byte of the IP address	0	0 to 255	This is not modifiable.	The lowest byte of the IP address. If the IP address is 192.168.0.2, this parameter is displayed as 2. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-05 Fd-80	Highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The highest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-06 Fd-81	Second highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The second highest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-07 Fd-82	Third highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The third byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.

Item	Name	Default	Value Range	Change Method	Parameter description:
n6-08 Fd-83	Lowest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The lowest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-09 Fd-84	Highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The highest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 192. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-10 Fd-85	Second highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The second highest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 168. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-11 Fd-86	Third highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The third byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-12 Fd-87	Lowest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The lowest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 1. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-20	Message number	-	0 to 65535	This is not modifiable.	Displays the communication message. Additional information: It is automatically displayed after the PN master configures and assigns the device name.

6.9.9 Communication Fault Diagnosis

When communication problems occur, the operating panel of MD630N-INT displays the corresponding fault code. The following table describes the communication fault and diagnostic methods related to PROFINET.

Table 6–35 PROFINET communication troubleshooting method

Fault Code	Fault Name	Cause	Check Method	Solution
E166.1	PROFINET communication times out.	The master or slave is disconnected during communication.	The operating panel displays the fault code.	Check the communication lines between the master and slave.
E166.4	The MAC address is not programmed to PROFINET.	The MAC address is lost or not programmed.	The operating panel displays the fault code.	Ask for technical support.
E166.5	PROFINET mapping address error	The mapping configured during configuration is illegal.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the illegal mapping address.

6.9.10 Communication Configuration Examples

6.9.10.1 Example for Communicating with TIA PORTAL

The following shows the configuration example for controlling MD630N-INT with TIA PORTAL and S7-315.

Prerequisite

To complete the process of connecting the AC drive to the bus system, see *"6.9.6 Connect AC Drive to Bus System" on page 946*.

Operation steps

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

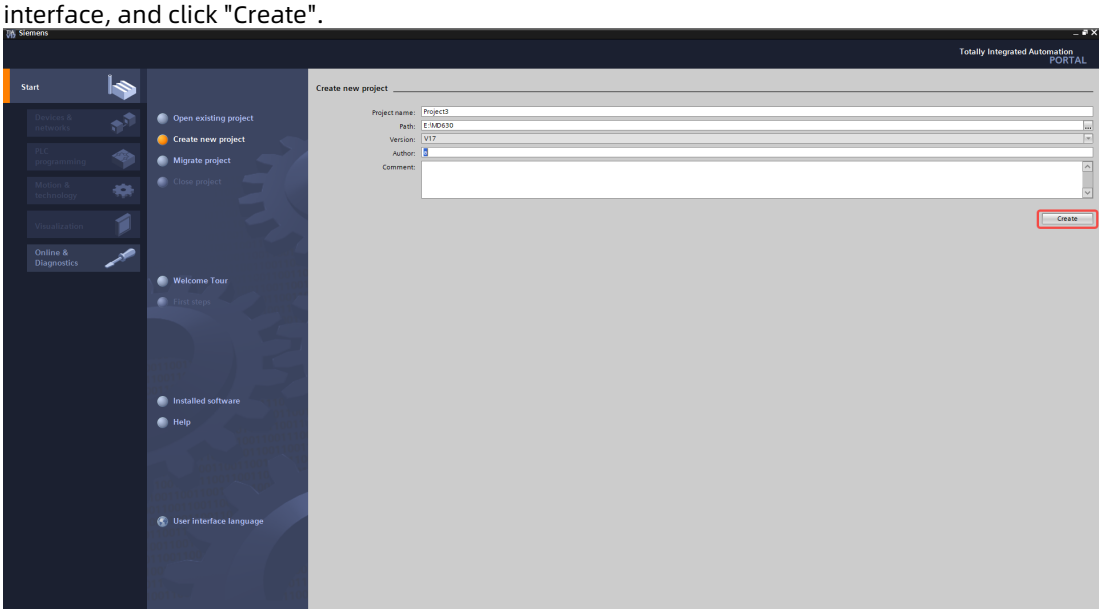
Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish PROFINET communication connection

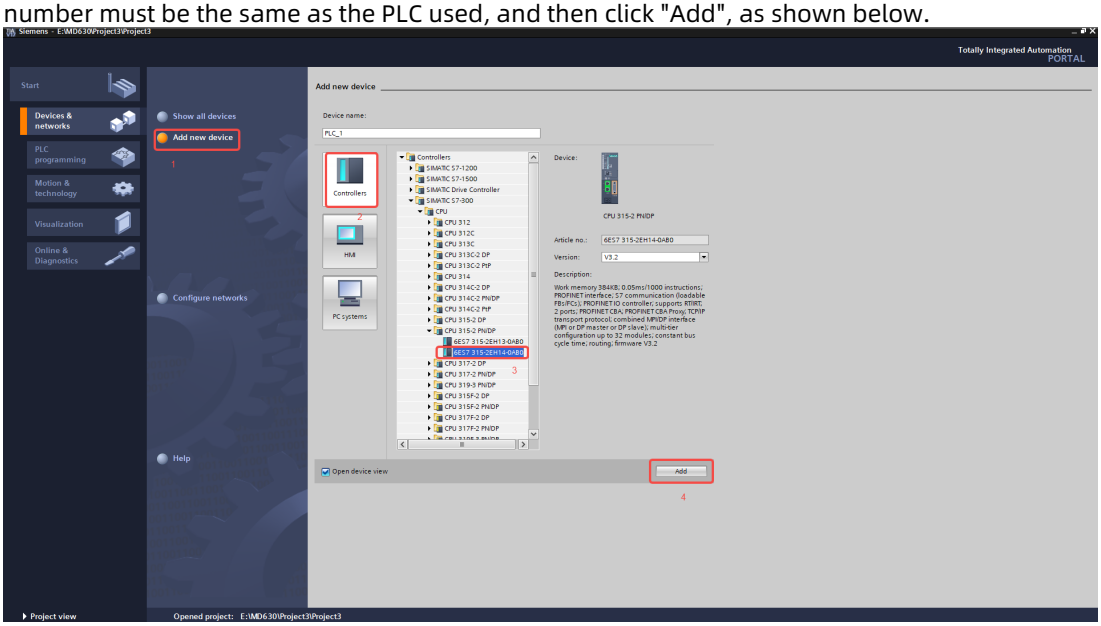
1. Set the value of n0-10 to 3 (through operating panel or the software tool). Set the communication mode to PROFINET.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow. This indicates that the slave and master are connected successfully and there is data exchange.
3. Create a project.

   a. Open the TIA PORTAL software, modify the project name and storage path on the "Create" interface, and click "Create".



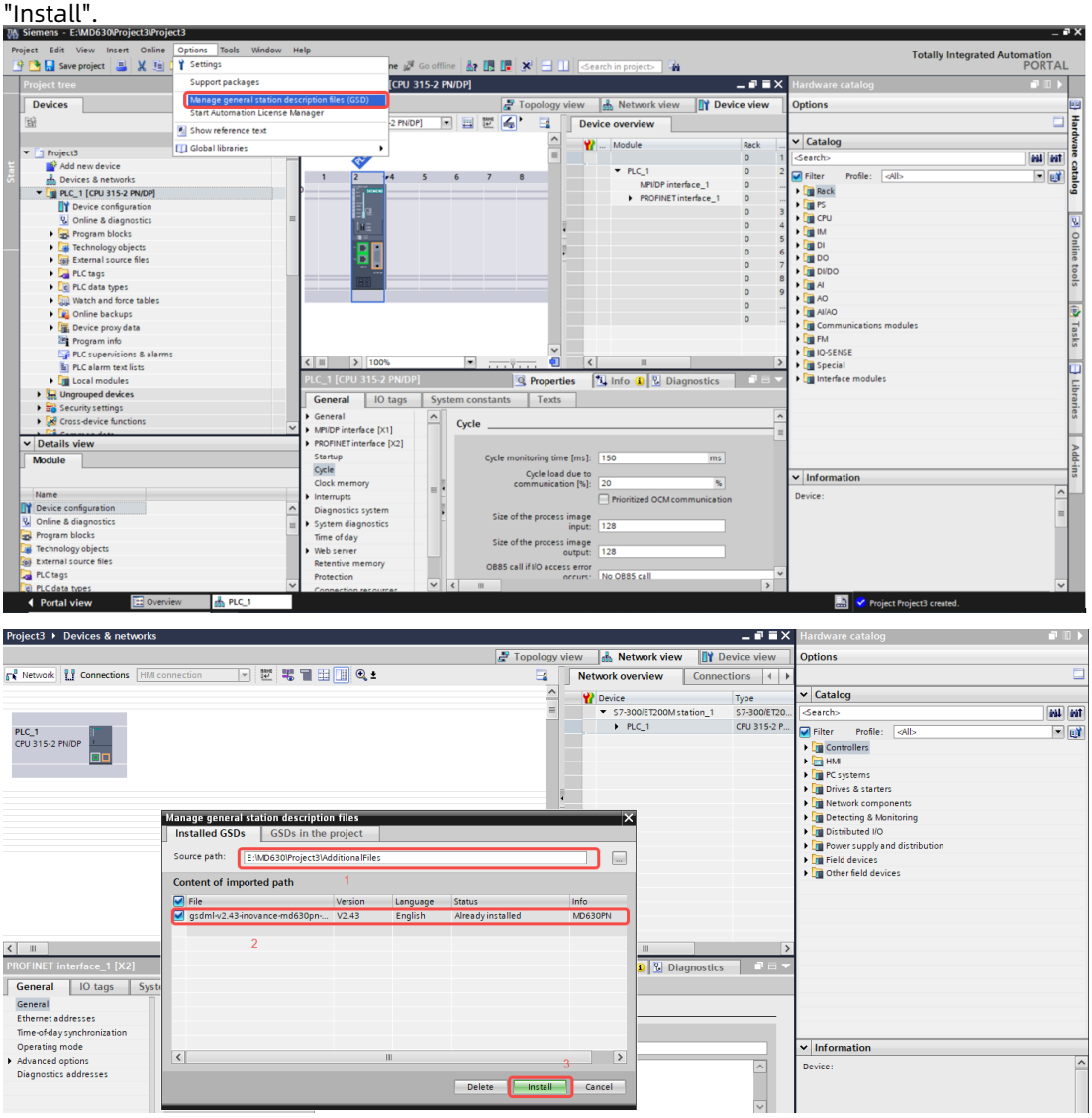
   b. Click "Configure a device".

   c. Click "Add new device", select the correct PLC model in the "Controllers". Note that the order number must be the same as the PLC used, and then click "Add", as shown below.

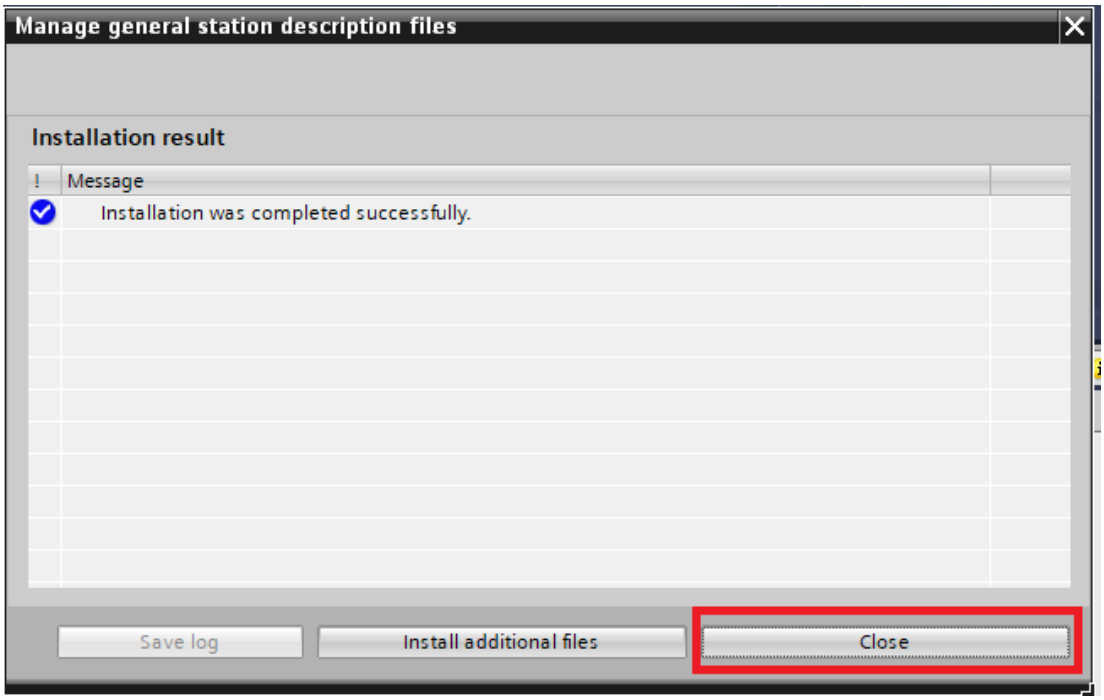


4. Import the device description file (XML) of the drive. Otherwise, the drive cannot be added in TIA PORTAL software.

a. Select "Options" in the toolbar, click "Manage general station description files (GSD)", and then select the path where the current XML file is saved and check the XML file to be installed. Click "Install".

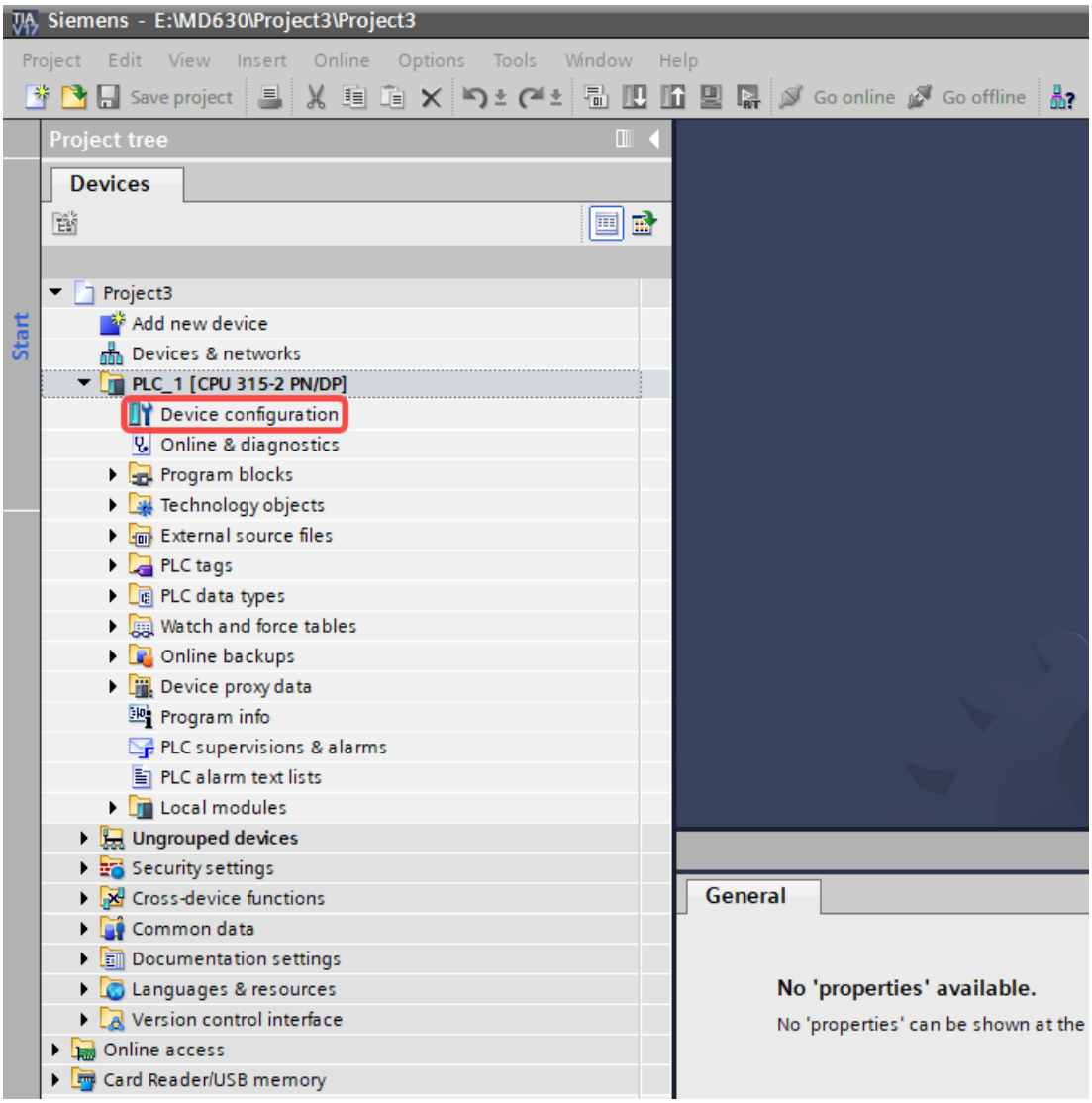


b. Click "Close" when the message "Installation was completed successfully" is displayed, as shown in the following figure.

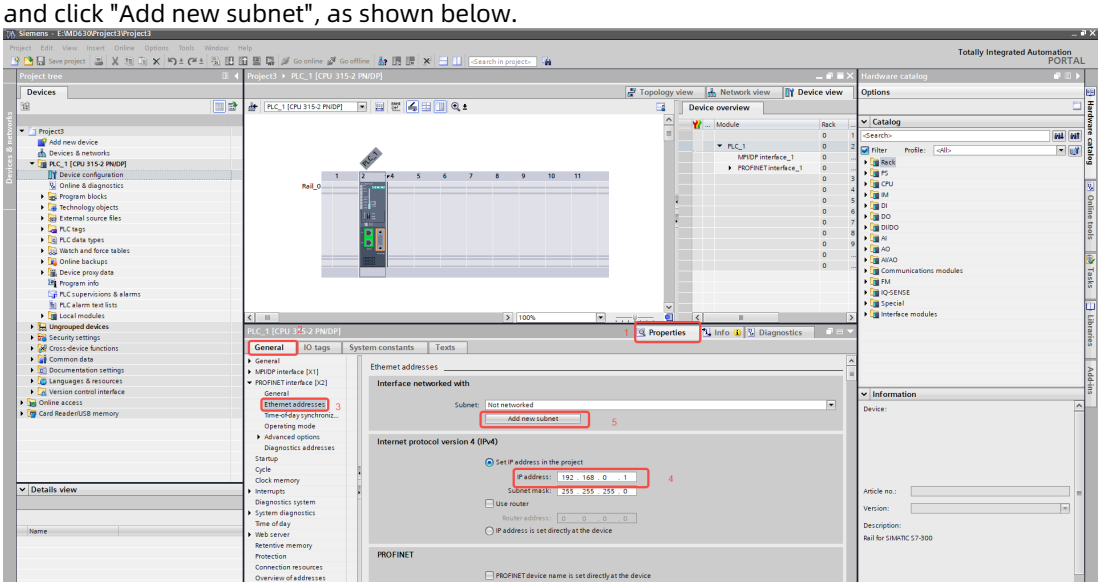


5. Set the device configuration.

   a. When the XML file is installed, the TIA PORTAL software automatically closes the current configuration to update the hardware directory. After you close the "Manage general station description files" window, double-click "Device configuration" at the location shown in the following figure.

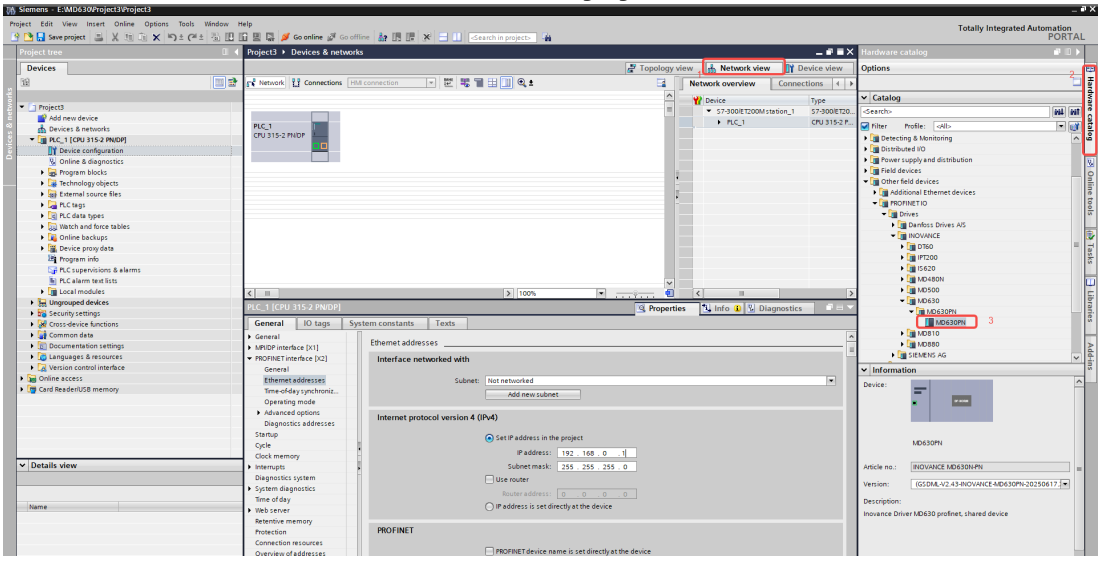


b. In "Properties" > "General", select "Ethernet addresses", set the IP address of the master PLC, and click "Add new subnet", as shown below.



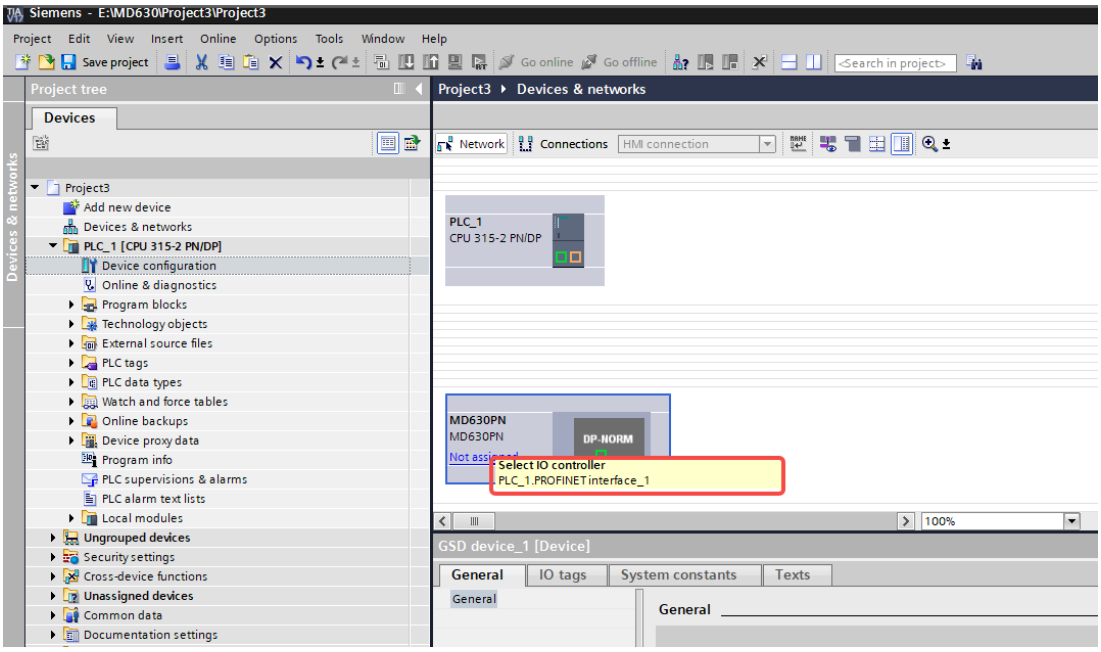
6. After adding the PN network, you can add the slave device.

a. Click "Network view" and locate the MD630PN in the "Hardware catalog" on the right. Double-click to add the MD630PN, as shown in the following figure.

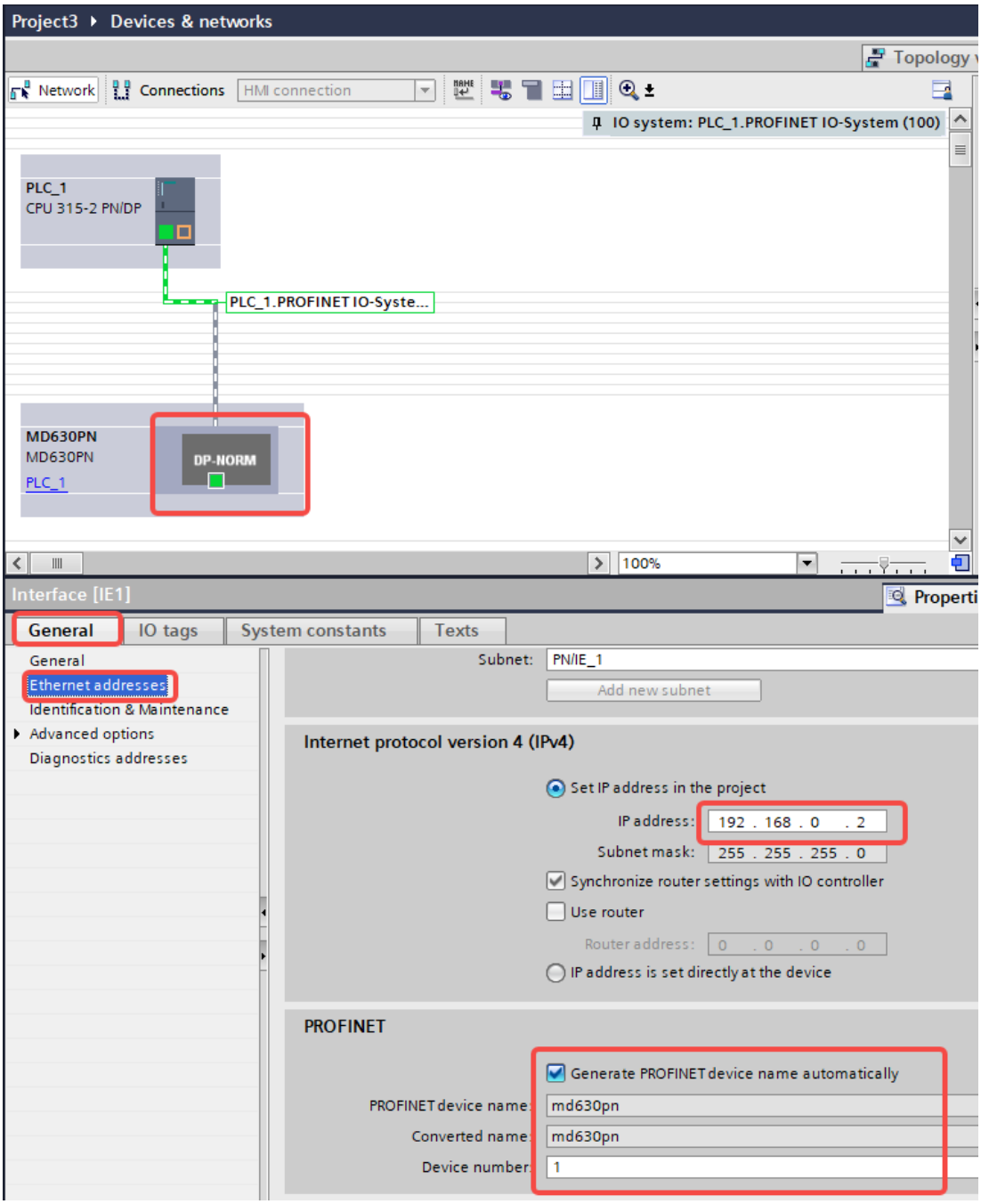


b. In this case, the MD630-INT slave is still in the "unassigned" state, and the master cannot control it.

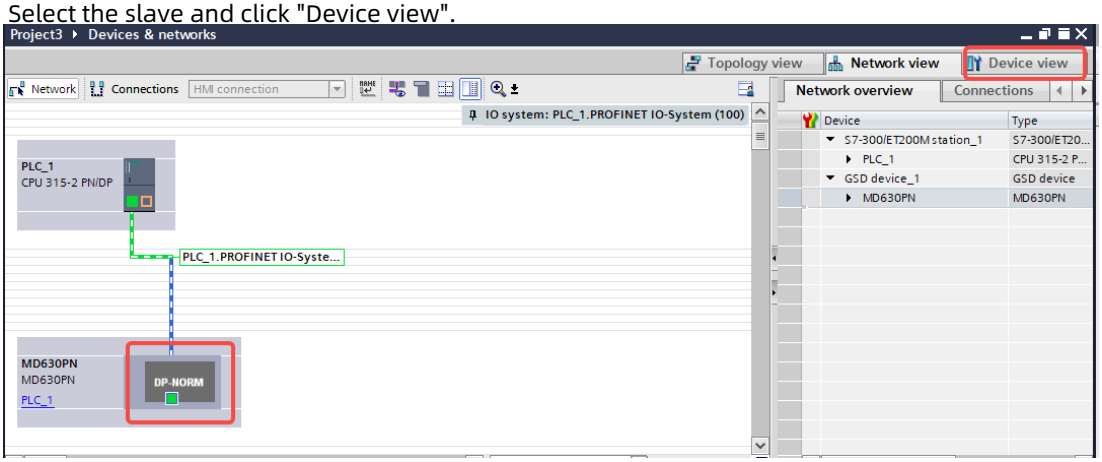
Click "Unassigned", the words "Select I/O controller" will pop up, and the available PROFINET network list is displayed. Click this network to add the device to the master PN network.



c. Select the slave. You can modify the IP address and device name in the "Ethernet address" under "General". (To modify the device name, de-select "Generate PROFINET device name automatically".)

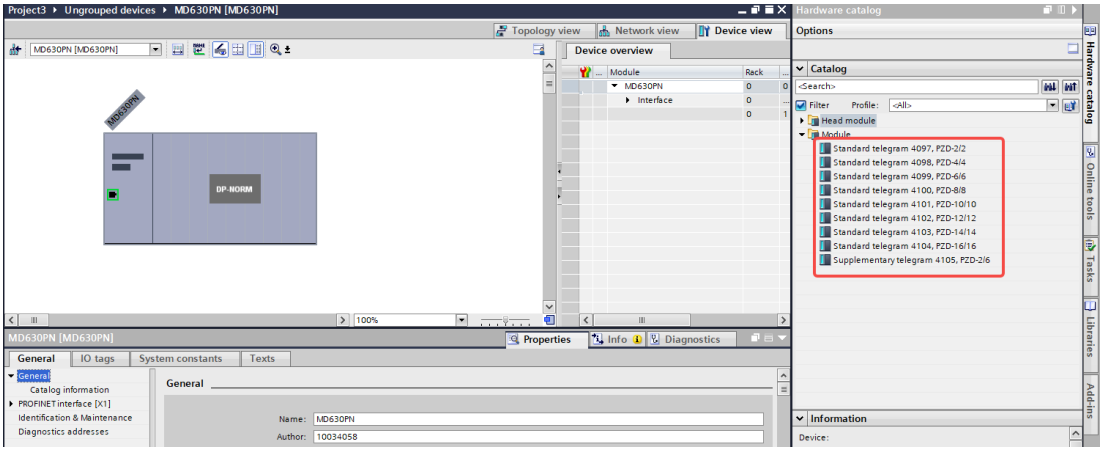


d. Select the slave and click "Device view".

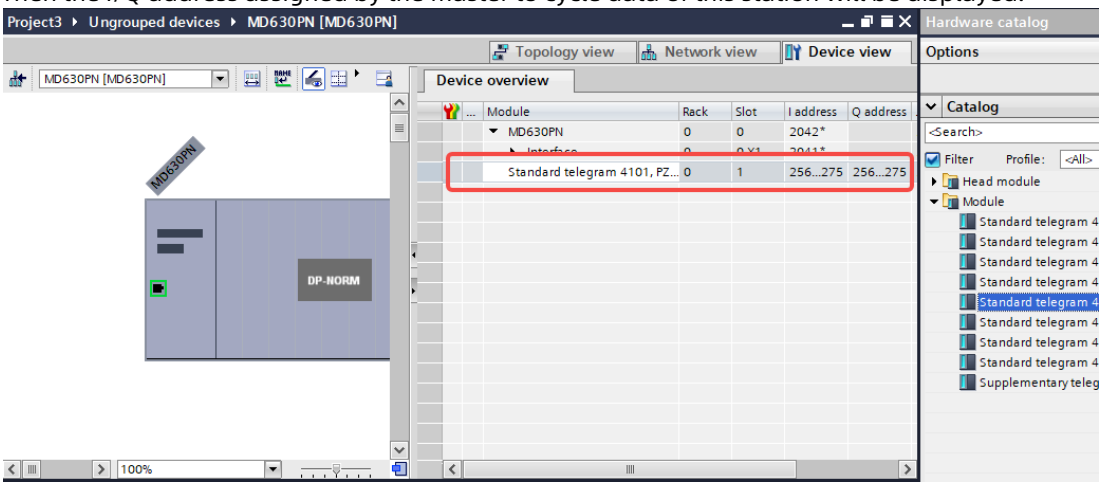


e. In the "Hardware catalog", select the module type needed and double-click to add it to the slave.

You can select the corresponding module as needed. The number after PZD indicates the number of data written/read (calculated by words). For example, "PZD-2/2" indicates that the module has two words written and two words read. The number before PZD indicates the message number, such as "4097". If a communication error occurs, check whether the message number is consistent with the message number of the parameter.



f. Then the I/Q address assigned by the master to cycle data of this station will be displayed.

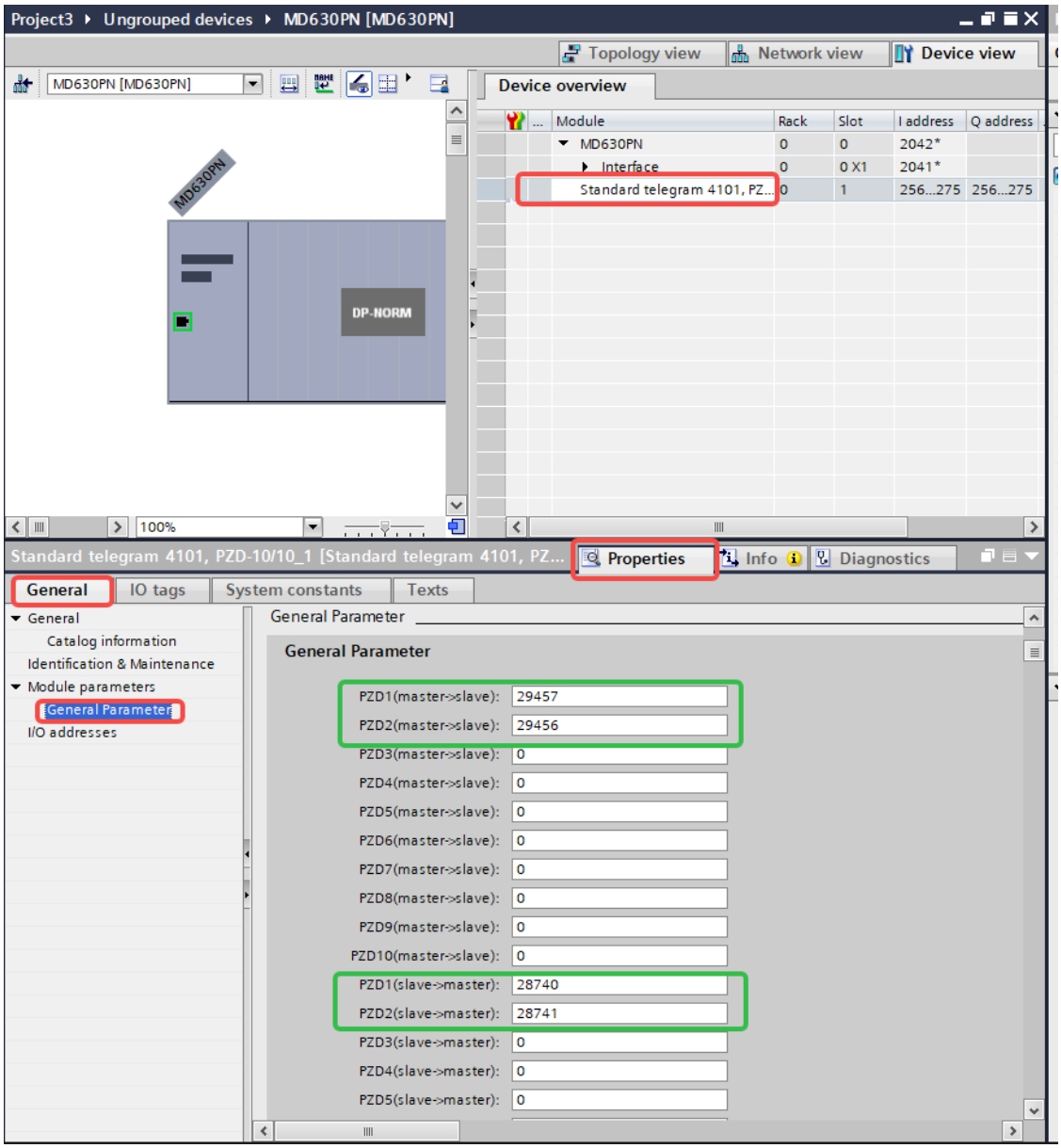


7. After adding a module, you can configure the module to set the corresponding parameter of each PZD.

As shown in the figure below, PZDx(master->slave) represents the PZD written by the master to the slave (i.e., out-data), and PZDx(slave ->master) represents the PZD returned by the slave to the master (i.e., in-data). In the figure, PZD1 and PZD2 marked in green have been pre-configured with initial values. The PZD3 written by the master is configured as 61488 (0xF030, ramp 1 acceleration time), and PZD4 is configured as 61489 (0xF031, ramp 1 deceleration time). The PZD3 read by the master is configured as 28674 (0x7002, bus voltage), PZD4 is configured as 28675 (0x7003, output voltage), and PZD4 is also configured as 28676 (0x7004, output current).

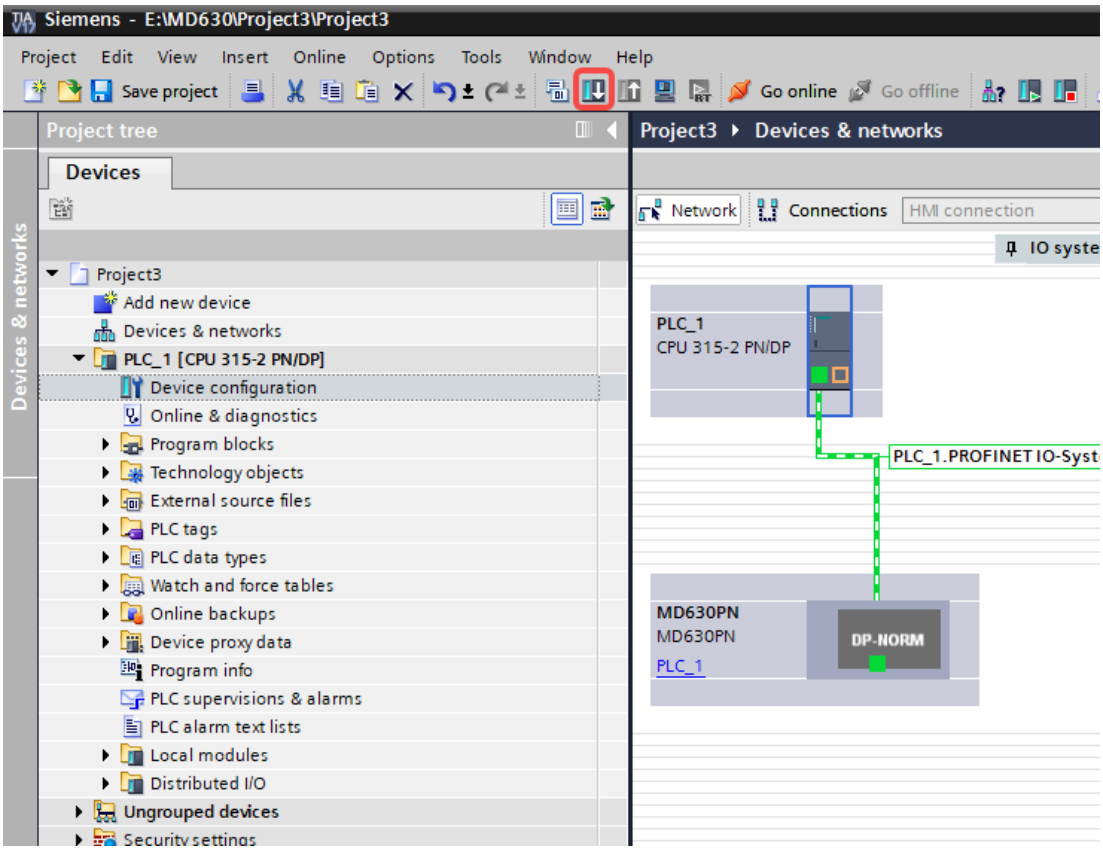
Caution

PZD configuration needs to be continuous. For example, if PZD1-4 and PZD6 are configured but PZD5 keeps the original value 0, this case is not allowed. This will prevent the mapping of PZD6 from taking effect.

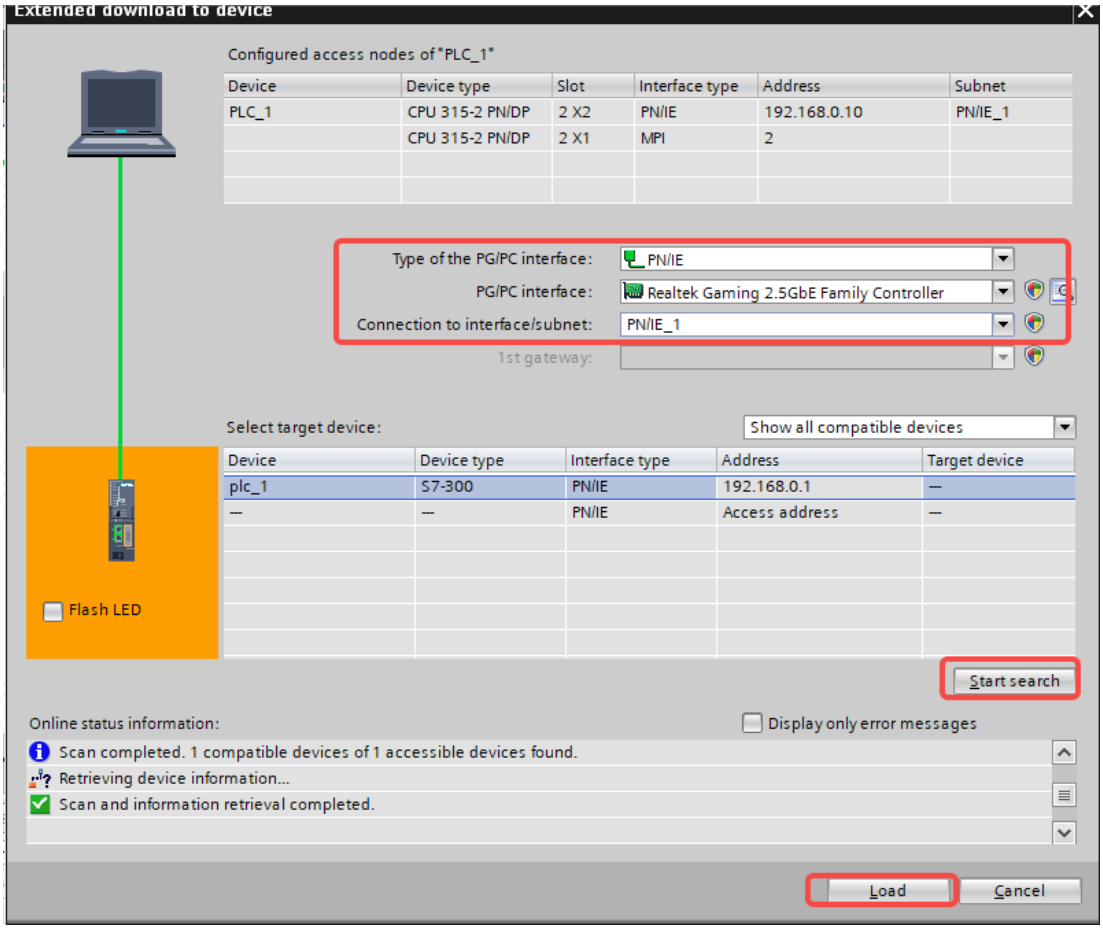


8. After the configuration is done, download the configuration to the PLC.

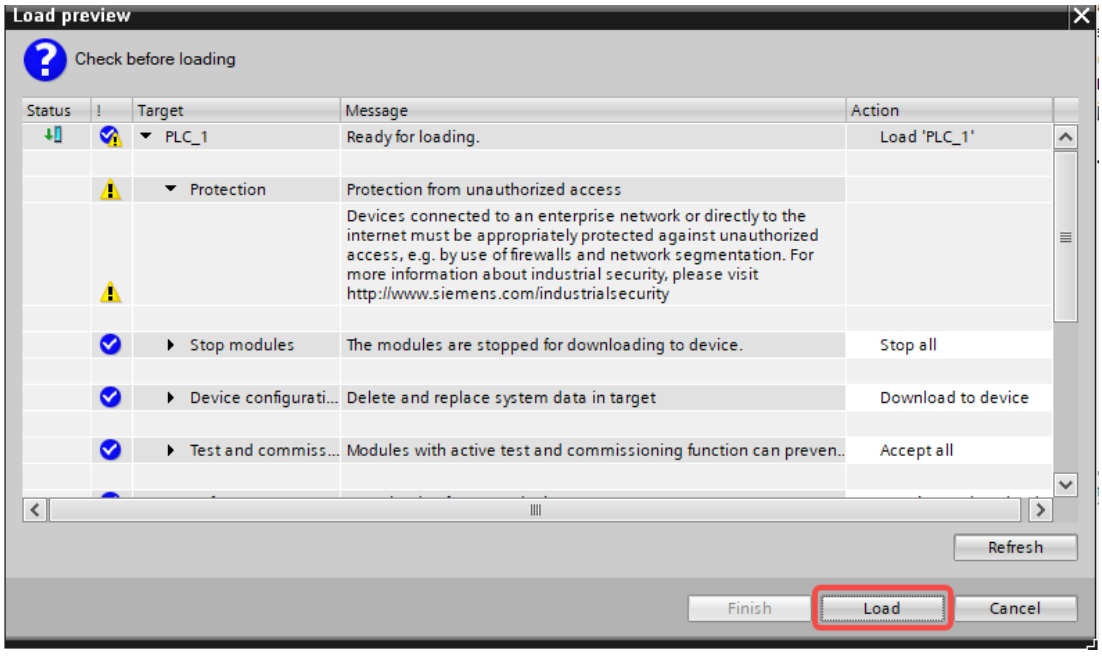
   a. Click the download icon, as shown in the following figure.



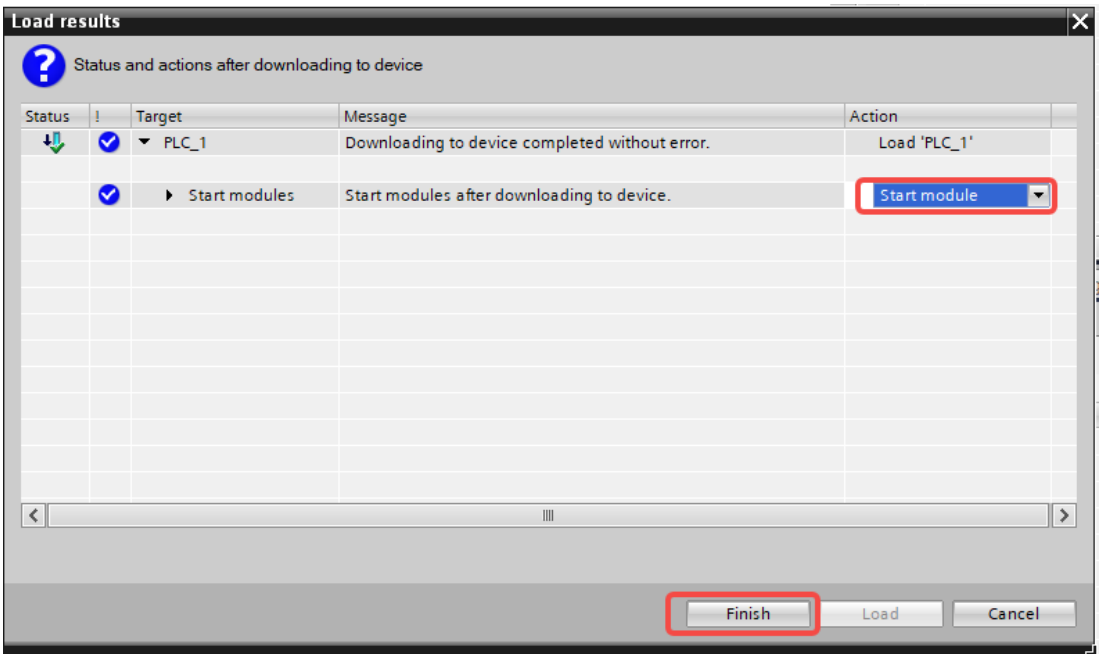
b. In the interface displayed, set the terminal parameters according to the terminals connected between the PC and the PLC. Click "Start search", select the PLC to be downloaded, and click "Load".



On the "Load preview" page, click "Load".

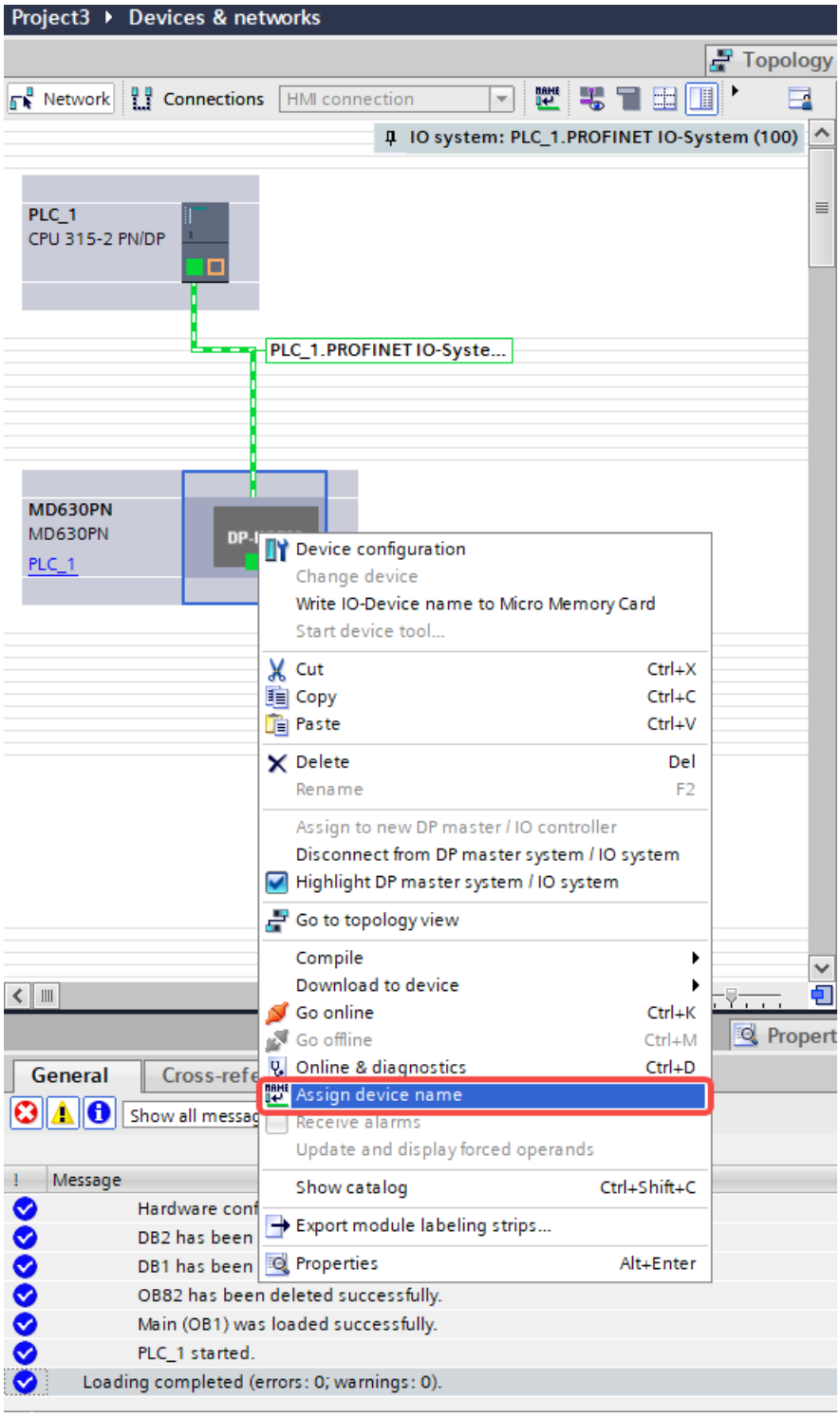


c. Select "Start module" and click "Finish" on the interface that prompts download completion.

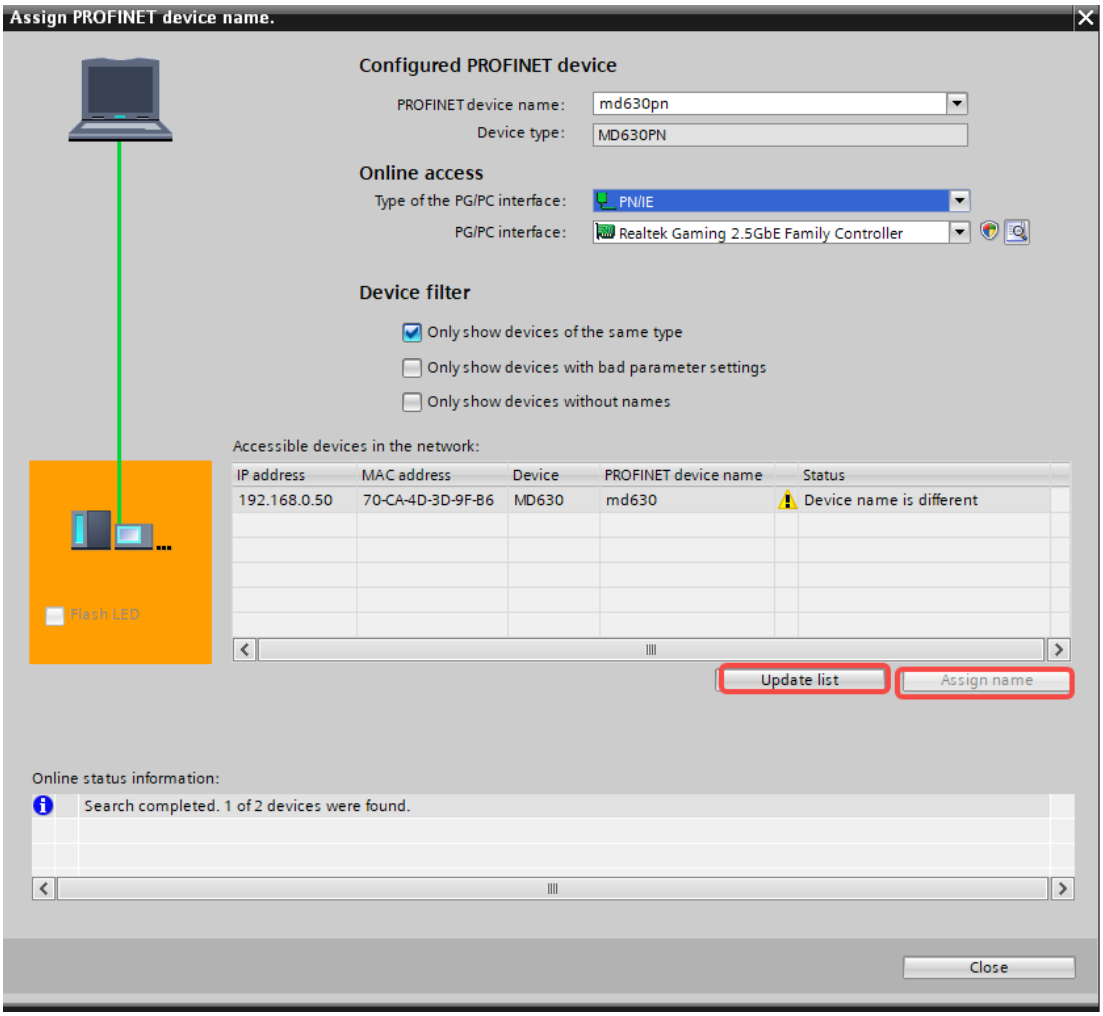


9. After the download is done, assign the device name to the slave.

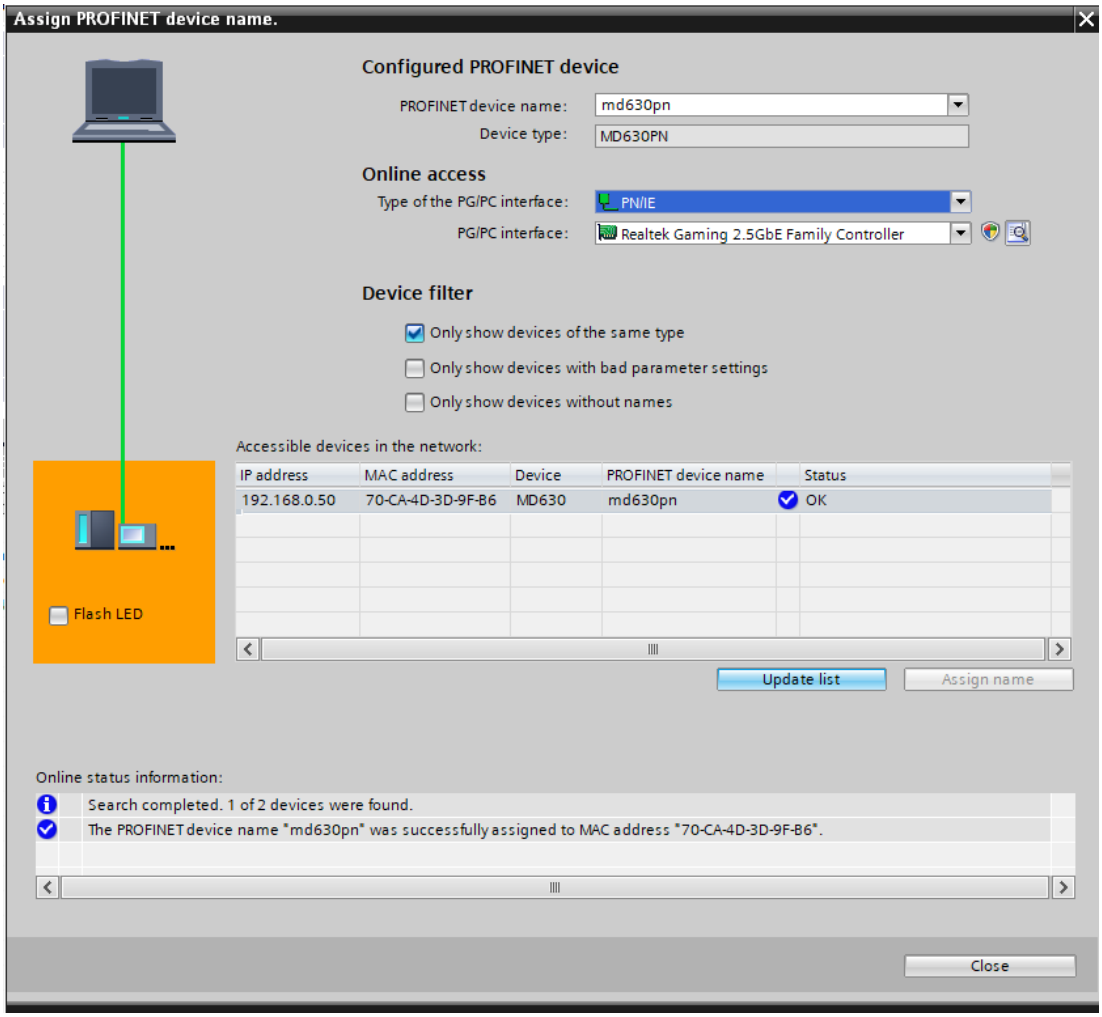
   a. Select the slave, right-click, and click "Assign device name".



b. After selecting the correct PC interface, click "Update list" and select the device to be assigned from the scanned devices (distinguished by MAC address or by checking "Flash LED"). After being checked, the device panel of the corresponding MAC flashes. After determining the device to be assigned, click "Assign name".



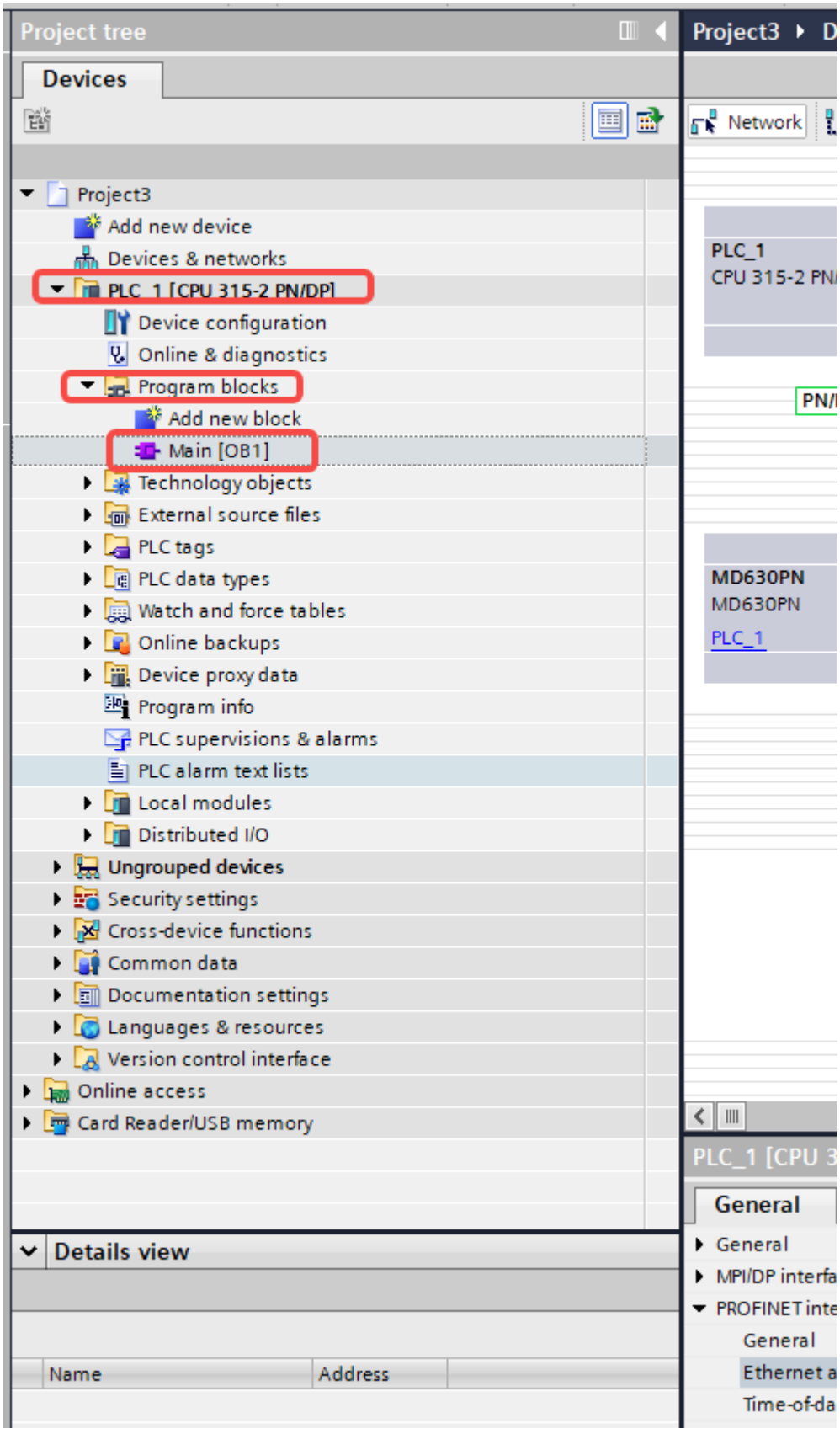
c. After the assignment is done, the word "OK" is displayed in the status bar of the corresponding device.



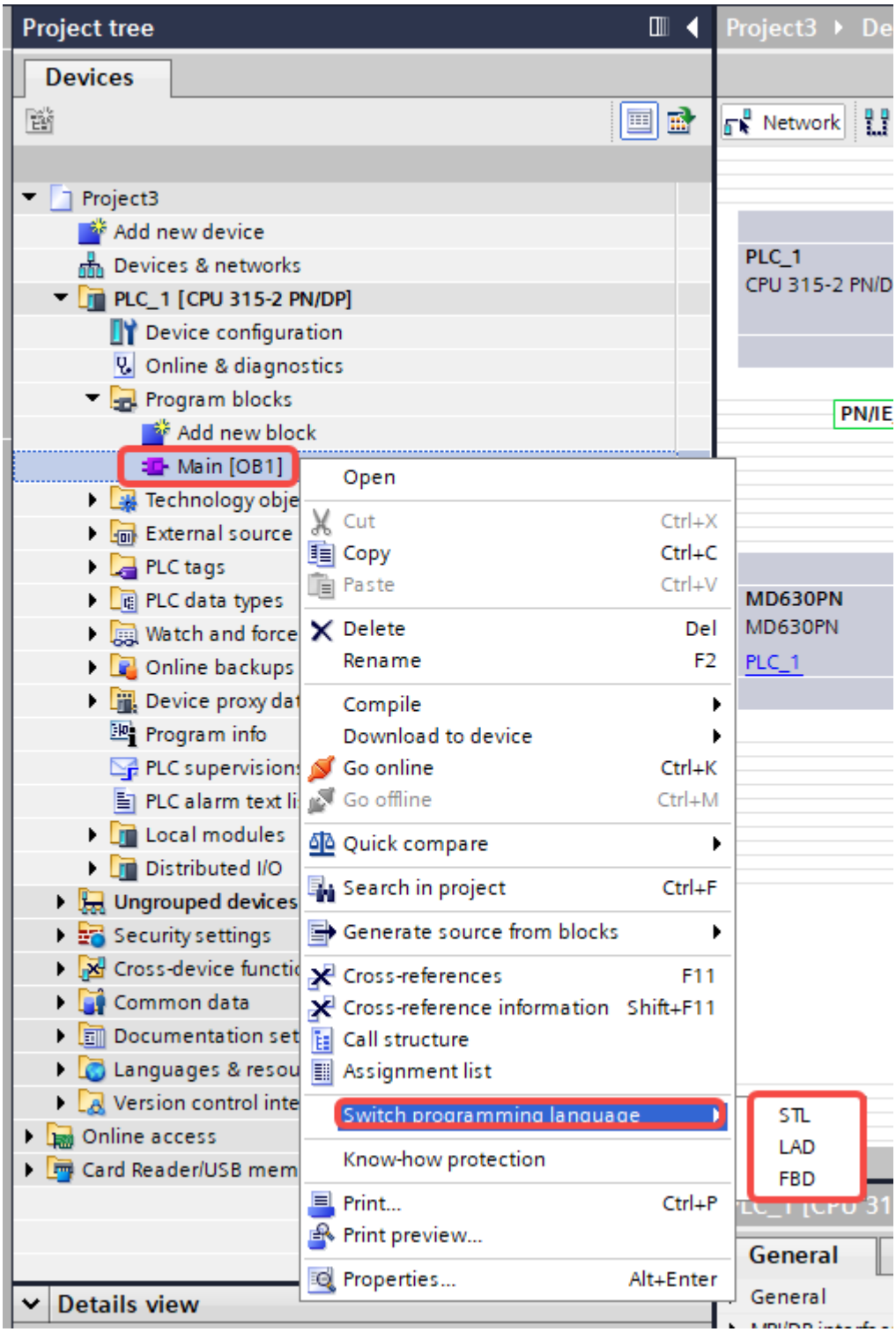
This completes the configuration of the group. You can control the MD630-INT by modifying the values in the Q addresses (in this example, PQW256-PQW274, corresponding to outputs PZD1-10), and you can obtain the status and parameter values of the MD630-INT by reading the values in the I addresses (in this example, PIW256-PIW274, corresponding to inputs PZD1-10).

Step 4: Control the drive through communication

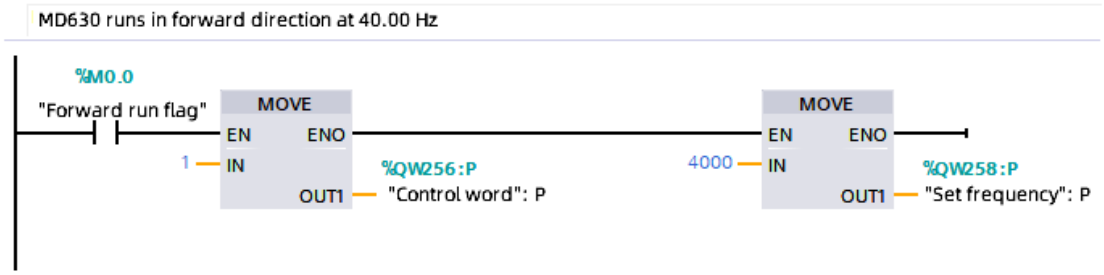
In the "Project tree" on the left, expand PLC_1 [CPU 315-2 PN/DP] and double-click "Main[OB1]" under "Program Block" to open the PLC main function.



Select the program block and right-click to select the programming language through "Switch programming language". The LAD (ladder diagram) is used by default.



The value transmission is generally done through MOVE instruction or SFC14 and SFC15. Take MOVE instruction as an example. If SFC is used, you can select the SFC block and press F1 to shown the help information for the SFC function block.



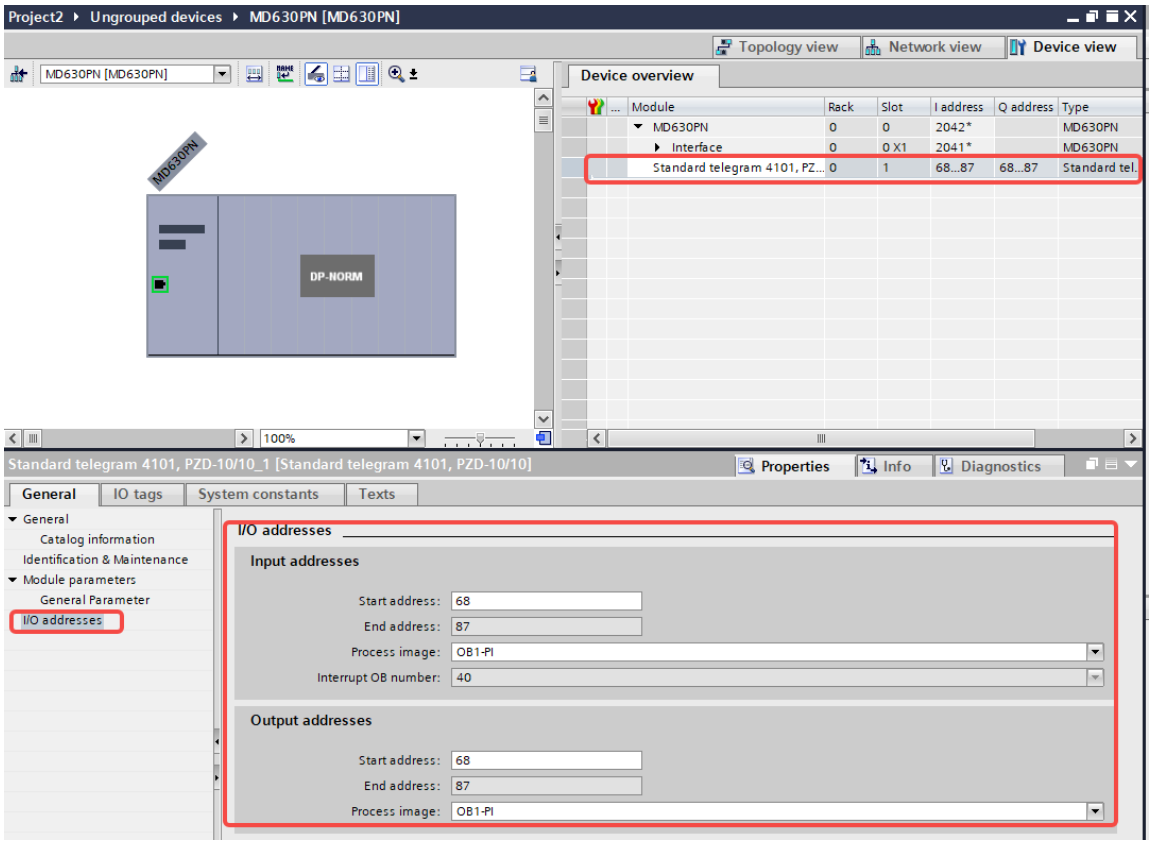
When "%M0.0 output switch value changed to 1 (closed)", the value 1 (Forward run command) is written to PZD1 (corresponding to PQW256, mapping relation 29457, hexadecimal 7311H), and the value 4000 (frequency, two decimal places) is written to PZD2 (corresponding to PQW258, mapping relation 29456, and hexadecimal 7310H) simultaneously.

Notes:

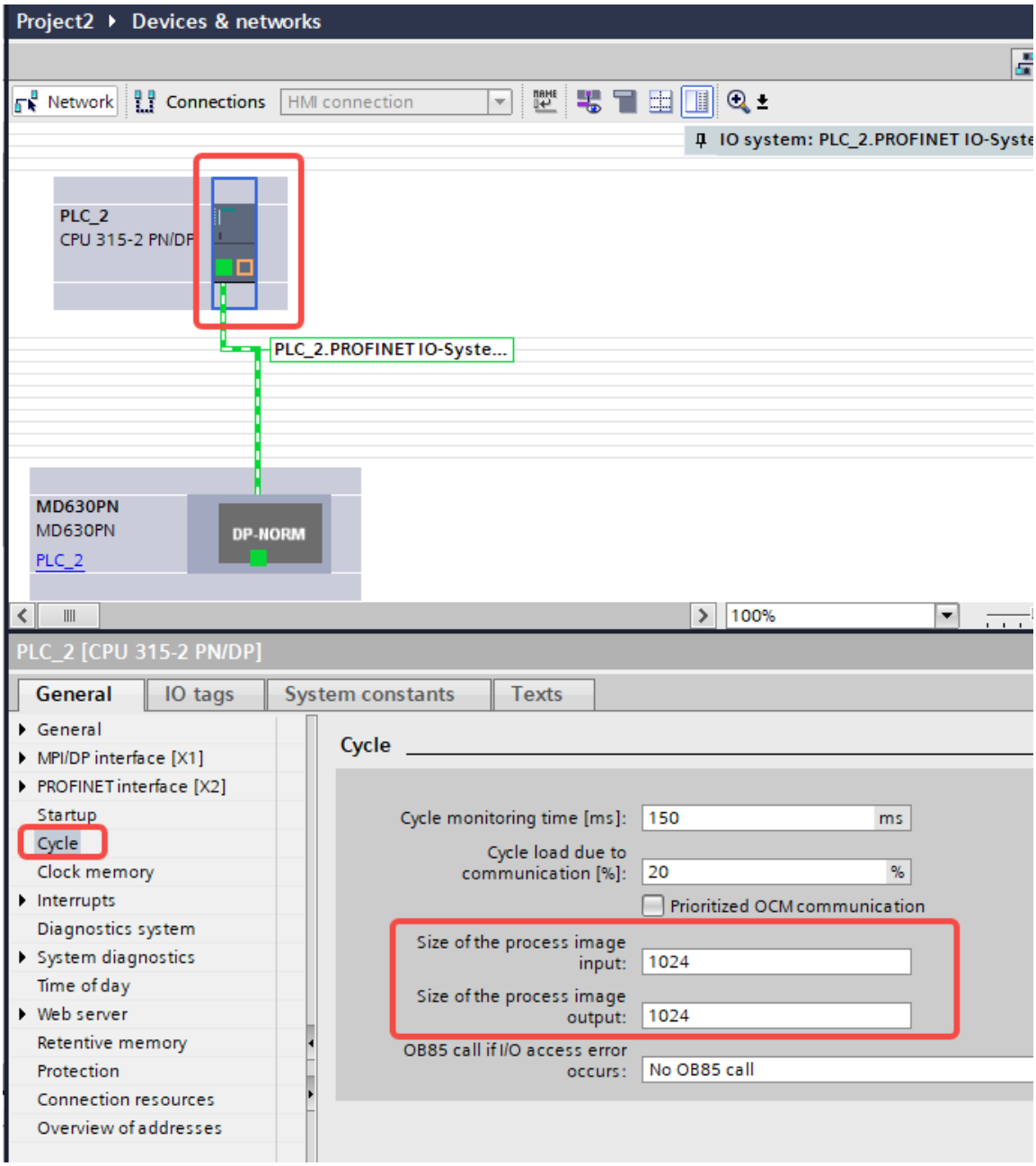
- To control the drive through communication, you need to set the command source and frequency source as the communication source according to section *" Special Communication Address" on page 844*.
- PZD1 and PZD2 are configured with default settings, but can also be modified as needed during configuration and then downloaded to the PLC.
- By default, the S7-300 PLC cannot perform write operations on addresses similar to QW256 through commands directly or perform read operations on the address of IW256.

PQW and PIW are external addresses. If you want to access them directly, you need to change them to process mirror addresses.

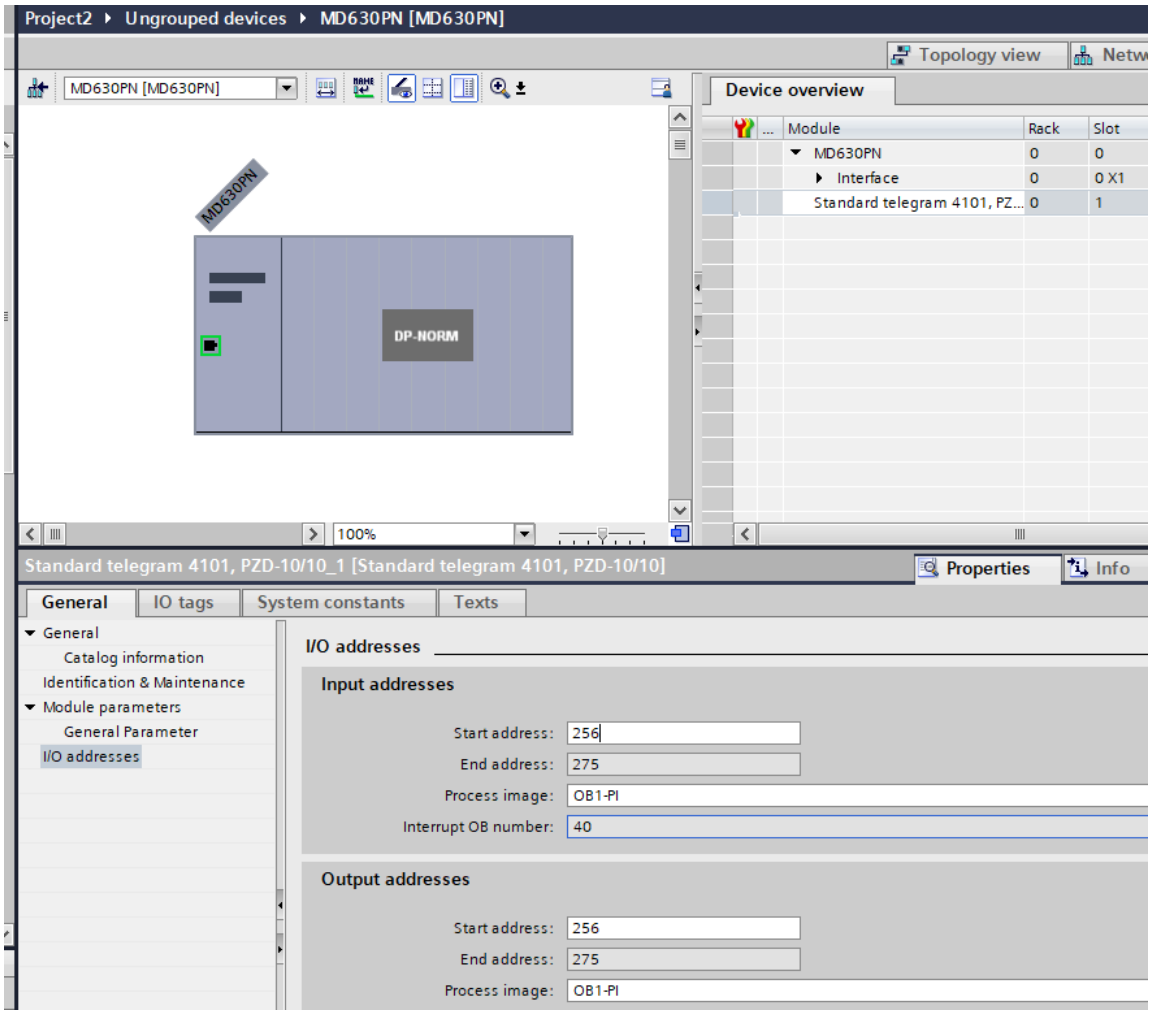
Method 1: Change the input/output address of the slave to the process mirror area. The process mirror area of S7-300 is the addresses 0 to 127 of I and Q. Select the slave and switch to the "Device view". After selecting the message, change the start address of the input/output to the process mirror area in the I/O address (the end address must also be in the process mirror area). After modification, the "process image" will be automatically switched from "None" in gray to "OB1-PI", as shown in the following figure:



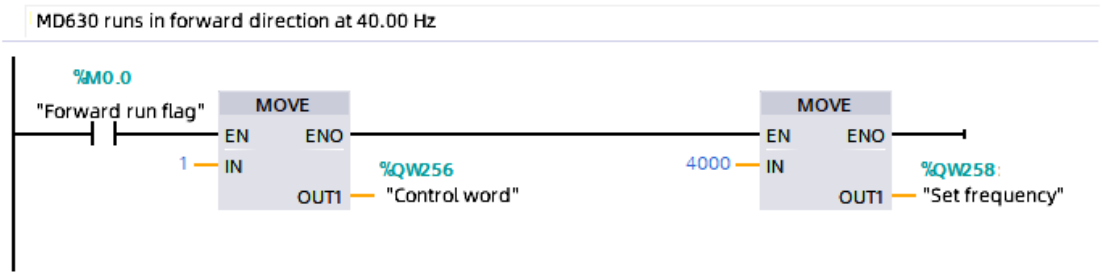
Method 2: Expand the process mirror area of the PLC. Because the process mirror area of S7-300 is small, when an excessively large number of PN nodes are present, the input/output addresses of some nodes will not in the process mirror area, which may also happen to other types of PLCs. In this case, you can expand the process mirror area of the PLC. Select the PLC in the configuration interface, and modify the "Size of the process image input" and "Size of the process image output" in "Cycle" in the "Properties" interface, as shown below. The default value of 128 is changed to 1024 (be careful not to exceed the memory size of the PLC).



Similarly, after modification, the slave I/O address that was not in the process image area will be automatically switched to the process image area.



After changing the input/output addresses to the process image area, you can directly use the addresses corresponding to these slaves in the monitoring table (The Q addresses correspond to output, which is the data written to the slaves. The I addresses correspond to input, which is the data returned from the slaves.) In addition, QW and IW can be directly used for the corresponding instructions in the user program, as shown below.



6.9.10.2 Communication Configuration Example for STEP7

The following shows the communication example of configuring S7-315 via STEP7 to control the MD630N-INT.

Prerequisite

To complete the process of connecting the AC drive to the bus system, see *"6.9.6 Connect AC Drive to Bus System" on page 946*.

Operation steps

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

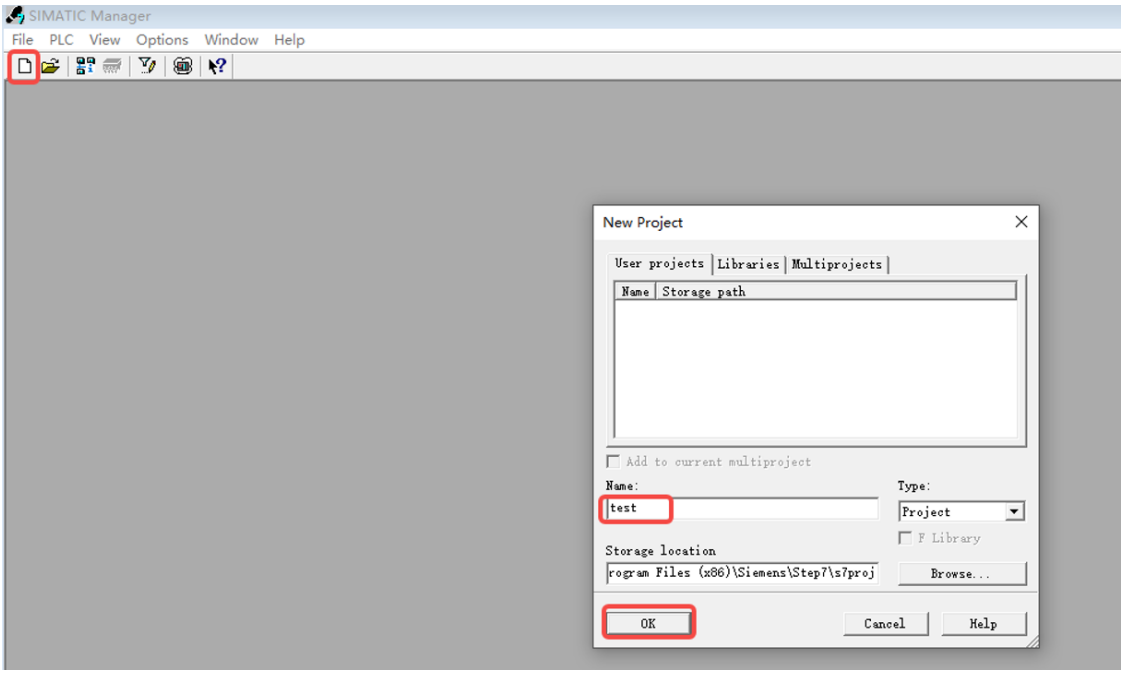
1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

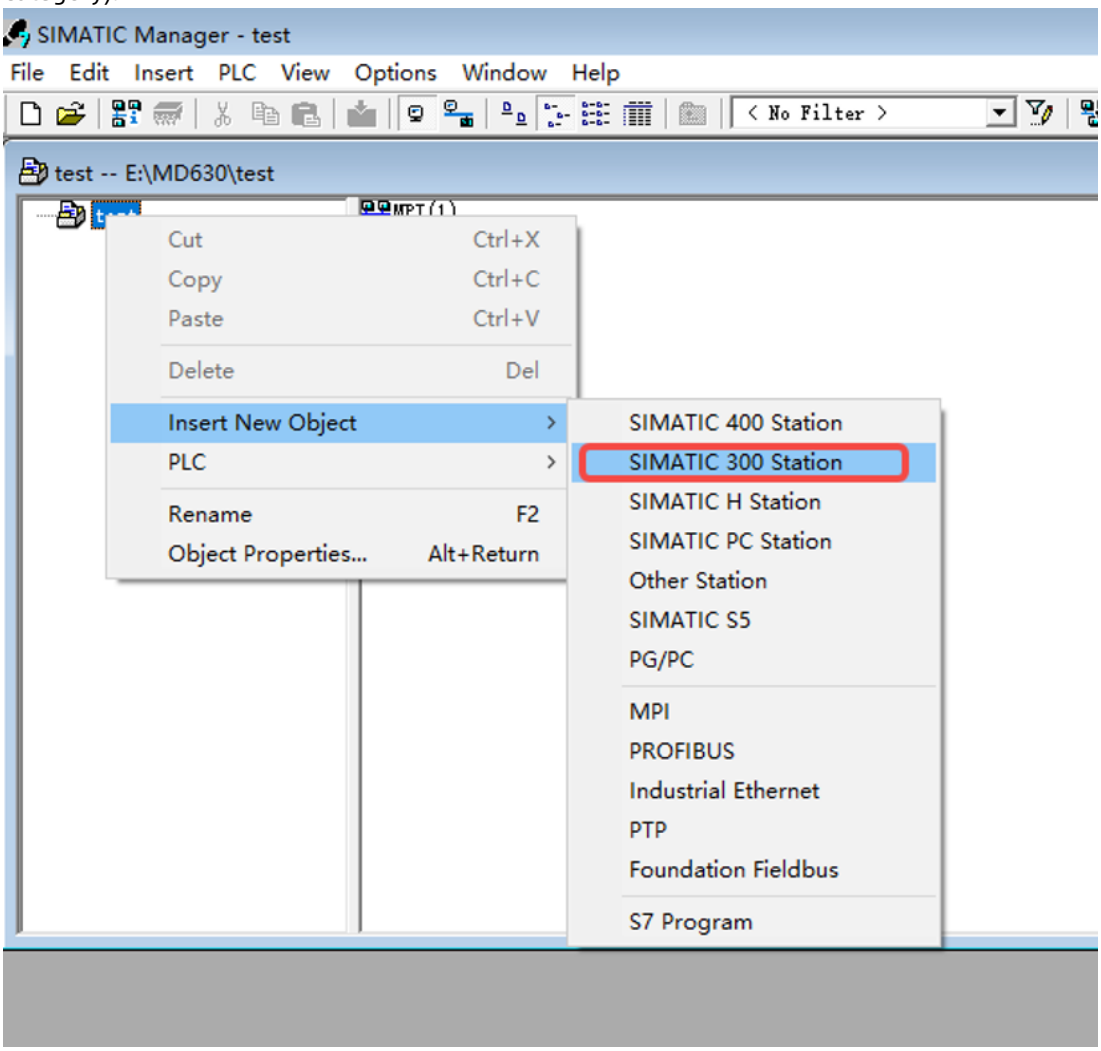
1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting selection) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish PROFINET communication connection

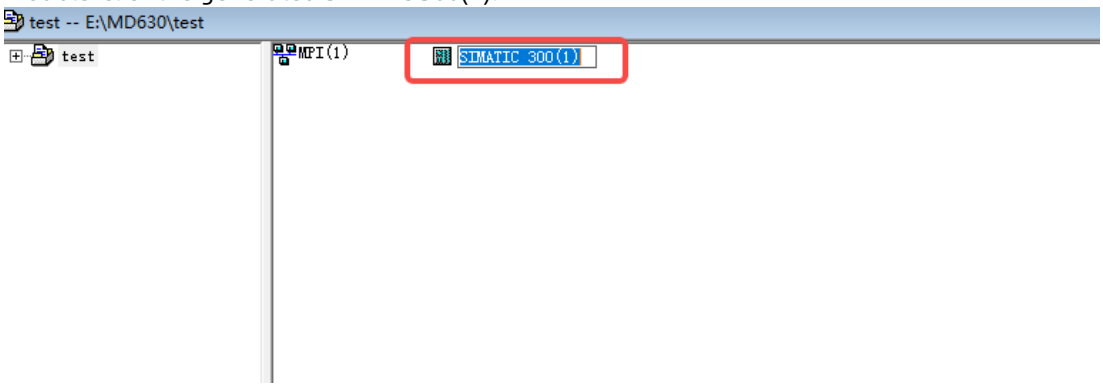
1. Set the value of n0-10 to 3 (through operating panel or the software tool). Set the communication mode to PROFINET.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow. This indicates that the slave and master are connected successfully and there is data exchange.
3. Create a project.
   Open STEP7 software, create a project, enter the project name, and click "OK".



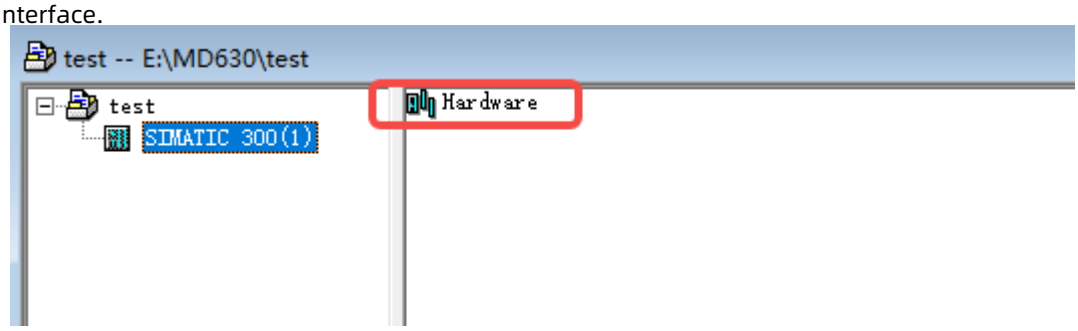
a. Right-click and select "Insert New Object" > "SIMATIC 300 station" (S7-315 belongs to this category).



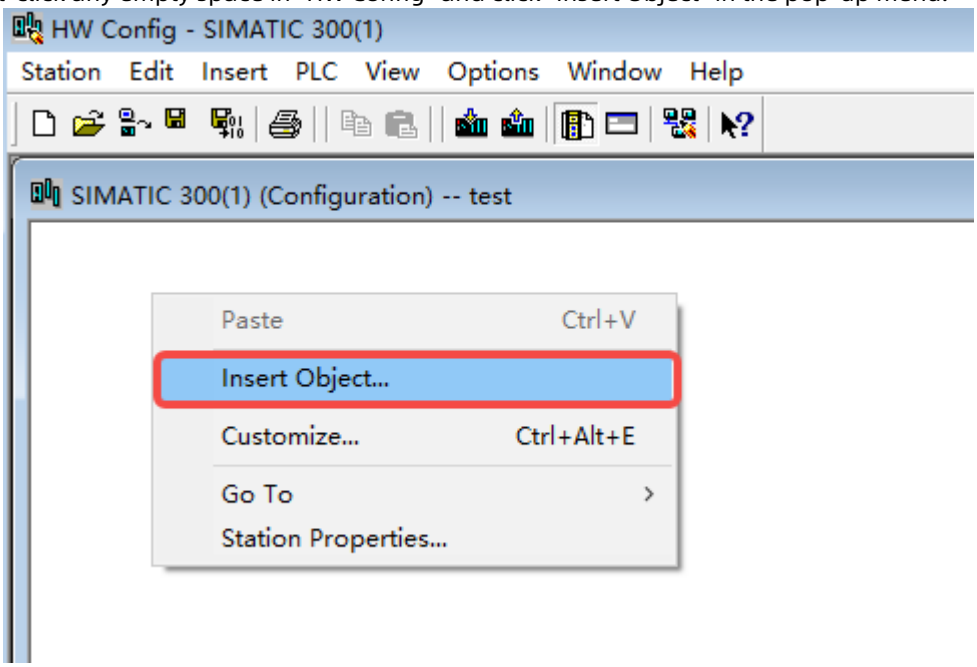
b. Double-click the generated SIMATIC 300(1).



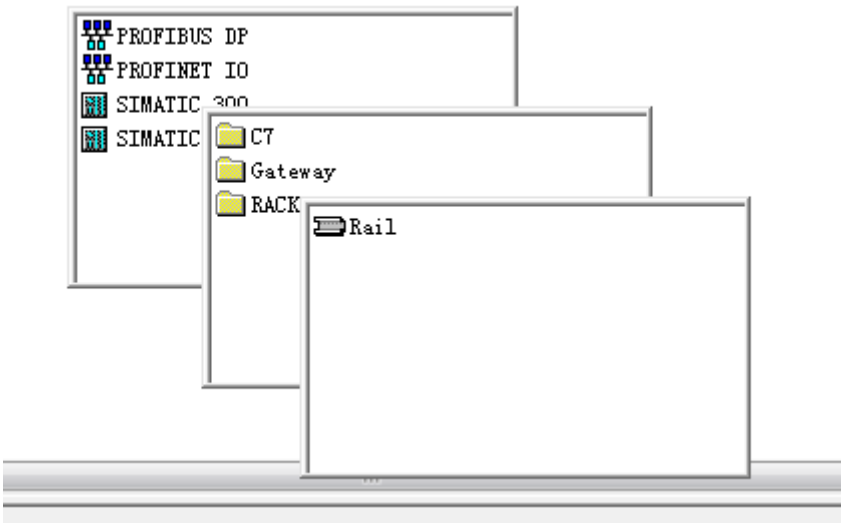
c. Double-click "Hardware" in the expanded interface to enter the hardware configuration interface.



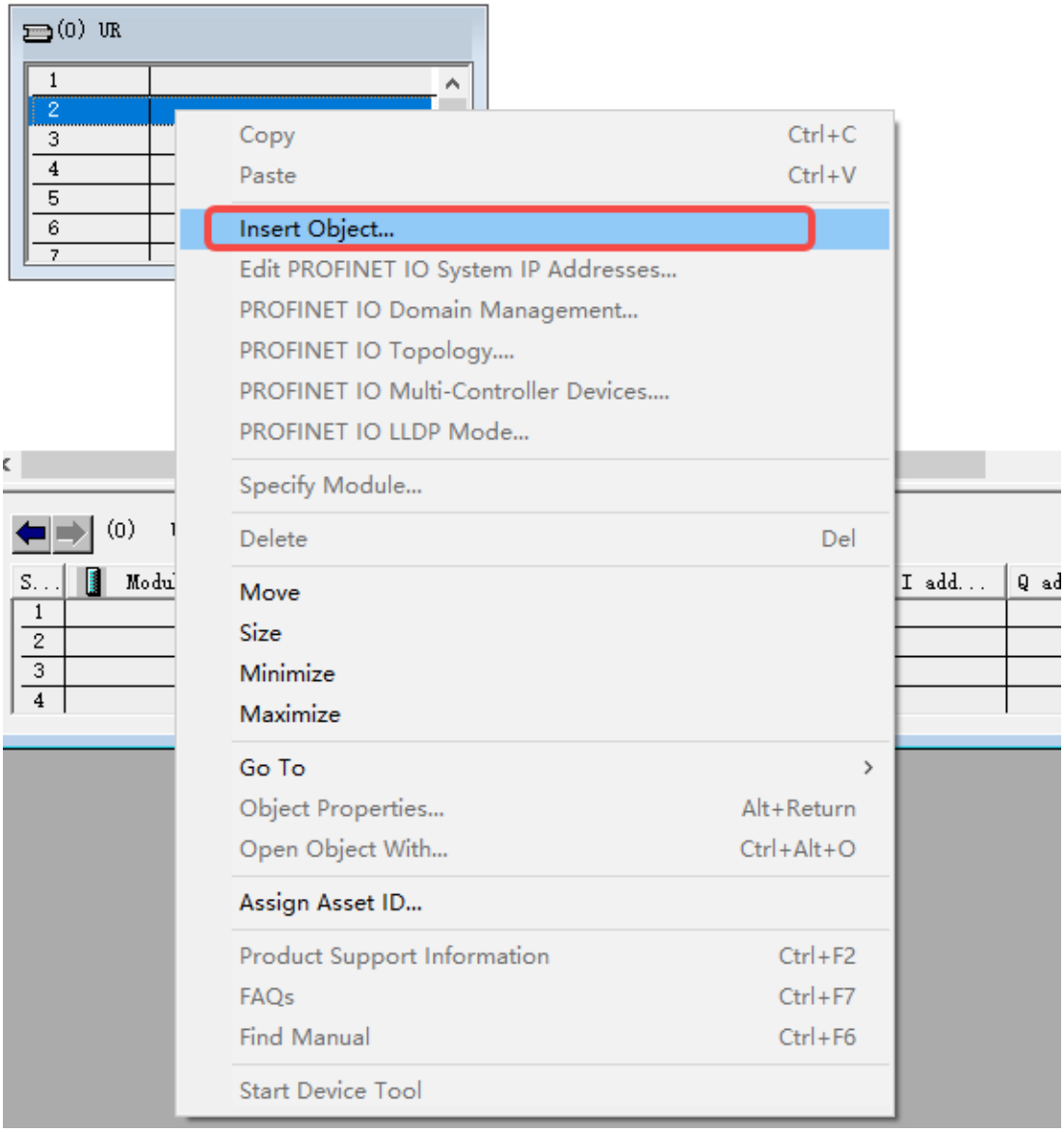
d. Right-click any empty space in "HW Config" and click "Insert Object" in the pop-up menu.



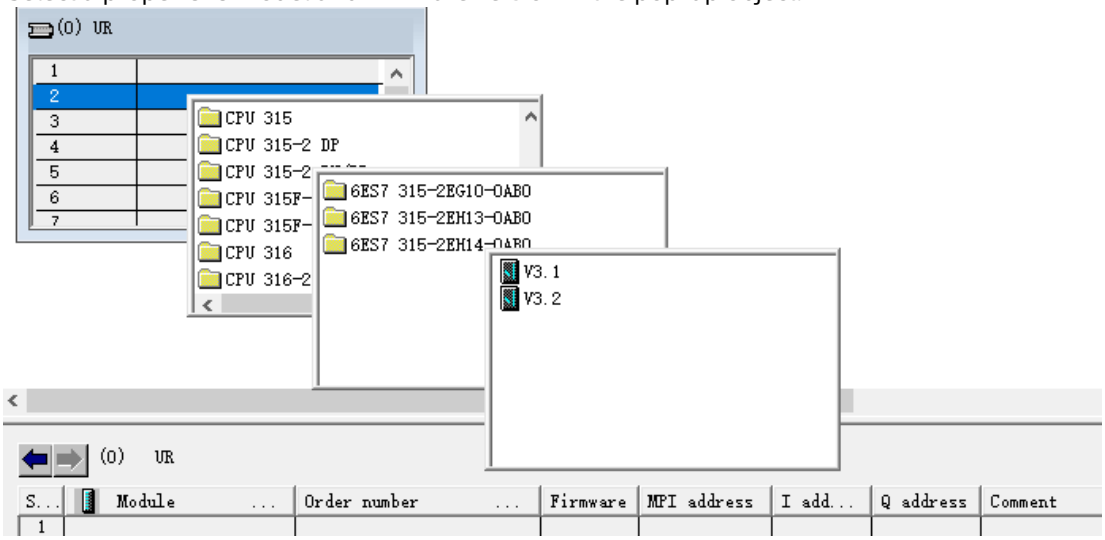
e. Click "SIMATIC 300" > "RACK" > "Rail".



f. This establishes the UR setup. Then, right-click on slot 2 (slot 1 can only be the power supply) and click "Insert Object" in the right-click menu.

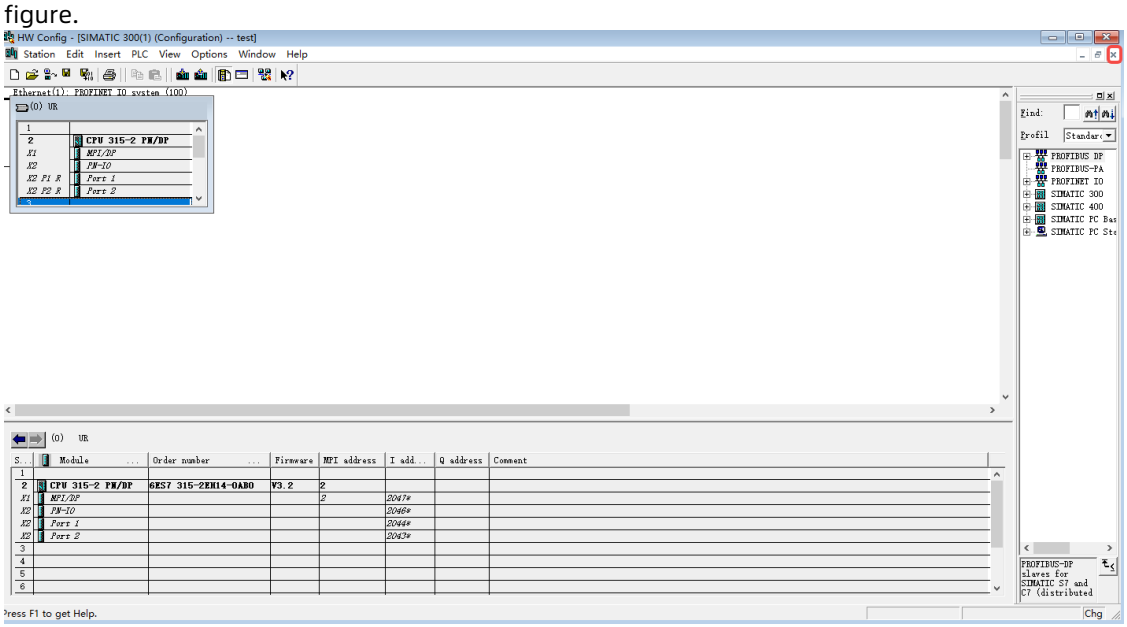


g. Select a proper CPU model and firmware version in the pop-up object.

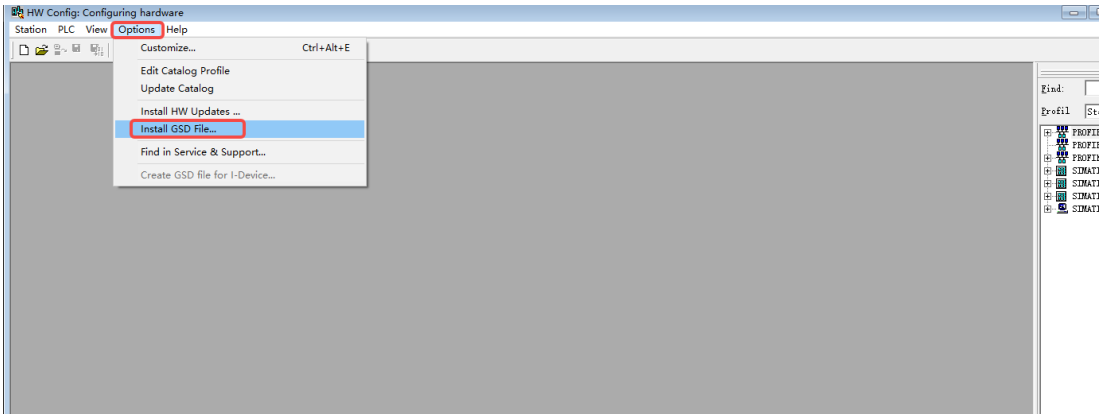


h. Set the IP address and click "New". After the Ethernet network is established, click "OK".

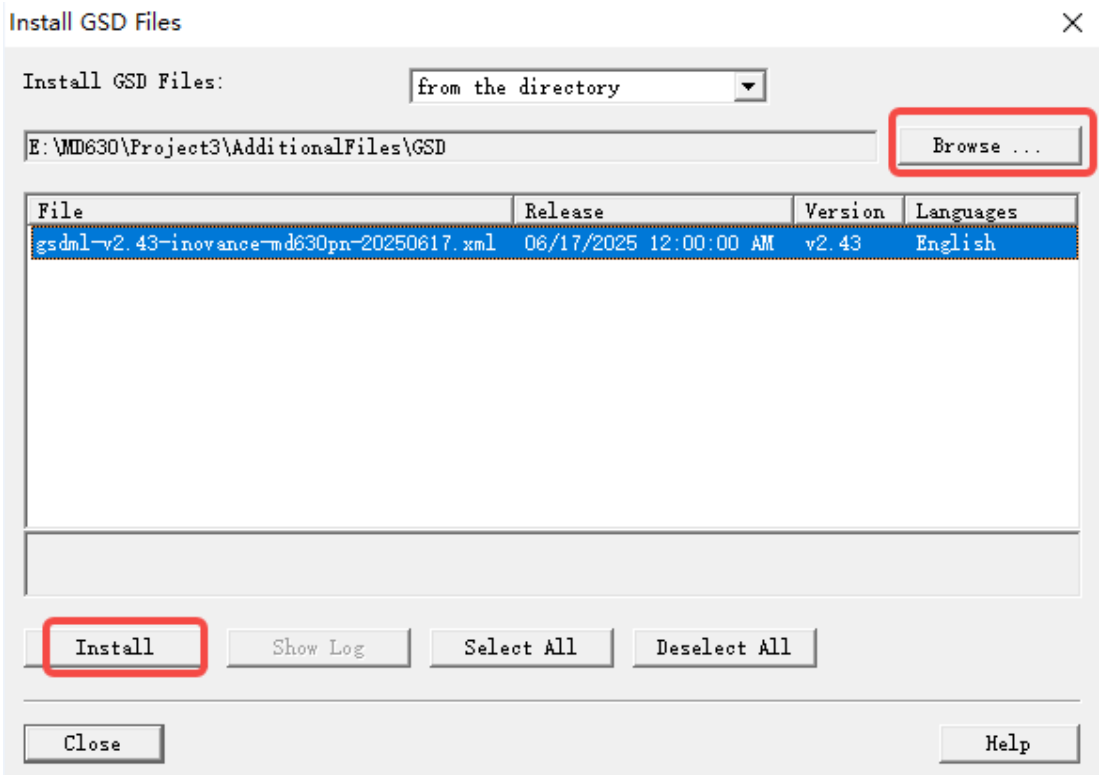
4. After the PLC master is configured, you need to import the XML file of the MD630N-INT (you can skip this step if it is already imported). Close the current configuration file (otherwise, you cannot perform the import operation) and click the red mark in the upper right corner of the following figure.



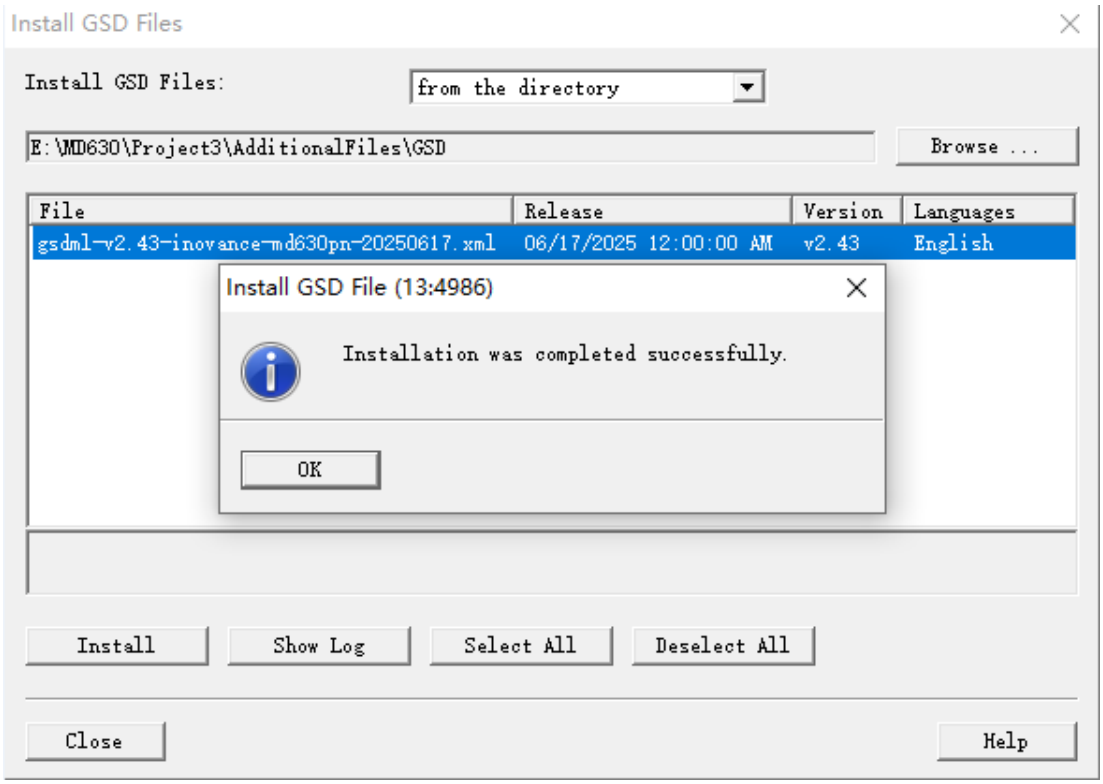
a. Click "Options" in the menu bar, and then select "Install GSD file".



b. Set the current GSD storage path, select the XML file to be imported, and click "Install".



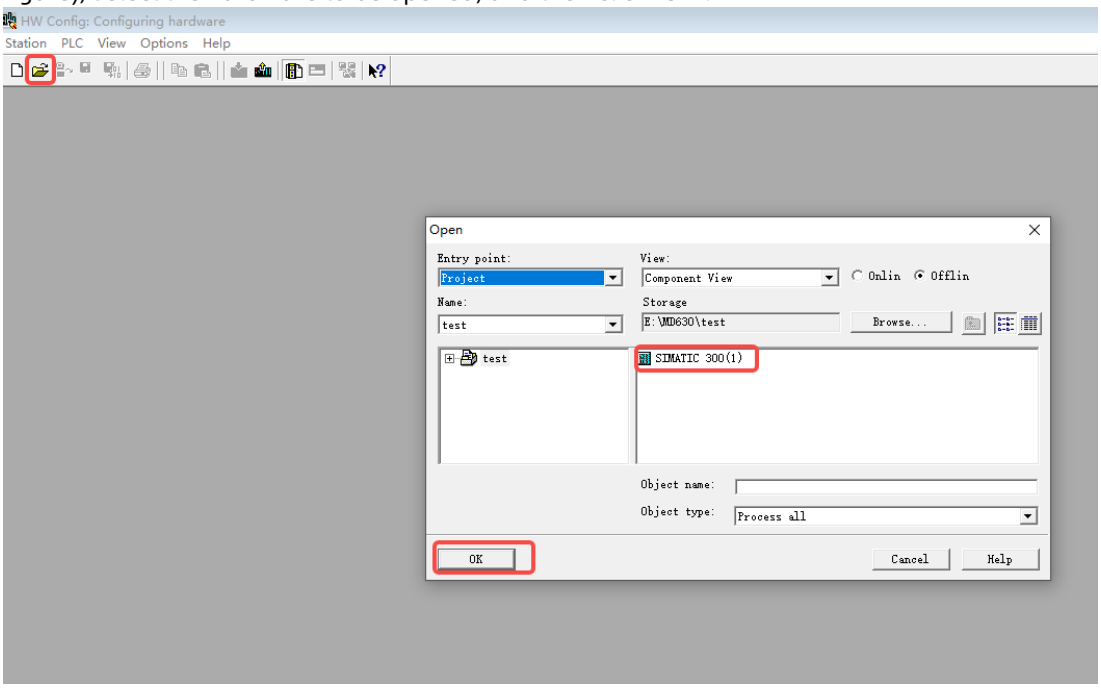
c. When the message "Installation was completed successfully" is displayed, click "OK", and then click "Close".



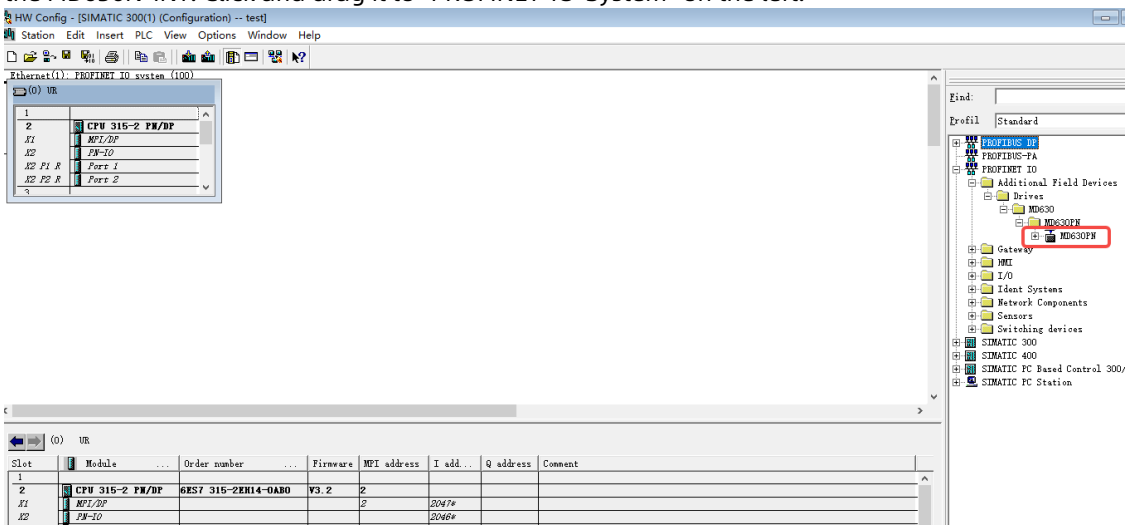
Caution

The XML file version of the MD630-INT is 2.42. During the installation of the STEP7 for earlier versions, some features are not available. You can ignore this alarm.

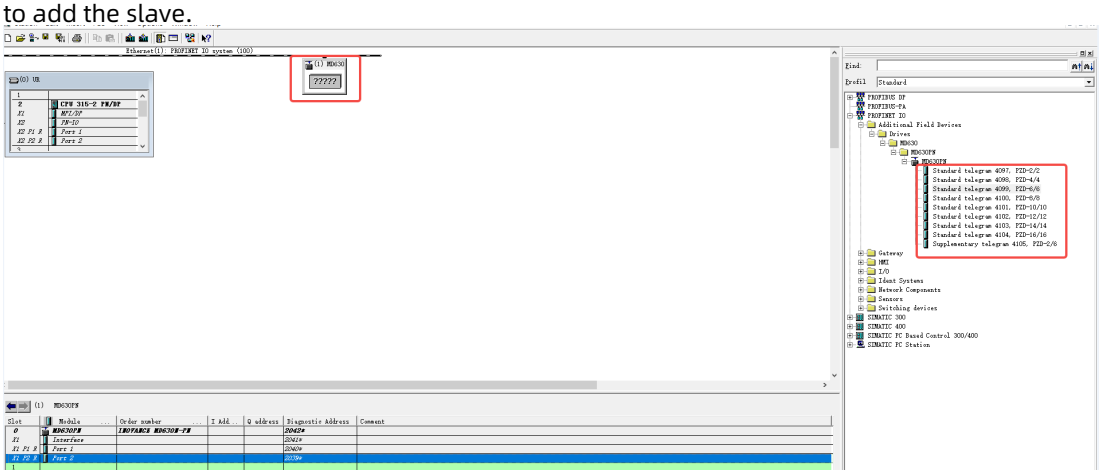
d. After the XML file is installed, click "Open" (marked in the upper left corner of the following figure), select the hardware to be opened, and then click "OK".



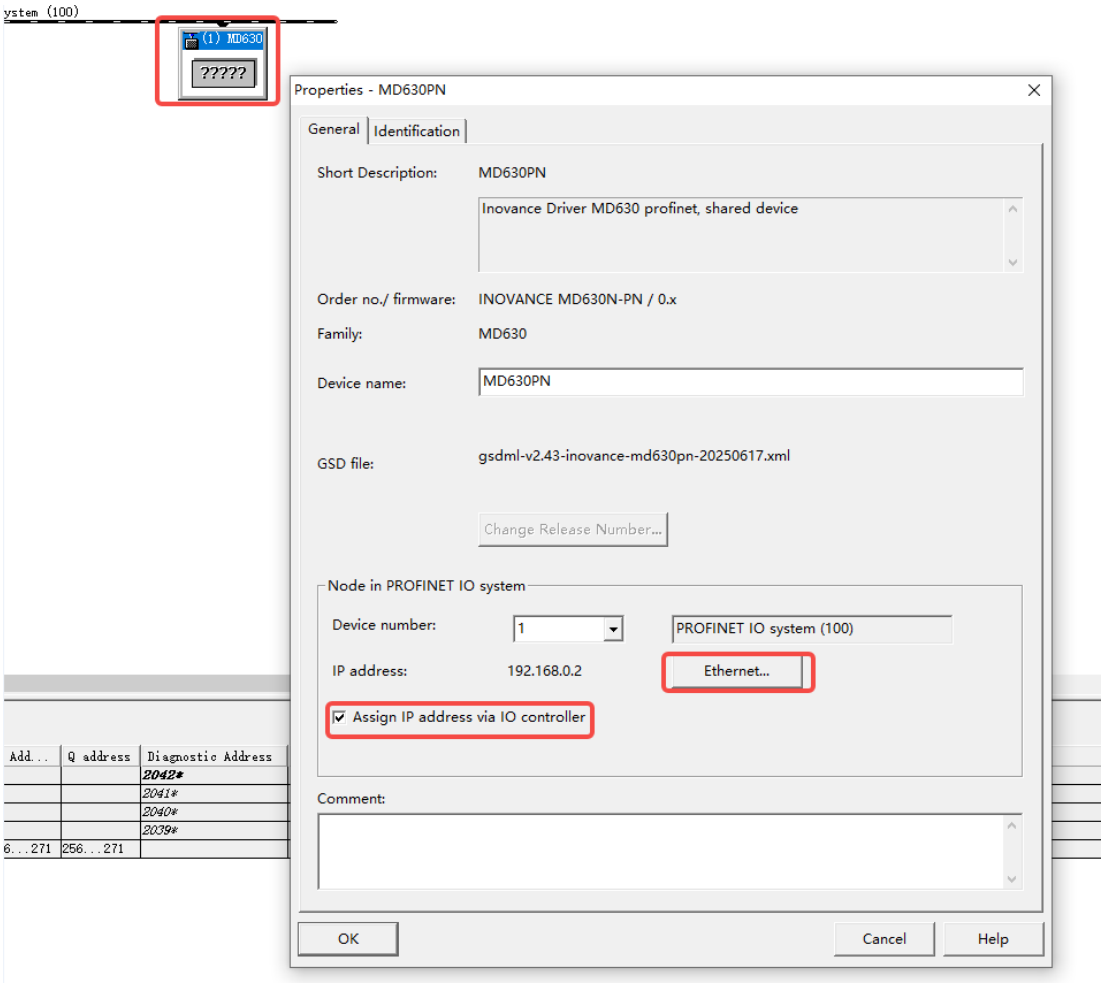
5. After XML is installed, configure the slave device. In the hardware directory, expand "PROFINET IO", "Additional Field Devices", "Drivers" and "MD630-INT" to find the PN device corresponding to the MD630N-INT. Click and drag it to "PROFINET-IO-System" on the left.



a. Select the slave and a message module in the hardware directory on the right, and double click to add the slave.



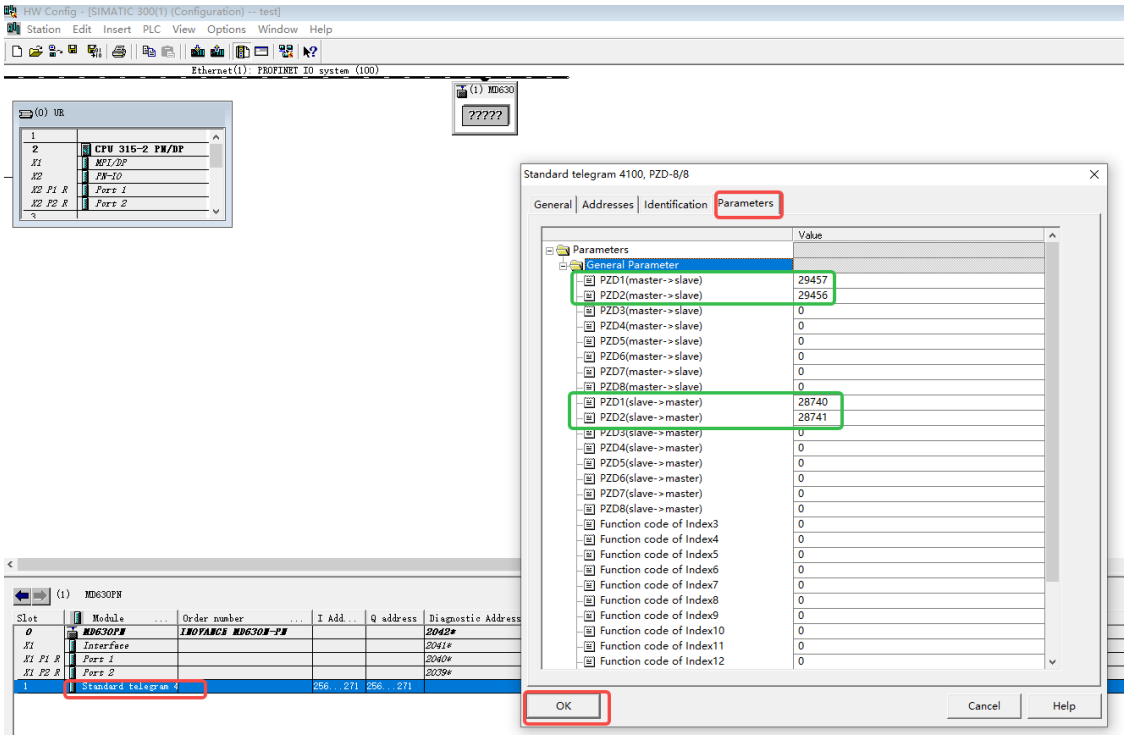
b. Double-click the slave, and in the pop-up screen, select "Assign IP address via IO controller". Then the slave is automatically assigned with an IP address. If the IP address is incorrect, click "Ethernet" on the right of the IP address to modify the IP address.



6. After adding the module, you can configure the module and set the parameter corresponding to each PZD. To do this, double-click the message module and select "Parameters" in the dialog box that appears.

   As shown in the figure below, PZDx(master->slave) represents the PZD written by the master to the slave (i.e., out-data), and PZDx(slave ->master) represents the PZD returned by the slave to the master (i.e., in-data). In the figure, PZD1 and PZD2 marked in green have been pre-configured with initial values. The PZD3 written by the master is configured as 61488 (0xF030, ramp 1 acceleration time), and PZD4 is configured as 61489 (0xF031, ramp 1 deceleration time). The PZD3 read by the master is configured as 28674 (0x7002, bus voltage), PZD4 is configured as 28675 (0x7003, output voltage), and PZD4 is also configured as 28676 (0x7004, output current).

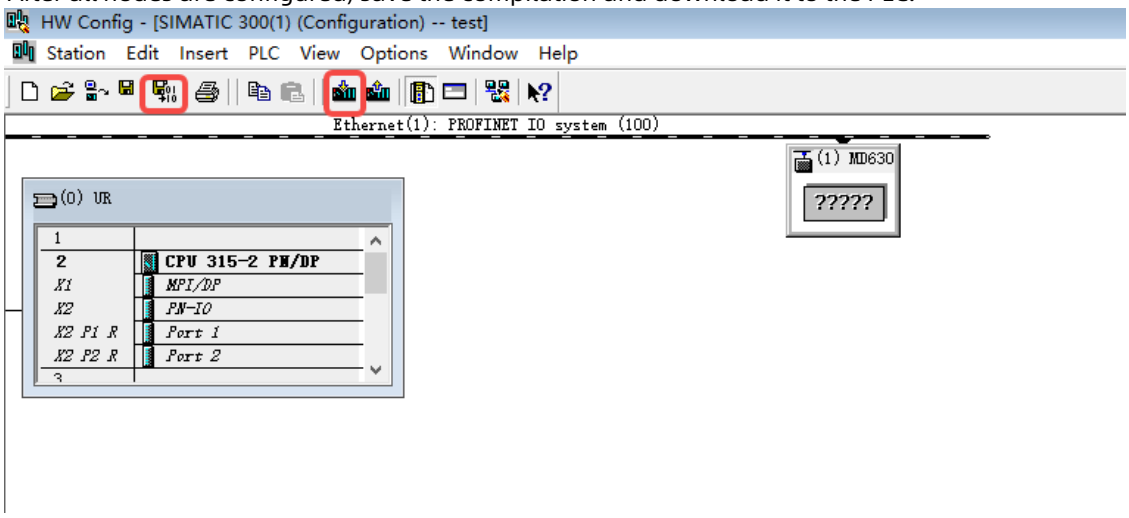
   Click OK to complete the configuration.



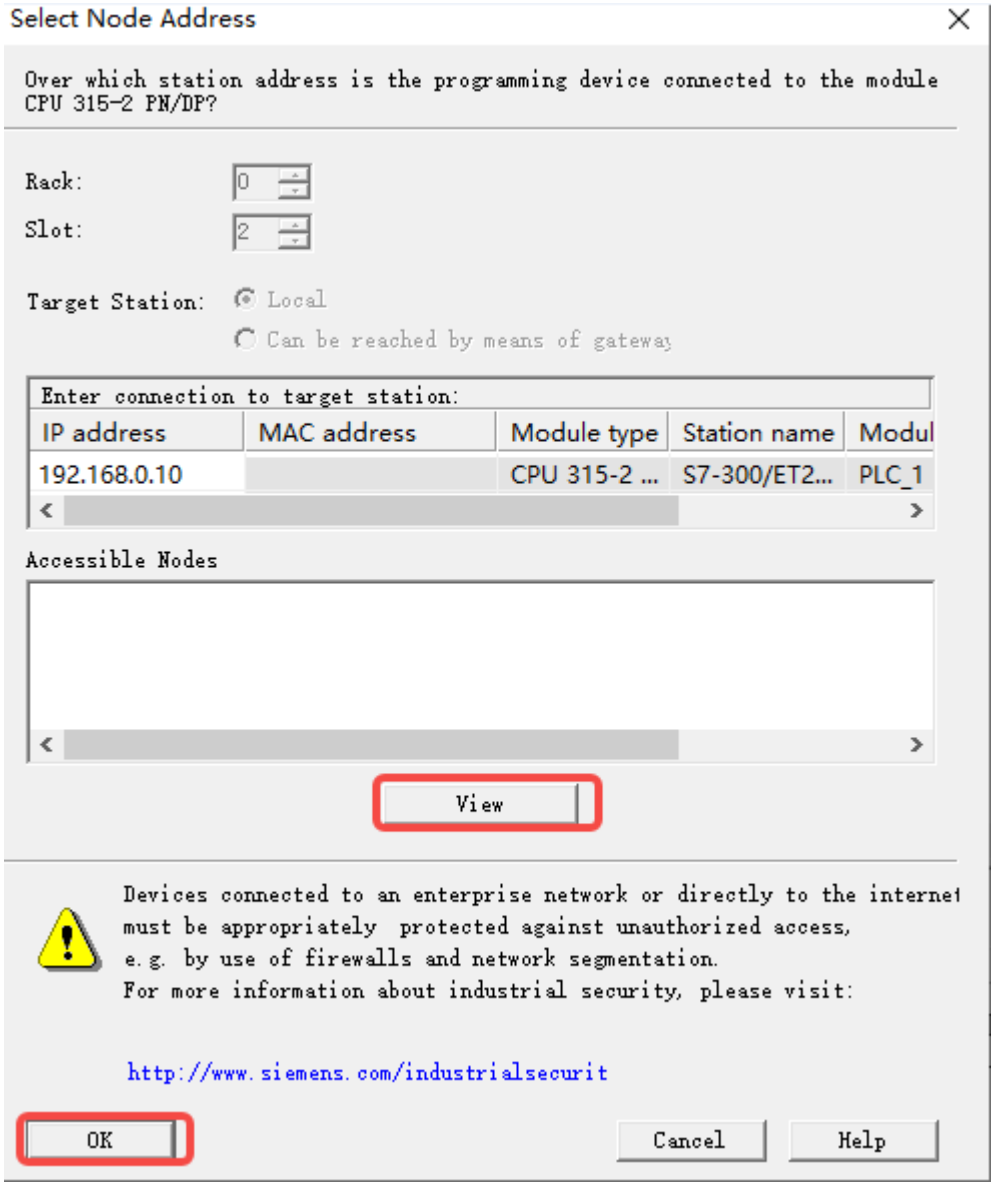
Caution

PZD configuration needs to be continuous, that is, PZD1-4 and PZD6 are not allowed, and PZD5 keeps the original value 0. This will prevent the mapping of PZD6 from taking effect.

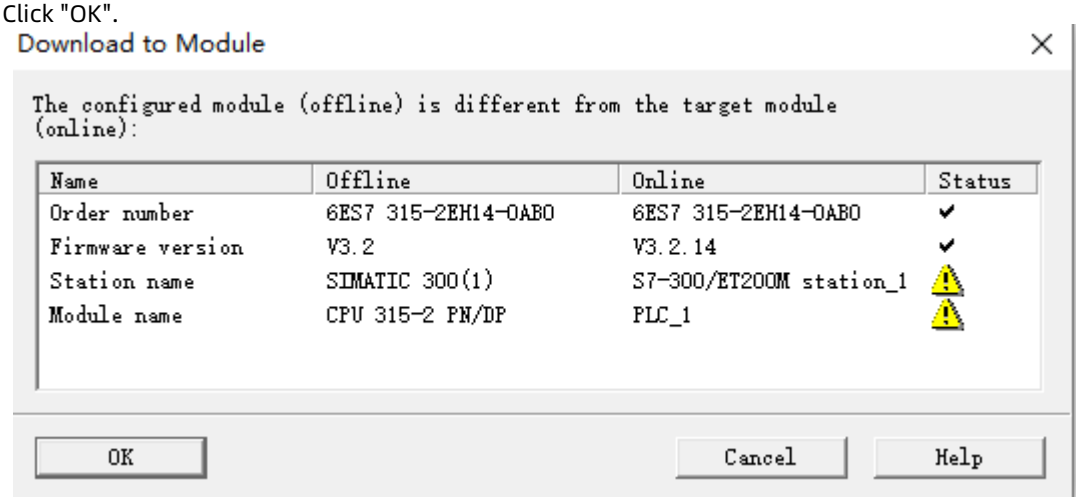
7. After all nodes are configured, save the compilation and download it to the PLC.



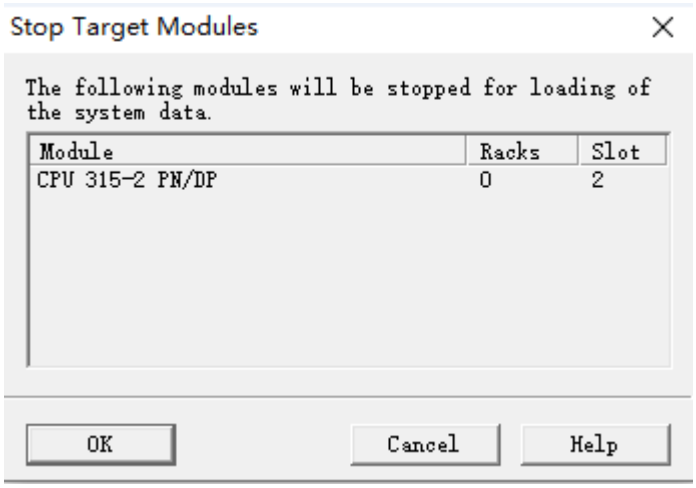
a. Click "View" to refresh the master found in STEP7. Click "OK".



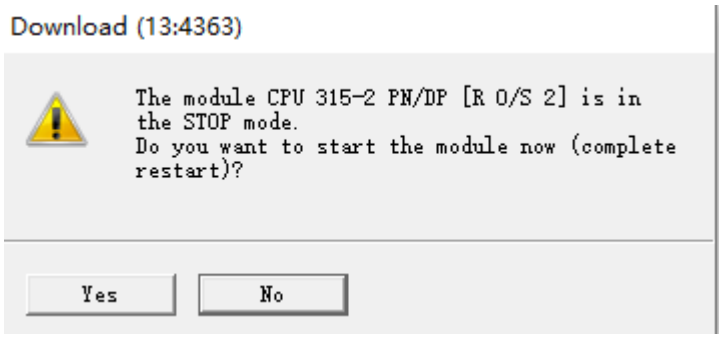
b. Click "OK".



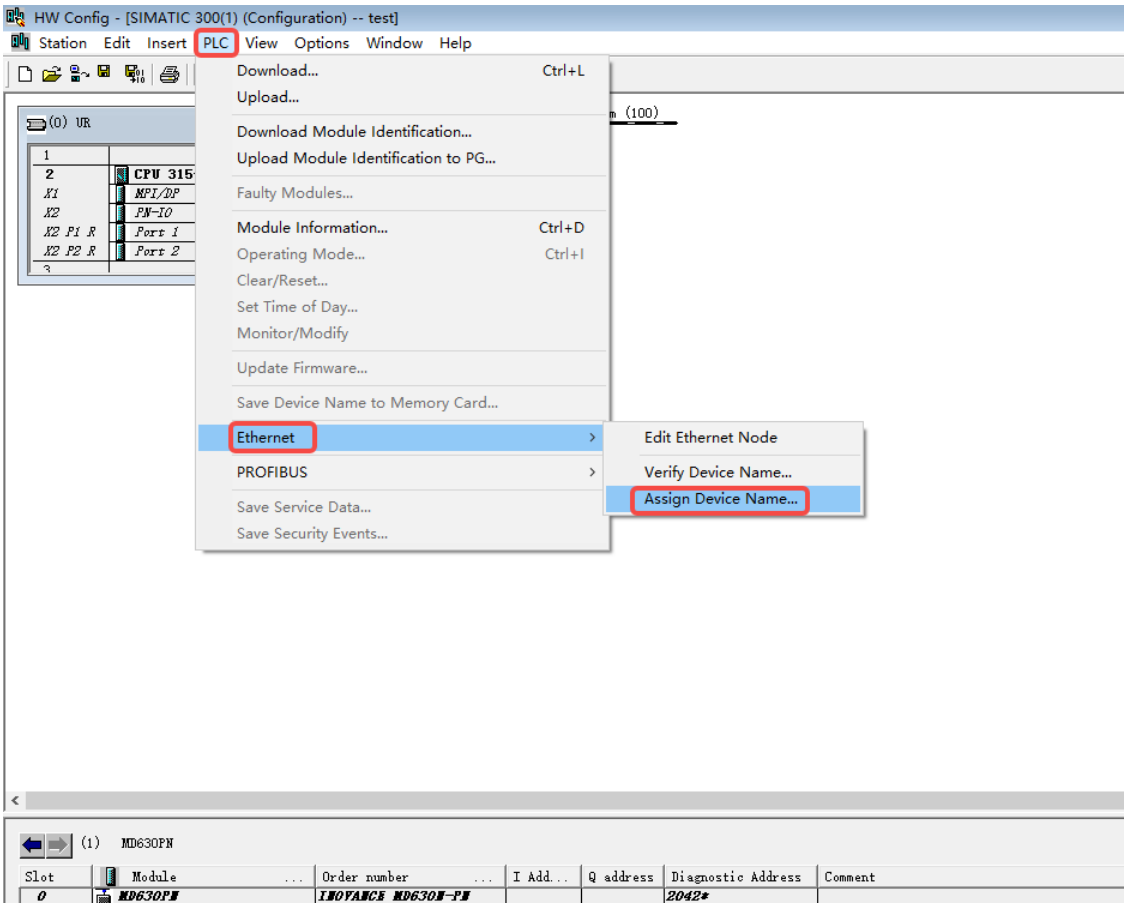
c. During download , click "OK" in the prompt that asks you whether to stop the target module.



d. After download is down, click "Yes" in the prompt that asks you whether to start the module right now. If you select "No", the master remains in the STOP state until the master is manually started.



8. If the master is not selected, click "PLC" > "Ethernet" > "Assign device name".



a. Select the "Device" to be assigned and click "Update" to list all PN nodes in the current network. Select the node to be assigned (distinguished by MAC address. You can also check "Flash LED" to determine the specific device. After this, the device panel of the corresponding MAC flashes.) Click "Assign name".



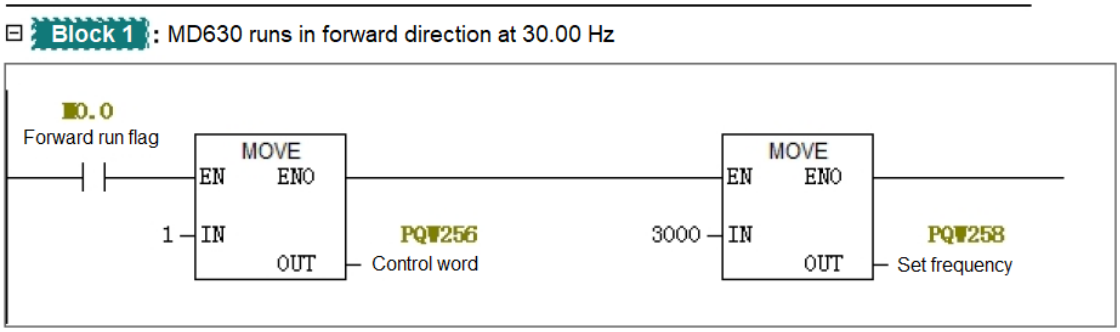
b. Click "Close" when assignment is done.

This completes the configuration of the group. You can control the MD630-INT by modifying the values in the Q addresses (in this example, PQW256-PQW267, corresponding to outputs PZD1-6), and you can obtain the status and parameter values of the MD630-INT by reading the values in the I addresses (in this example, PIW256-PIW267, corresponding to inputs PZD1-6).

The value transmission is generally done through the MOVE instruction or SFC14 and SFC15.

Step 4: Control the drive through communication

Value transmission is generally done through MOVE instruction or SFC14 and SFC15. For the MOVE instruction, see STEP7 Help for SFC (select the SFC block and press F1).



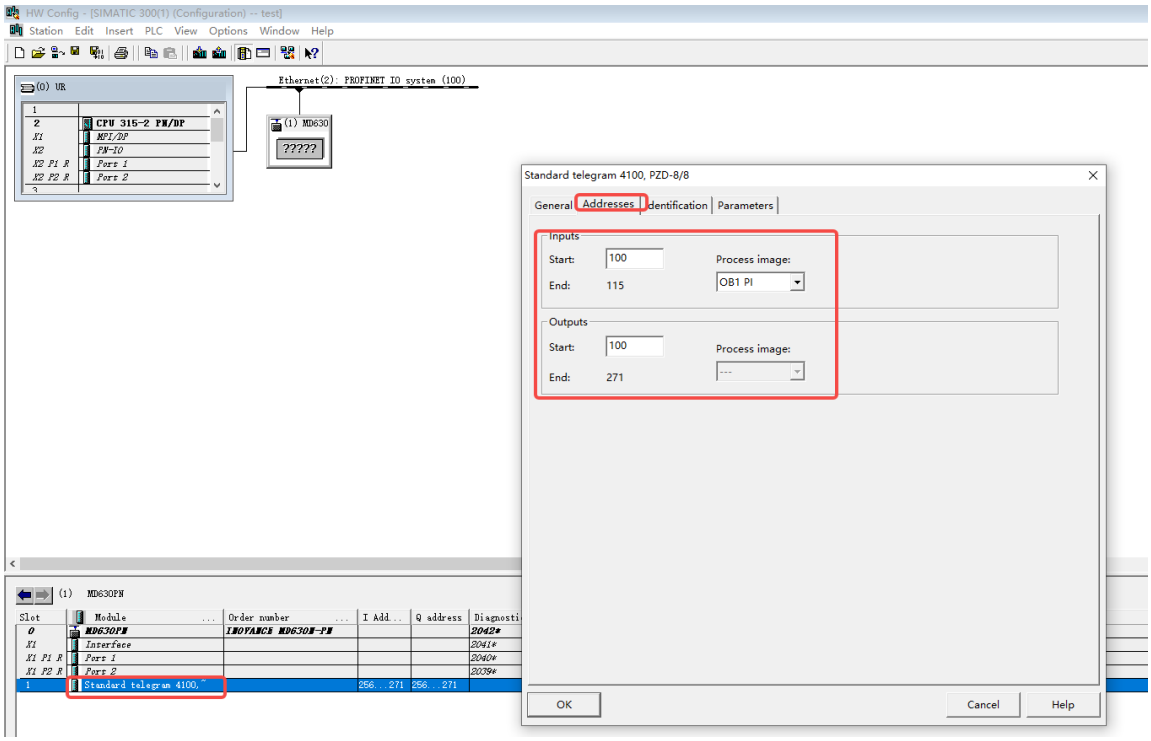
When M0.0 is set, the value 1 (Forward run) is written to PZD1 (corresponding to mapping relation 29457, hexadecimal 7311H) and the value 3000 (Frequency reference) is written to PZD2 (corresponding to mapping relation 29456, hexadecimal 7310H).

Similarly, the data returned by MD630N-INT can be retrieved from the PIW (PIW256 corresponds to PZD1, mapping relation 28740, hexadecimal H7044; PIW258 corresponds to PZD2, mapping relation 28741, hexadecimal H7045, and so on).

Notes:

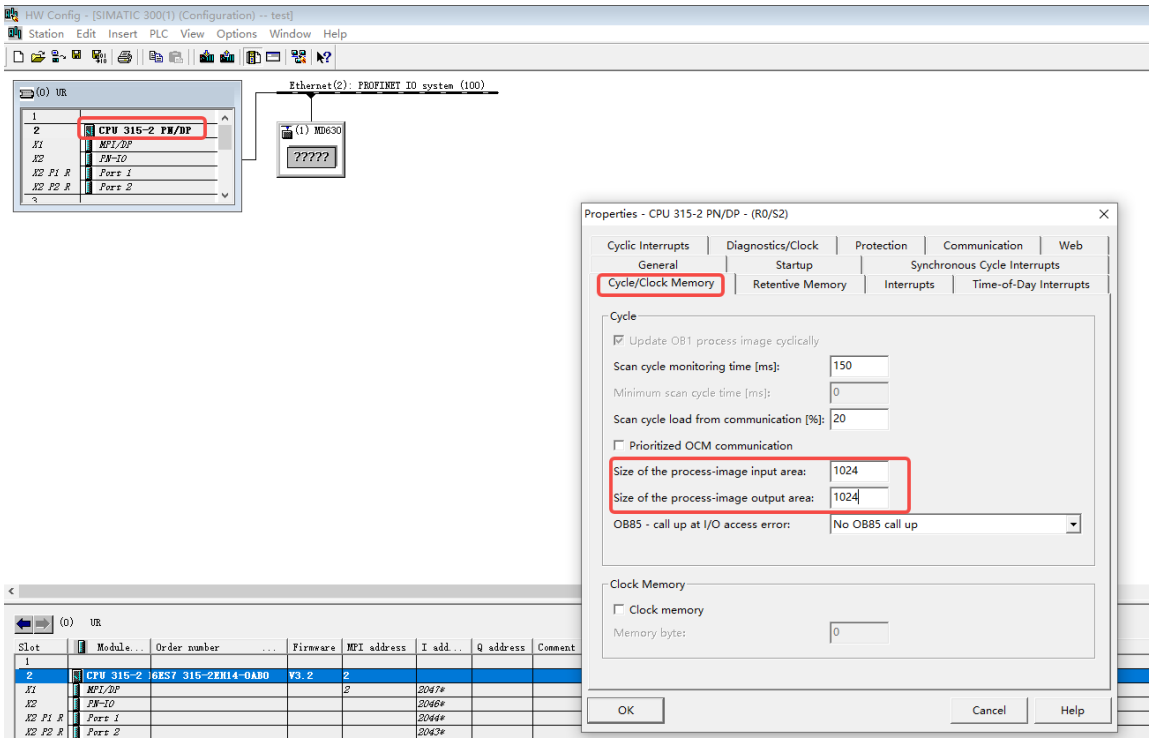
- The command source and frequency source have been set to "Communication" according to *" Special Communication Address" on page 844*.
- PZD1 and PZD2 are configured with default settings, but can also be modified as needed during configuration and then downloaded to the PLC.

By default, the S7-300 PLC cannot write to addresses similar to QW256 directly using commands or read addresses similar to IW256. If such operation is required, the I/O address of the slave needs to be modified to the process mirror area (the process mirror area of S7-300 is in addresses 0 to 127), as shown in the following figure.



If this address does not need to be modified by every station, you can also change the process mirror area size of the PLC (the default process mirror area size of S7-300 is 128 bytes for I and Q addresses respectively), as shown in the following figure.

After the modification is done, the input/output address of the slave is displayed in the process mirror area (grayed out when not in the process mirror area).



After modifying the input/output address or changing the process mirror area size, you need to recompile and download it to the PLC.

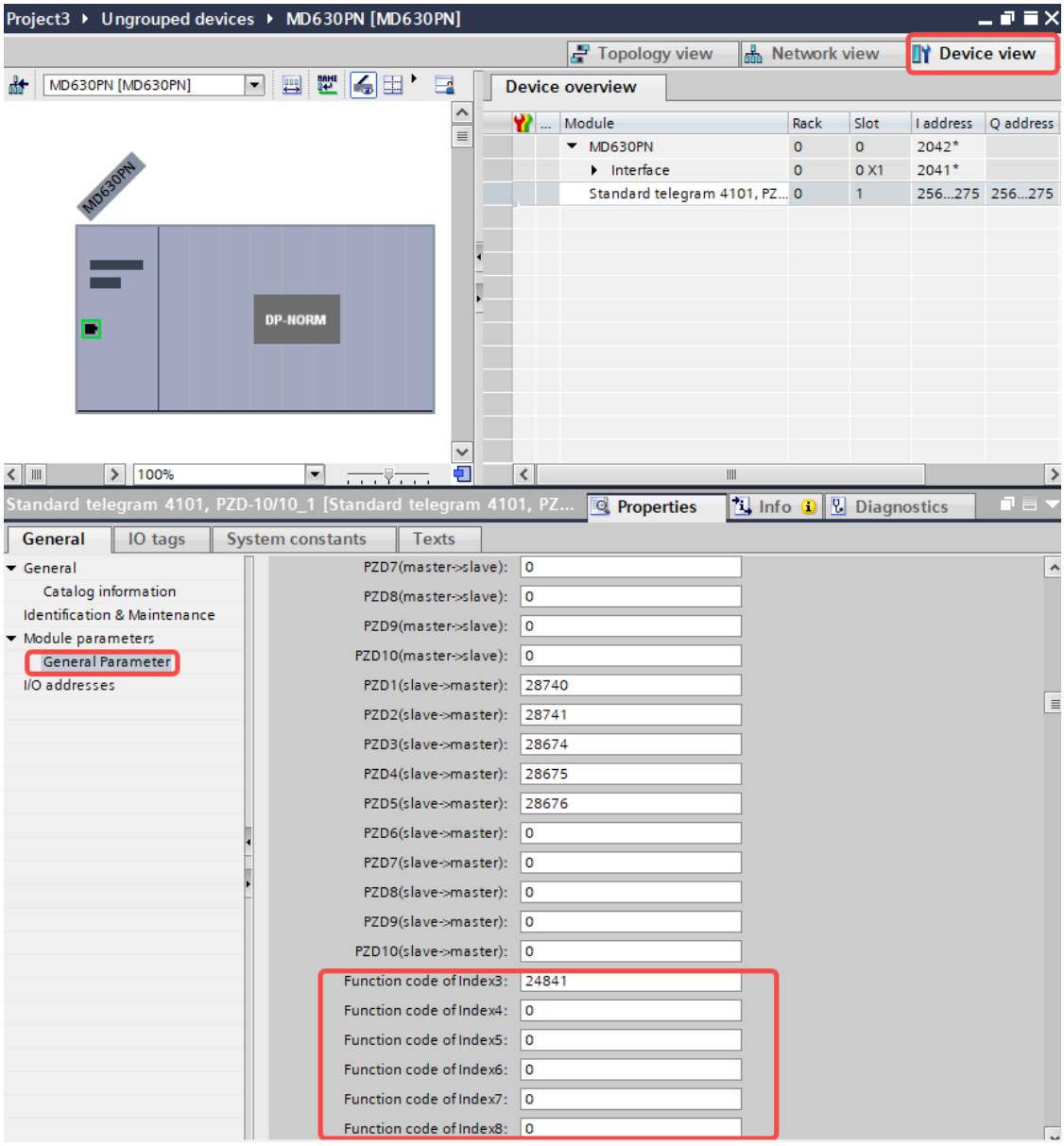
If the modified address is in the process mirror area, you can directly use IW and QW.

6.9.11 Non-cyclic Read/Write Operation Example

PROFINET of MD630N-INT supports non-cyclic read and write operation. You can read and write the parameters of the AC drive through the corresponding function block.

6.9.11.1 Non-cyclic Reading and Writing in TIA Portal

1. The parameter address of the corresponding index must be configured first for non-cyclic read/write.
   Select the slave station, switch to the Device View, select the message module (slot 1), and fill in the Function code of Index (as shown in 24841 in the following figure, which corresponds to 0x6109, or P1-09).

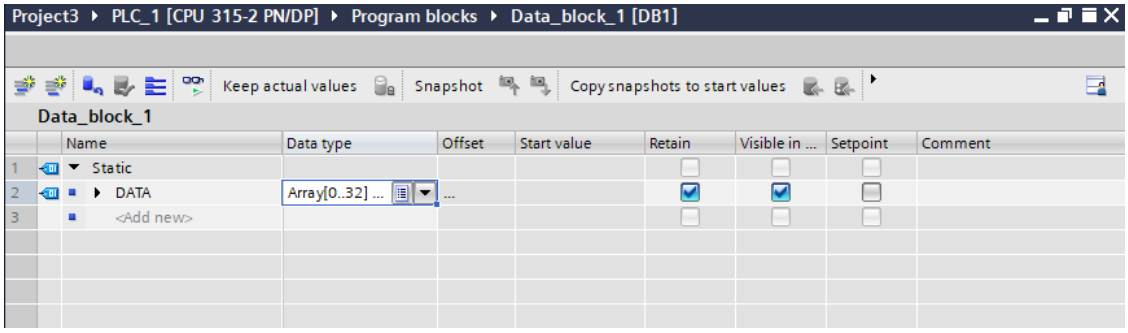


Note

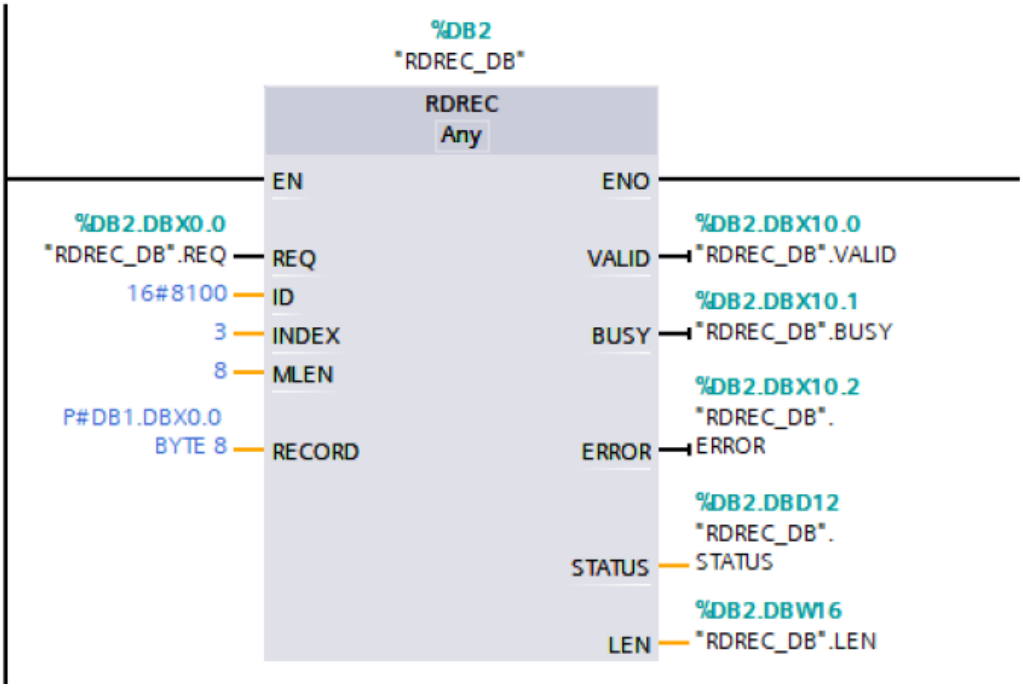
1. The index must be set to a valid parameter address.
2. Unused index keeps the initial value 0.
3. The address in the index indicates the starting address. The non-cyclic read/write operation starts from the set parameter address and continues based on the number of calls.
4. The index configuration does not need to comply with the rule starting from the first point, that is, you can keep Index3 to 0 and configure only Index4.

2. After the configuration is complete, click Save Project to compile and download the project to the master.

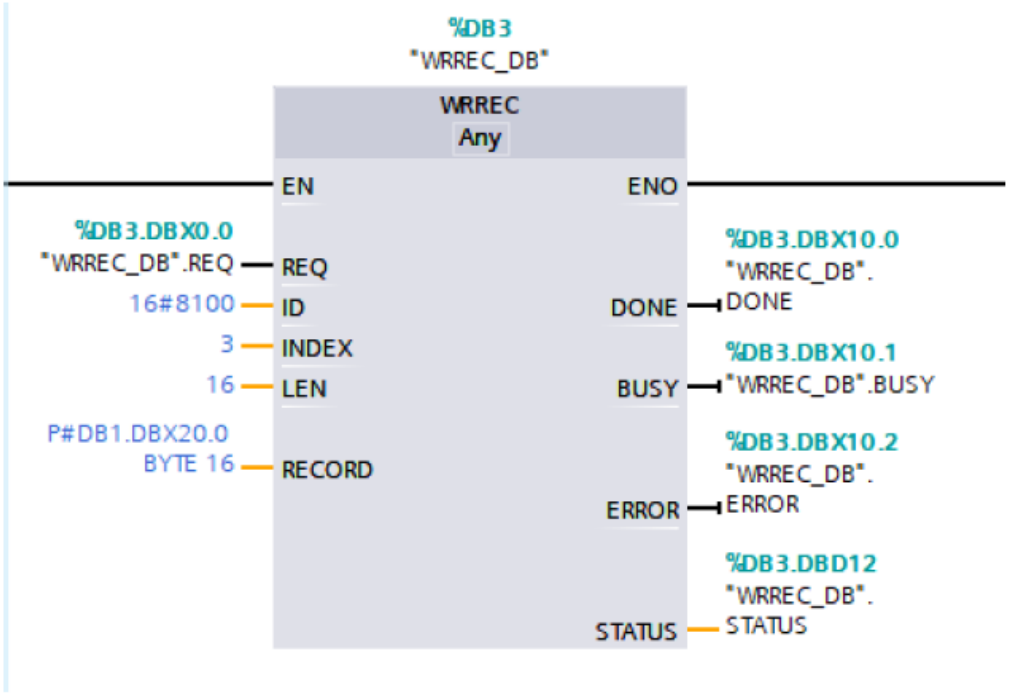
   Then create a new data block DB1 in Program Block, as configured in the following figure.



3. Create an OB1 in the Program Block to open and call the non-cyclic function block (non-cyclic read input RDREC or SFB52, non-cyclic write input WRREC or SFB53).



4. Read the 8-byte parameter value (that is, four consecutive parameters starting from P1-09) from the start address of Index3 through non-cyclic reading. Store DB1.DBW0 to DB1.DBW6 (DB1.DATA [0] to DB1.DATA[3] can also be used).



5. Write 16 bytes of data (that is, eight consecutive function codes starting from P1-09) to consecutive function codes starting from the corresponding starting address in Index3 through non-cyclic writing. The data is from DB1.DBW20 to DB1.DBW34 (DB1.DATA[10] to DB1.DATA[17] can also be used).

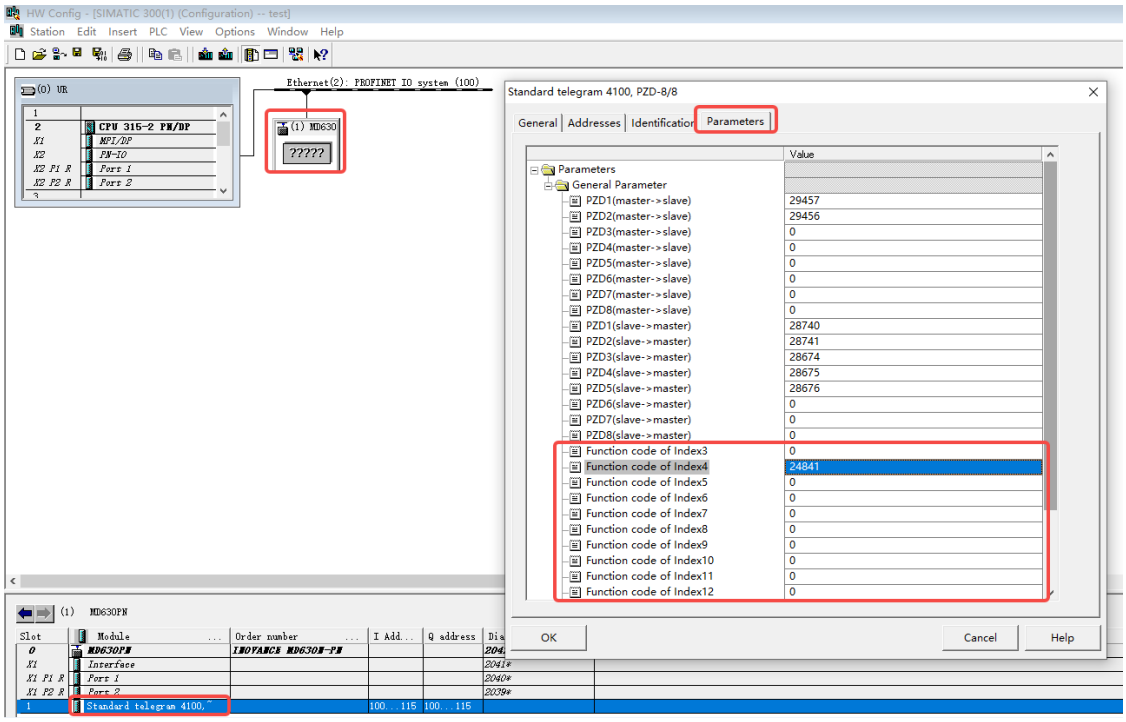
Item	Description
REQ	The non-cyclic enable is used to start non-cyclic read/write when 1 is set.
ID	The logical address of the PROFINET I/O component and hexadecimal of the start address of the Q address must be set to bit15 in the format "16#xxxx".
INDEX	Data record number, which requires non-cyclic execution, is the same as the index number of the corresponding address configured in the parameter. An error will be returned if the illegal address is operated.
MLEN	The maximum number of bytes for non-cyclic operations is set in the range 2 to 24. If a function code corresponds to two bytes, an error will be returned if the number is not within the range or odd.
VALID	When set, the non-cyclic read data is received and valid.
DONE	When set, the non-cyclic write transmission is completed.
BUSY	When set, the non-cyclic operation is not completed.
ERROR	When the position is set, an error occurs during non-cyclic operation.
Status	The current error code (highest position 1) is indicated when the block status or error information is negative.
LEN	The length of data obtained during non-periodic read.
RECORD	Data record position: For non-cyclic read, it indicates the non-cyclic data storage position. For non-cyclic write, it indicates the non-cyclic data storage area to be written to the node.

6.9.11.2 Perform non-cyclic read/write in STEP7

1. The parameter address of the corresponding index must be configured first for non-cyclic read/write.

   In the HW Config interface, select the slave, double-click the message module (slot 1), and select "Parameters" in the pop-up interface. Fill in the function code of index address (as shown in 24841 in the following figure, corresponding to 0x6109, or P1-09).

   After the configuration is complete, click OK to save the compilation and download it to the master.

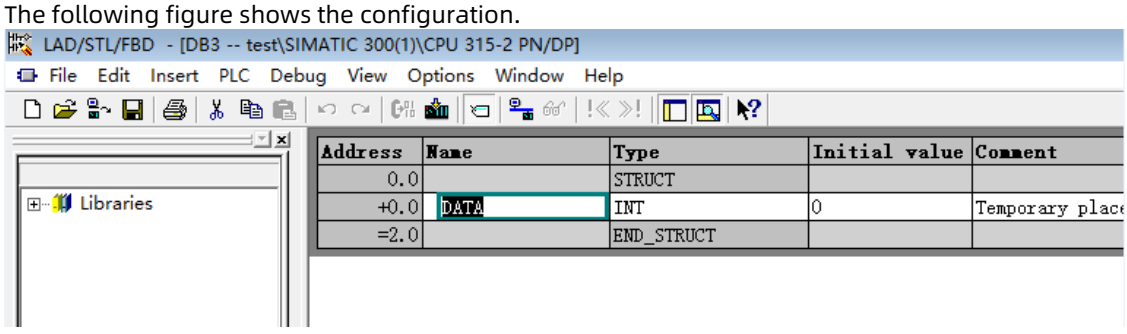


Note

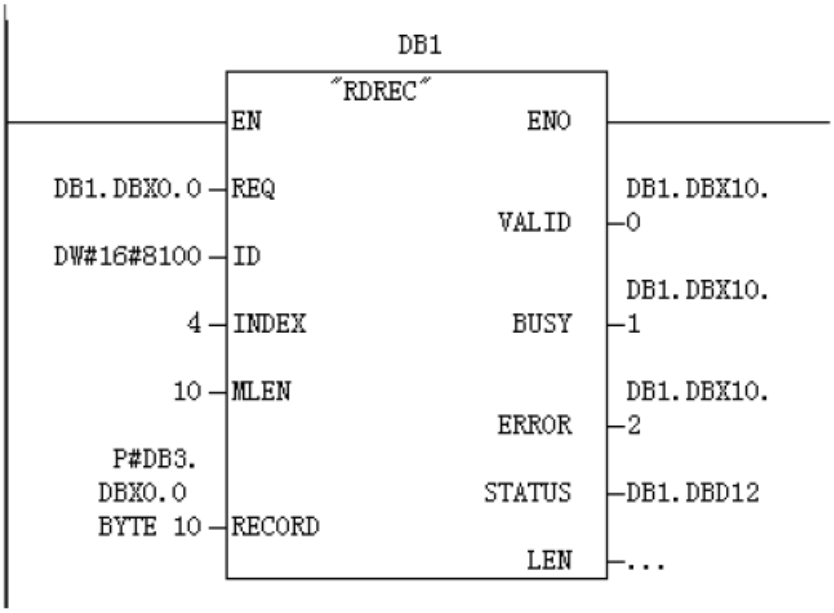
1. The index must be set to a valid parameter address.
2. Unused index keeps the initial value 0.
3. The address in the index indicates the starting address. The non-cyclic read/write operation starts from the set parameter address and continues based on the number of calls.
4. The index configuration does not need to comply with the rule starting from the first point, that is, you can keep Index3 to 0 and configure only Index4.

2. After the configuration is completed, you can program non-cyclic read/write operations.

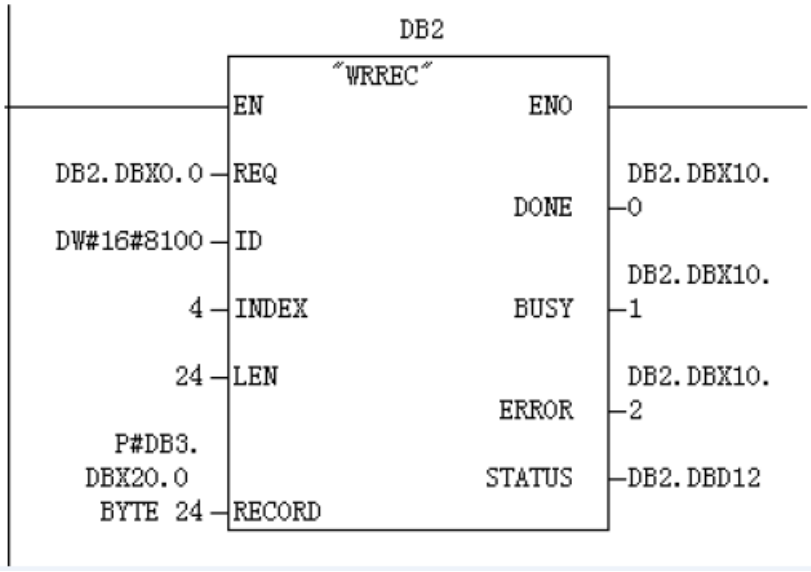
   Configure a data block first. In DB3, for example, create a new DB3 and double-click it to open it. The following figure shows the configuration.



Non-cyclic reading example:



3. Read the 10-byte function code value (that is, five consecutive function codes from P1-09) from the start address of Index 4 through non-cyclic reading. Store DB3.DBW0 to DB3.DBW8 (DB3.DATA [0] to DB3.DATA[4] can also be used).
   Example of non-cyclic writing:



4. Write 24 bytes of data (that is, 12 consecutive function codes starting from P1-09) to consecutive function codes starting from the corresponding starting address in Index4 through non-cyclic writing. The data is from DB3.DBW20 to DB3.DBW42 (DB3.DATA[10] to DB3.DATA[21] can also be used).

Item	Description
REQ	The non-cyclic enable is used to start non-cyclic read/write when 1 is set.
ID	The logical address of the PROFINET I/O component and hexadecimal of the start address of the Q address must be set to bit15 in the format of "DW#16#xxxx".
INDEX	Data record number, which requires non-cyclic execution, is the same as the index number of the corresponding address configured in the parameter. An error will be returned if the illegal address is operated.
MLEN	The maximum number of bytes for non-cyclic operations is set in the range 2 to 24. If a function code corresponds to two bytes, an error will be returned if the number is not within the range or odd.
VALID	When set, the non-cyclic read data is received and valid.
DONE	When set, the non-cyclic write transmission is completed.
BUSY	When set, the non-cyclic operation is not completed.
ERROR	When the position is set, an error occurs during non-cyclic operation.
Status	The current error code (highest position 1) is indicated when the block status or error information is negative.
LEN	The length of data obtained during non-periodic read.
RECORD	Data record position: For non-cyclic read (SFB52), it indicates the non-cyclic data storage position. For non-cyclic write (SFB53), it indicates the non-cyclic data storage area to be written to the node.

6.9.12 Replacing Faulty Device

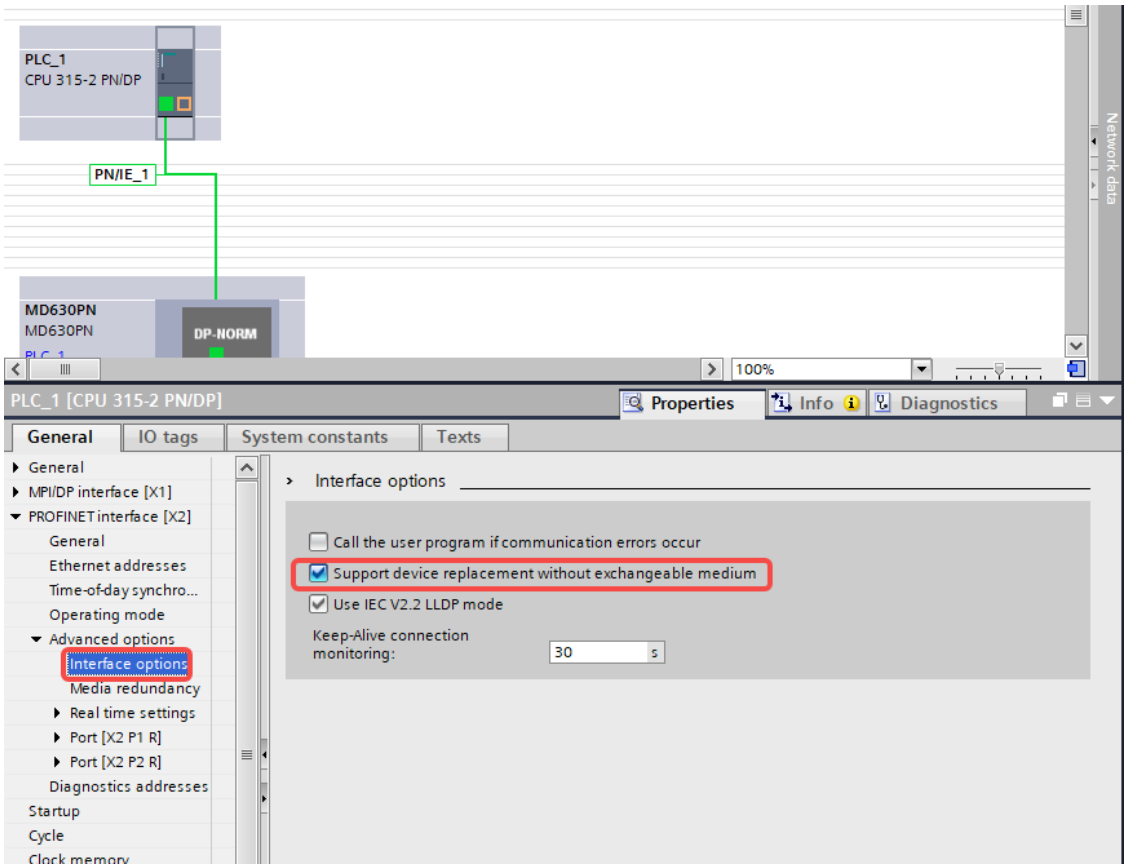
When using PROFINET, MD630N-INT supports directly replacing faulty device without having to reconfigure and assign the device.

The following conditions must be met to replace the failed device:

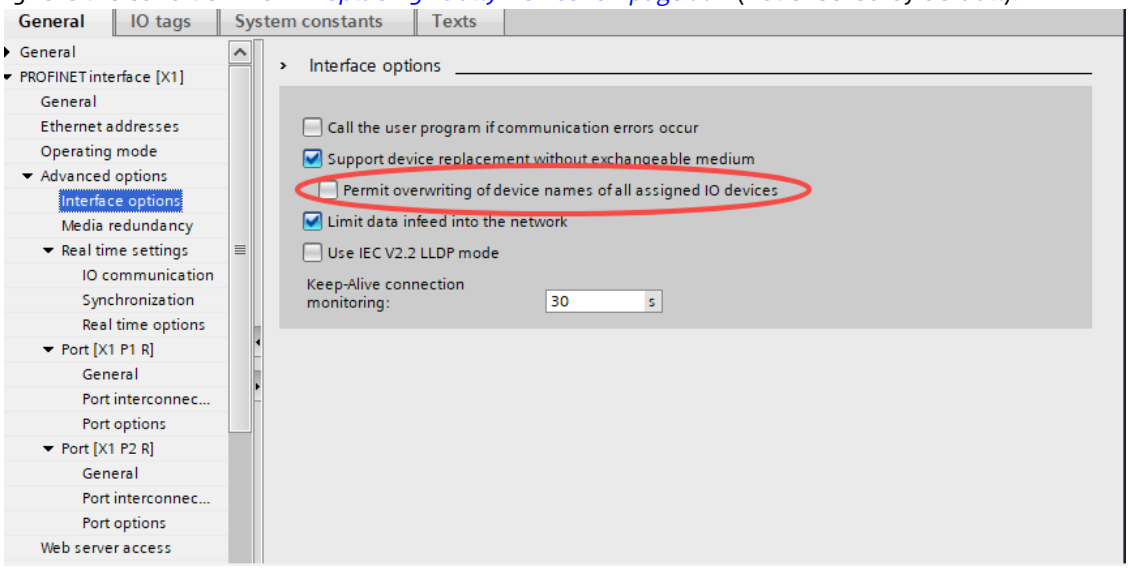
1. The alternative component and the component to be replaced are both the MD630N-INT;
2. The component to be replaced has not been assigned a device name (if it has been assigned, it needs to be reset by the PC).
3. During configuration, the topology was already defined and verified–every cable is mapped to its actual port.
4. The Support device replacement without exchangeable medium option is enabled during master configuration.

6.9.12.1 Selecting the Support device replacement without exchangeable medium option and setting the topology in TIA Portal

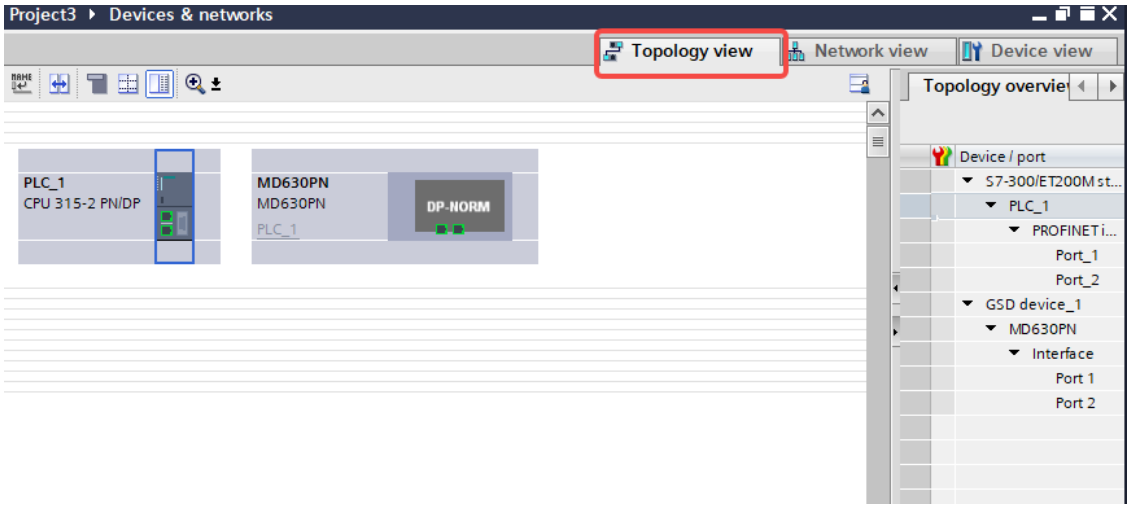
1. Select the slave in Network View, select Interface Options in Advanced Options under General, and check Enable device replacement without swap media. (Note: By default, the configuration is checked.)



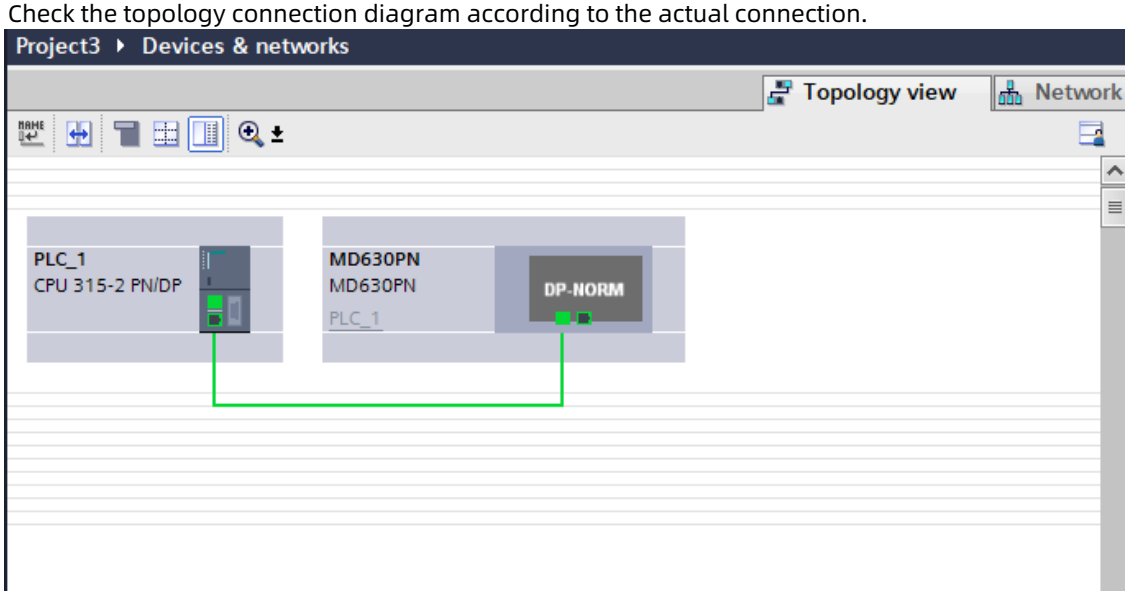
2. If the PLC is S7-1200 or S7-1500, there is an option to "Permit overwriting of device names of all assigned IO devices" on this interface. If this option is checked, If it is checked, the function can ignore the condition 2 on *" Replacing Faulty Device" on page 991* (not checked by default).



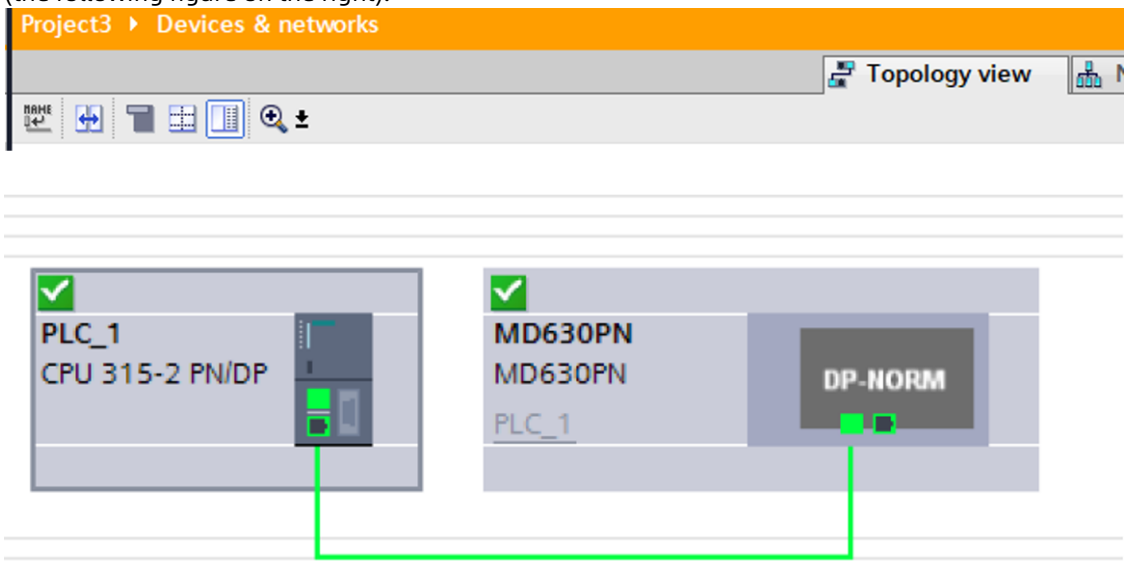
3. Switch to **Topology View**.

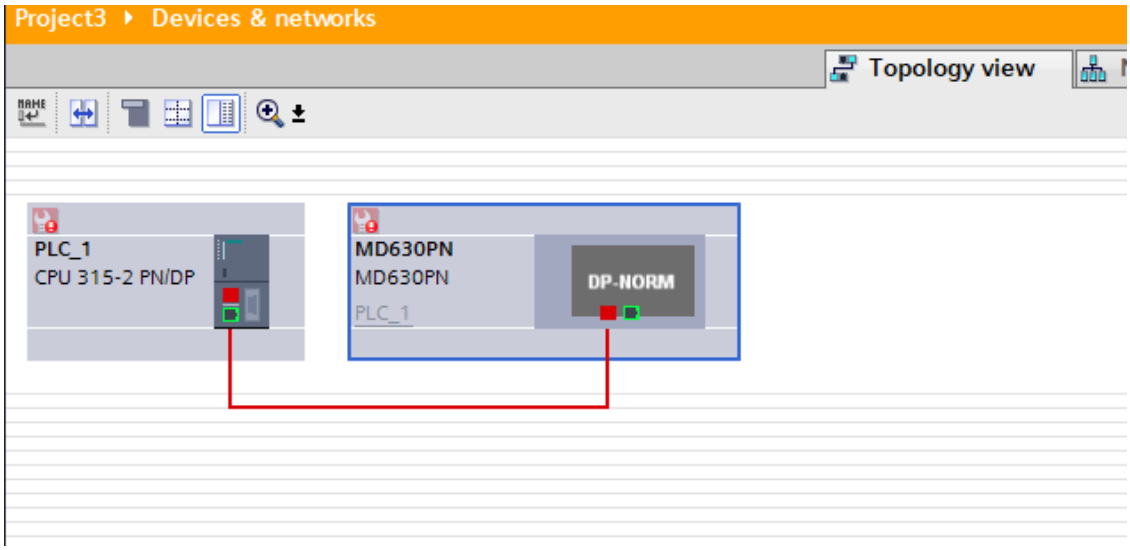


4. Check the topology connection diagram according to the actual connection.



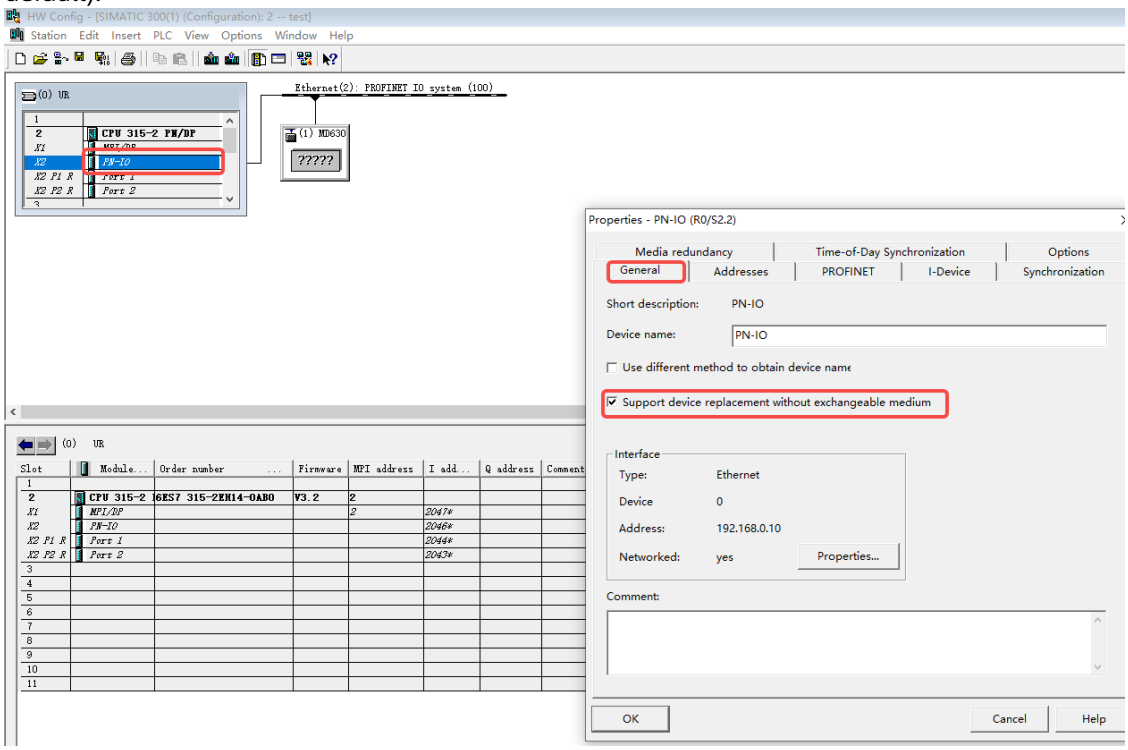
5. Compile and download to the master station. If the topology is correct, the cable will display green (bottom left) in the online state. Otherwise, it will be red. The master station reports a fault (the following figure on the right).



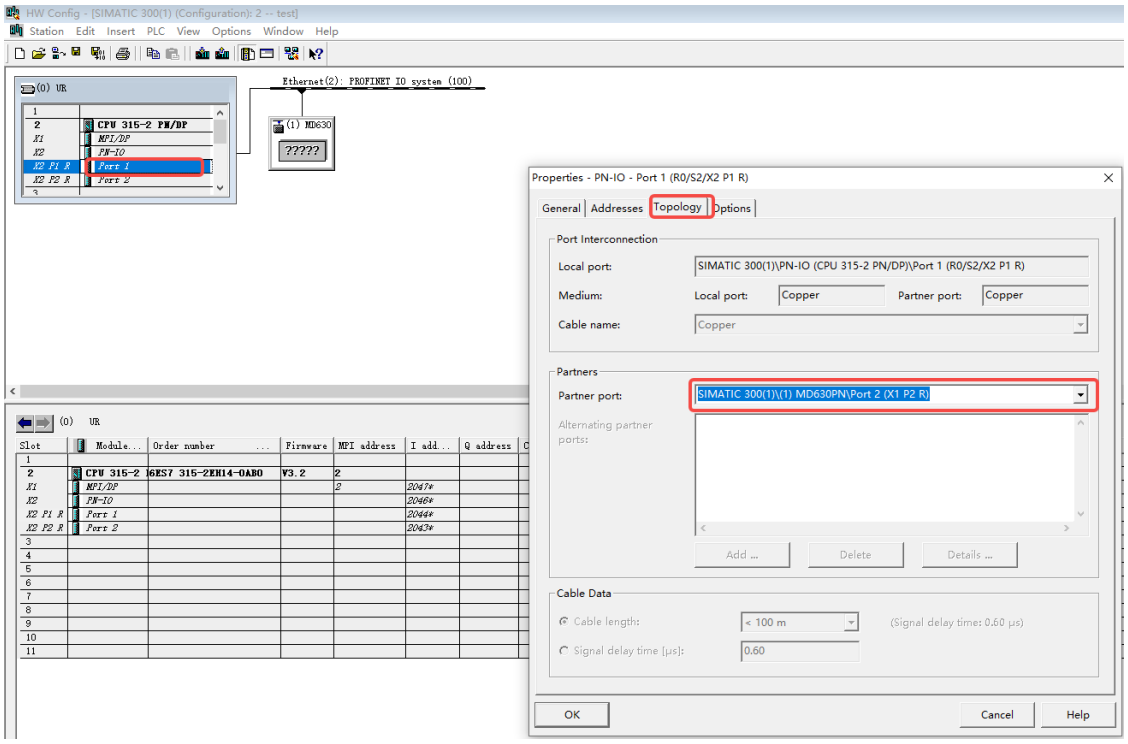


6.9.12.2 Selecting the Support device replacement without exchangeable medium option and setting the topology in STEP 7

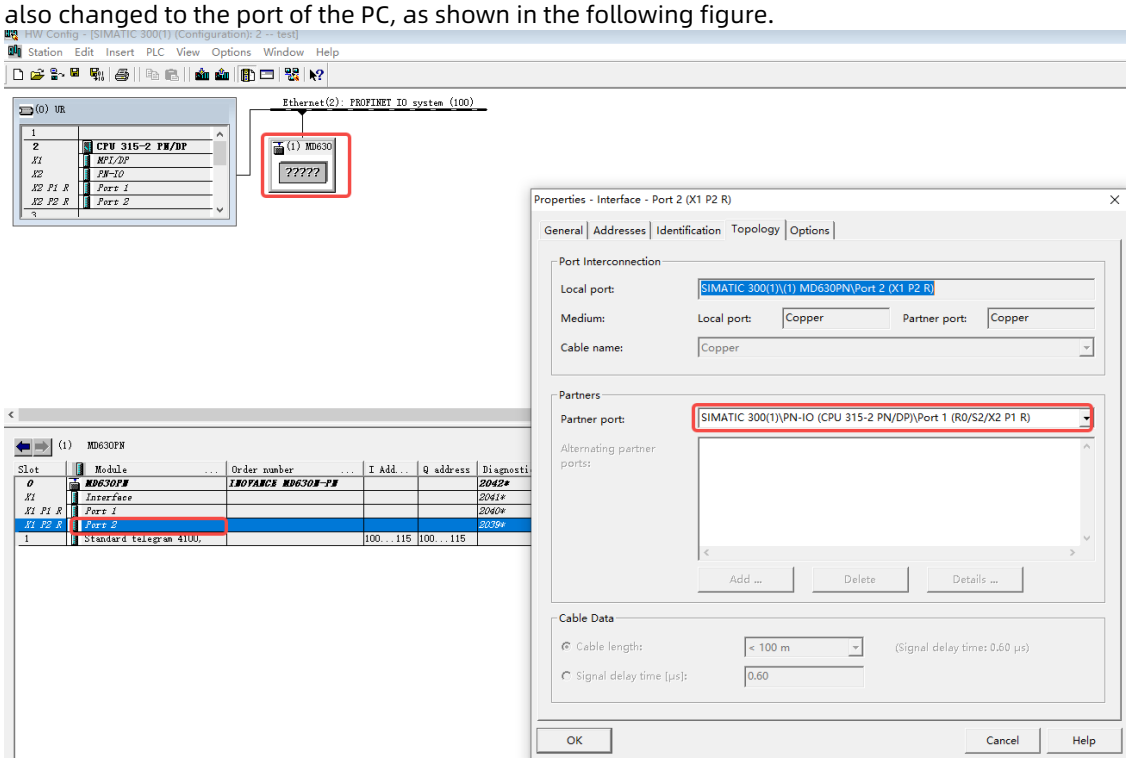
1. In the HW Config interface, double-click the PN-I/O interface of the master station, click General in the pop-up screen, and check Enable device replacement without swap media (selected by default).



2. Double-click the port of the master station, select Topology in the pop-up screen, and then drop-down the port of other devices connected to the port in Partner port (the default value is Any Partner), as shown in the following figure. Connect PLC port 1 to MD630PN port 2. Click OK.



3. After the configuration of the PLC is completed, the corresponding port of the newly set device is also changed to the port of the PC, as shown in the following figure.



4. Continue to configure other cascaded ports until all ports are configured, and then compile and download them to the PLC.

Caution

Communication is normal when the topology is incorrect. Normal switches do not support the topology. If you need to draw a topology, select a managed PN switch. Otherwise, the topology will be wrong.

6.9.13 Configuration of Ring Network Redundancy

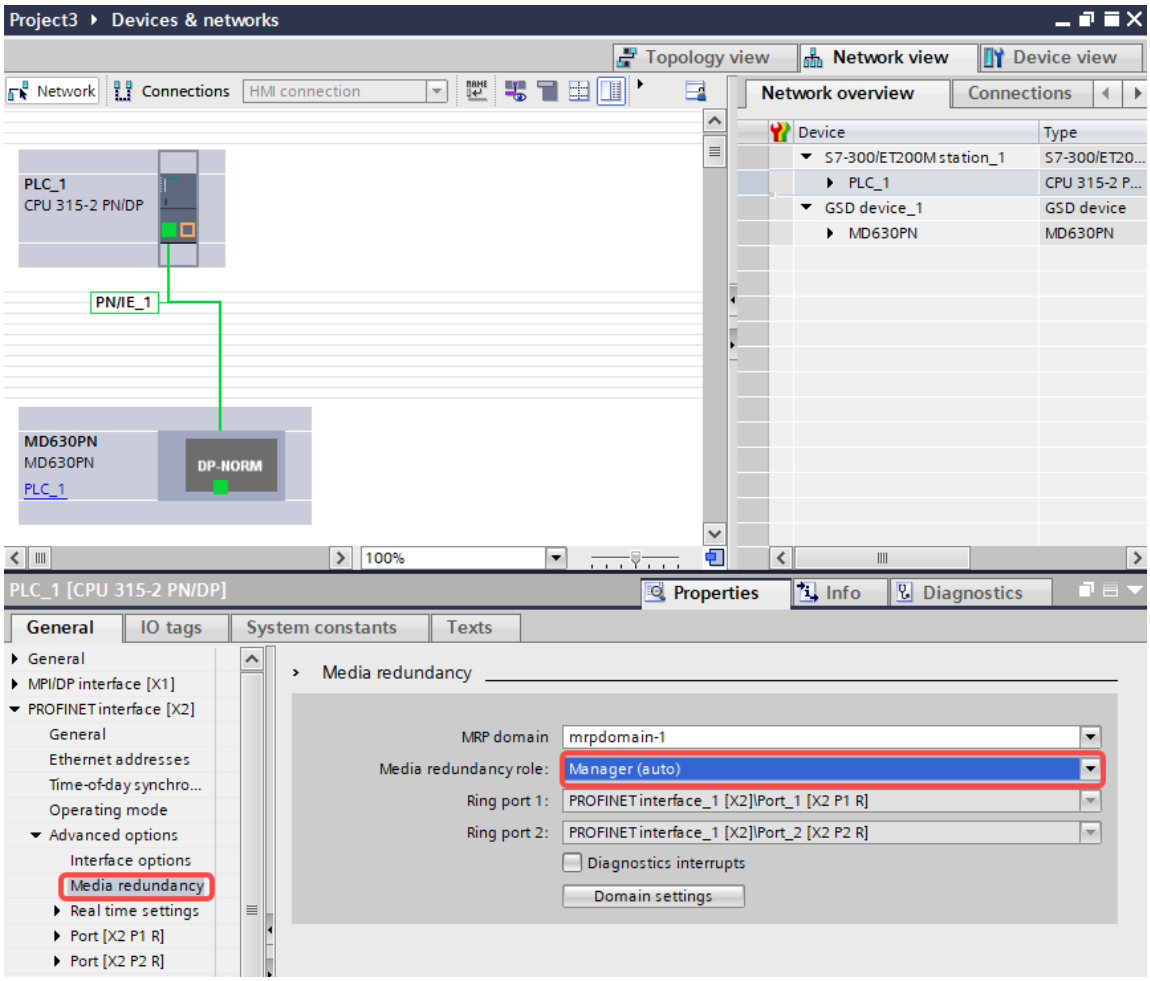
MD630N-INT supports ring topology when using PROFINET communication. When configuring a ring network, enable MRP (Media Redundancy Protocol). MRP includes two roles: MRP Manager and MRP Client. All devices in the ring network must be configured to one of these roles, and MD630N-INT can only be an MRP client.

6.9.13.1 Configure MRP in TIA Portal

Configure the MRP manager.

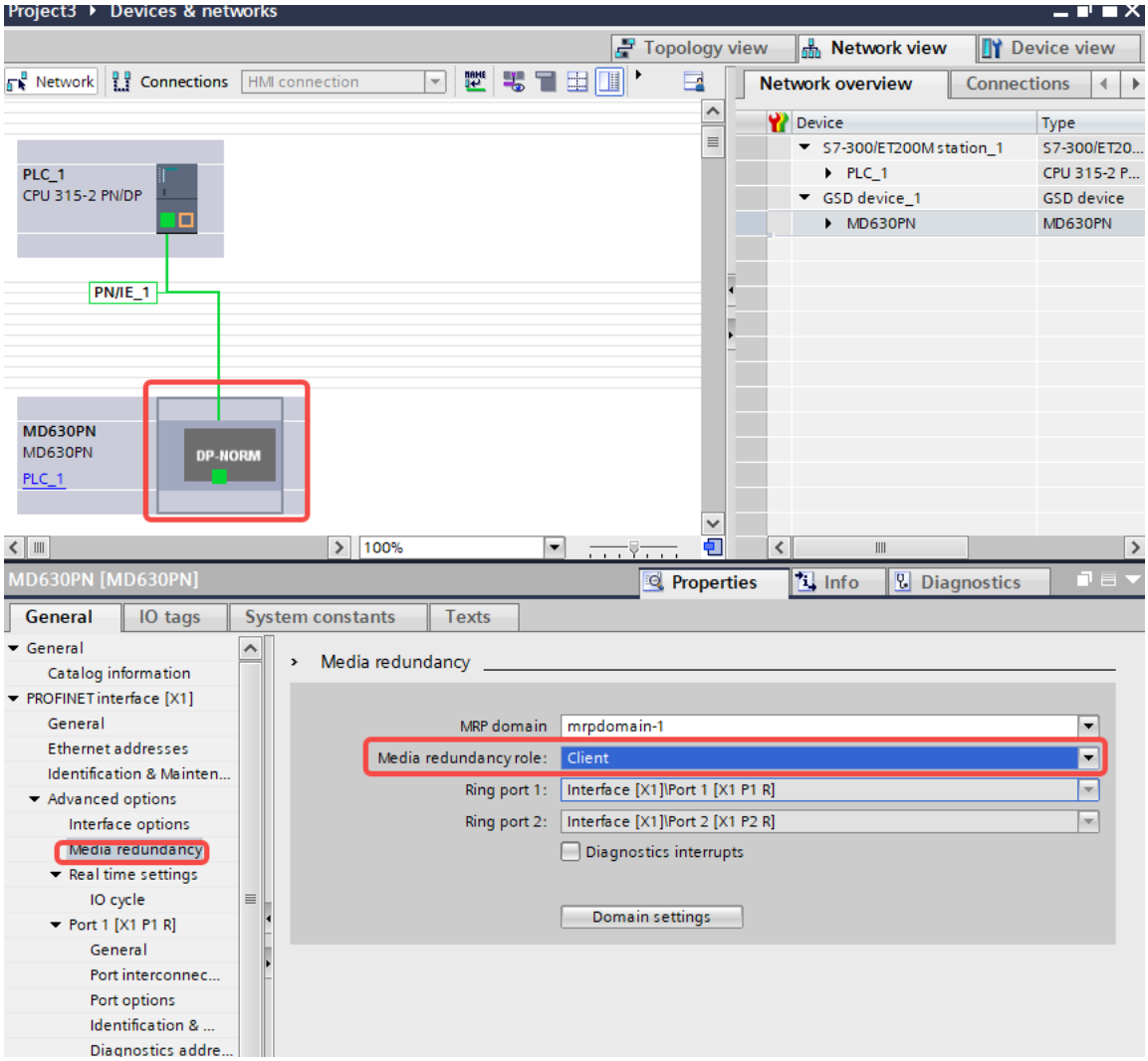
There must be a unique MRP manager in the ring network (configured before the MRP client), which is usually the master station or managed PN switch (if a certain part of a complex network topology forms the ring network, only the switches in that part can act as the manager).

Select the station to be used as the manager, and select **Manager (auto)** from the **Media redundancy role** drop-down list, as shown in the following figure.



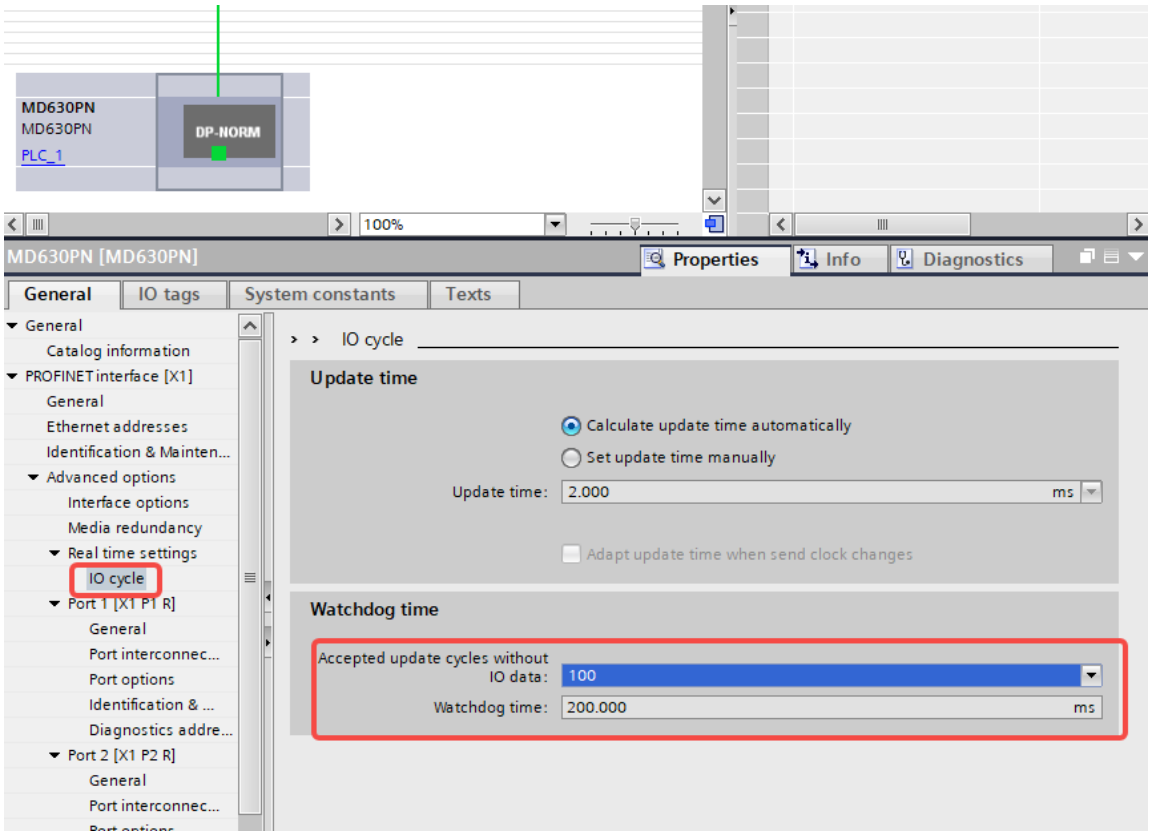
Configure the MRP client.

Select the slave in the network. In the interface shown in the following figure, drop down "Client" in "Media redundancy". You need to configure the MRP manager first. Otherwise, an error will be reported.



Configure the watchdog time.

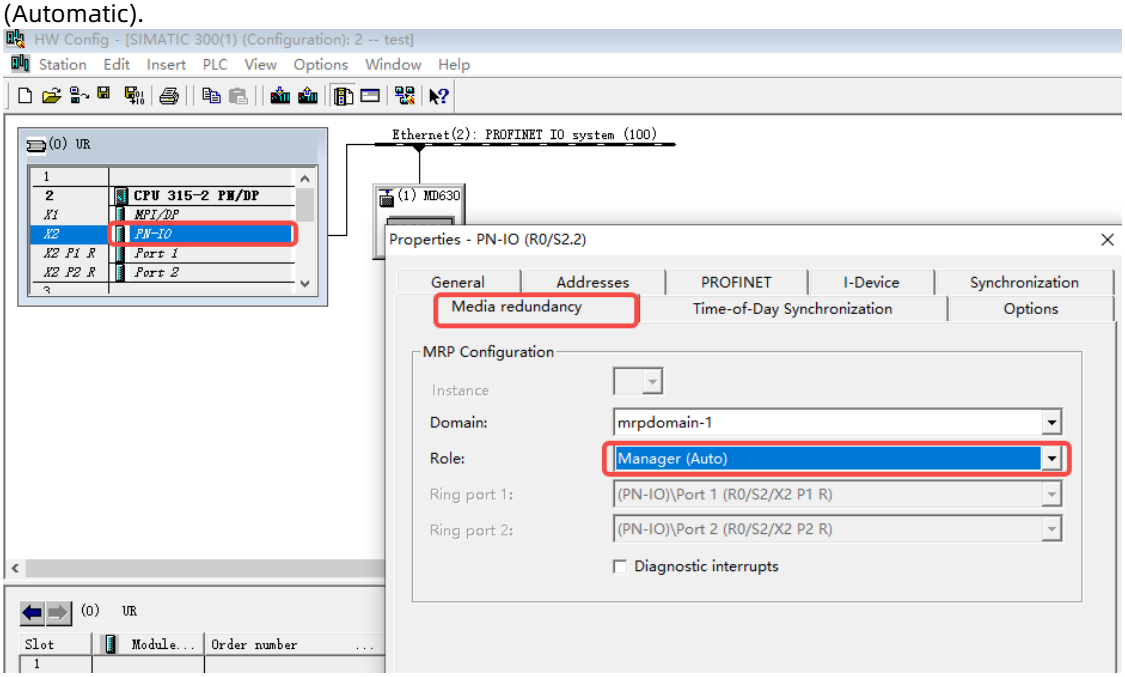
The MRP function requires that the watchdog time cannot be shorter than 200 ms. Therefore, you need to modify the watchdog time, as shown in the following figure. Go to **IO cycle** > **Watchdog time**, and modify **Accepted update cycles without IO data** to a value not less than 200 ms.



6.9.13.2 Configuring the MRP function in STEP 7

Configure the MRP manager.

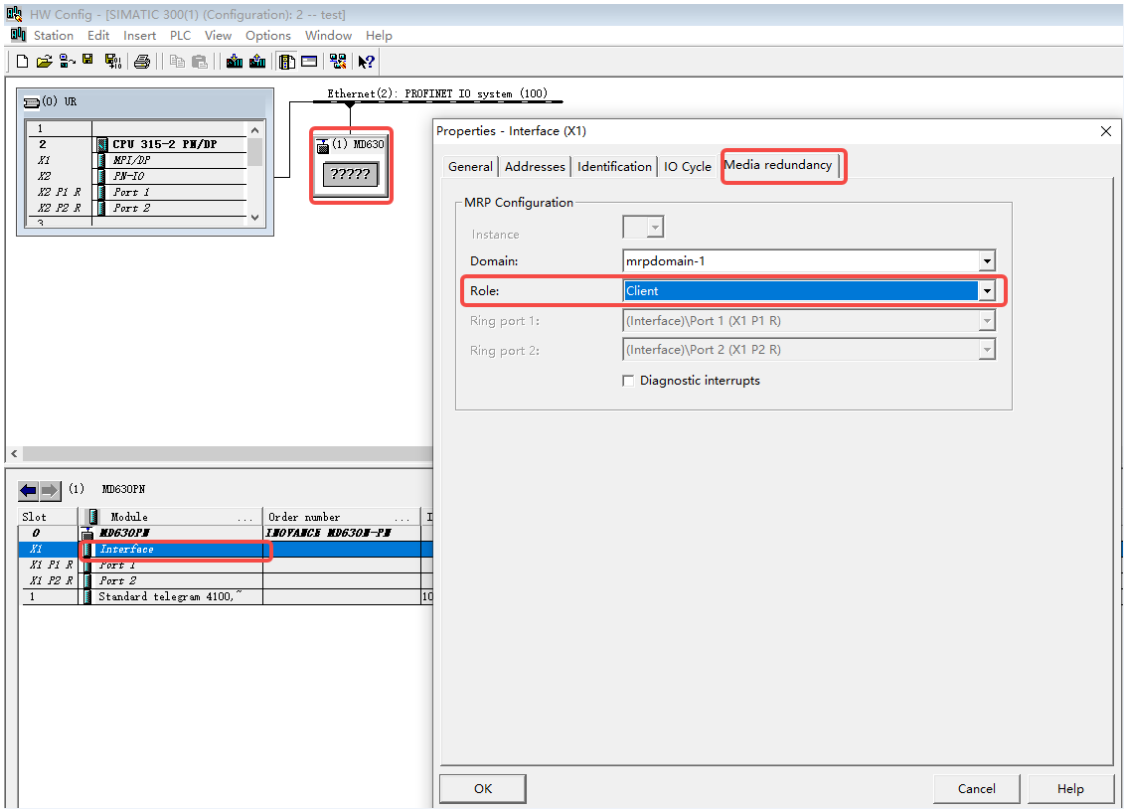
1. In the HW Config interface, double-click the PN-I/O interface of the PLC master station, select Media Redundancy in the pop-up interface, and drop down and select Role as Manager (Automatic).



2. Click OK below when finished.

Configure the MRP client.

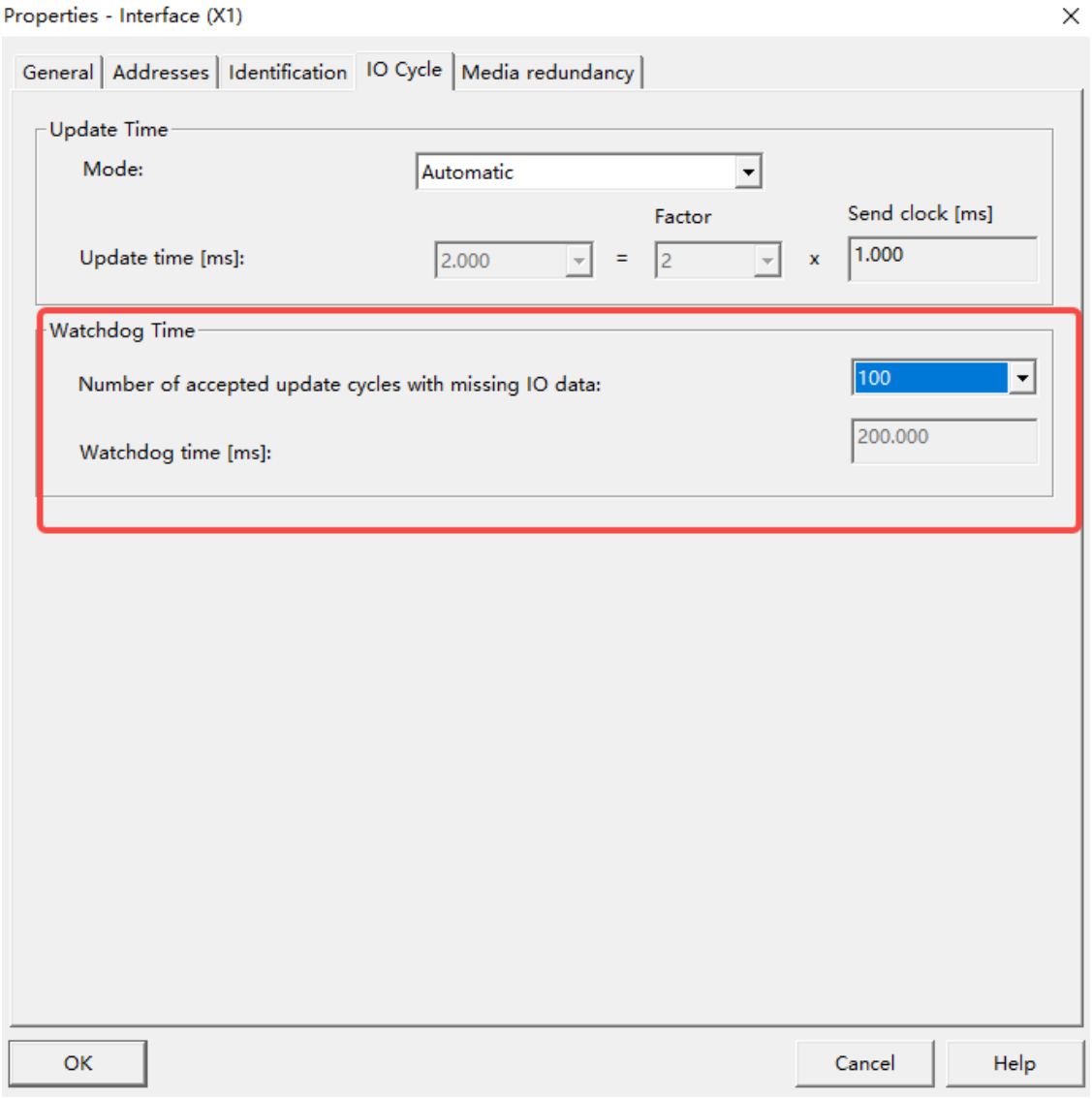
1. After you configure the MRP manager, you can configure the client.
   Select the slave, double-click Interface, and in the pop-up screen, select Media Redundancy. In Role, select Client.



2. Click "OK".

Configure the watchdog time.

1. The MRP function requires that the watchdog time cannot be shorter than 200 ms. Therefore, you need to modify the watchdog time.
   Go to **IO cycle** > **Watchdog time**, and modify **Accepted update cycles without IO data** to a value not less than 200 ms.



2. Click "OK".

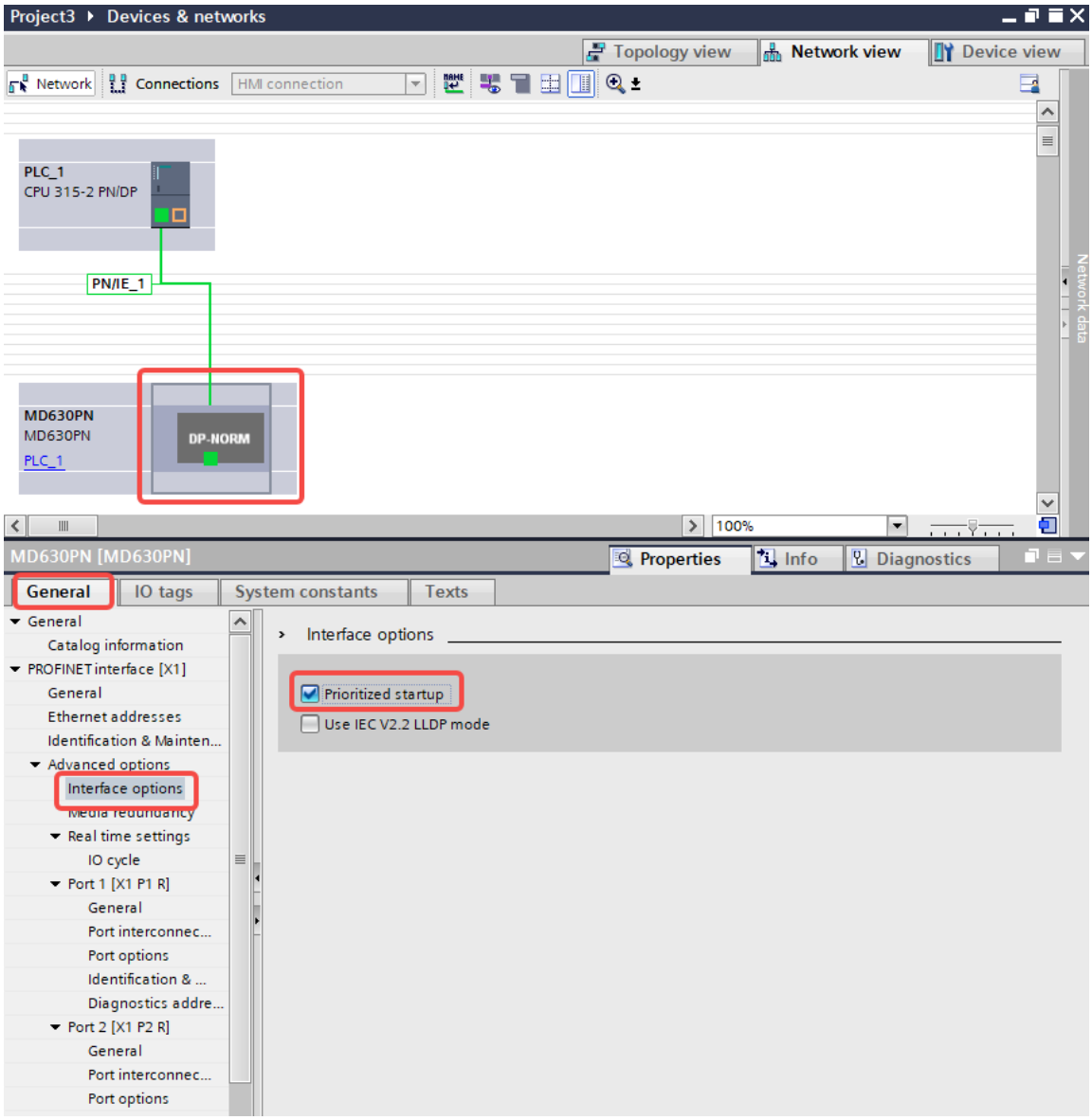
After all nodes in the ring network are configured, download the configuration to the PLC to enable the ring network function. After the ring network is formed, When any of the middle network cables is disconnected, all nodes can still communicate normally.

6.9.14 Boot Priority

MD630N-INT PROFINET supports the boot priority settings. When the device is configured with boot priority, it is connected to the master station firstly. That is, the device configured to start first will establish communication with the master station before the device not configured with boot priority.

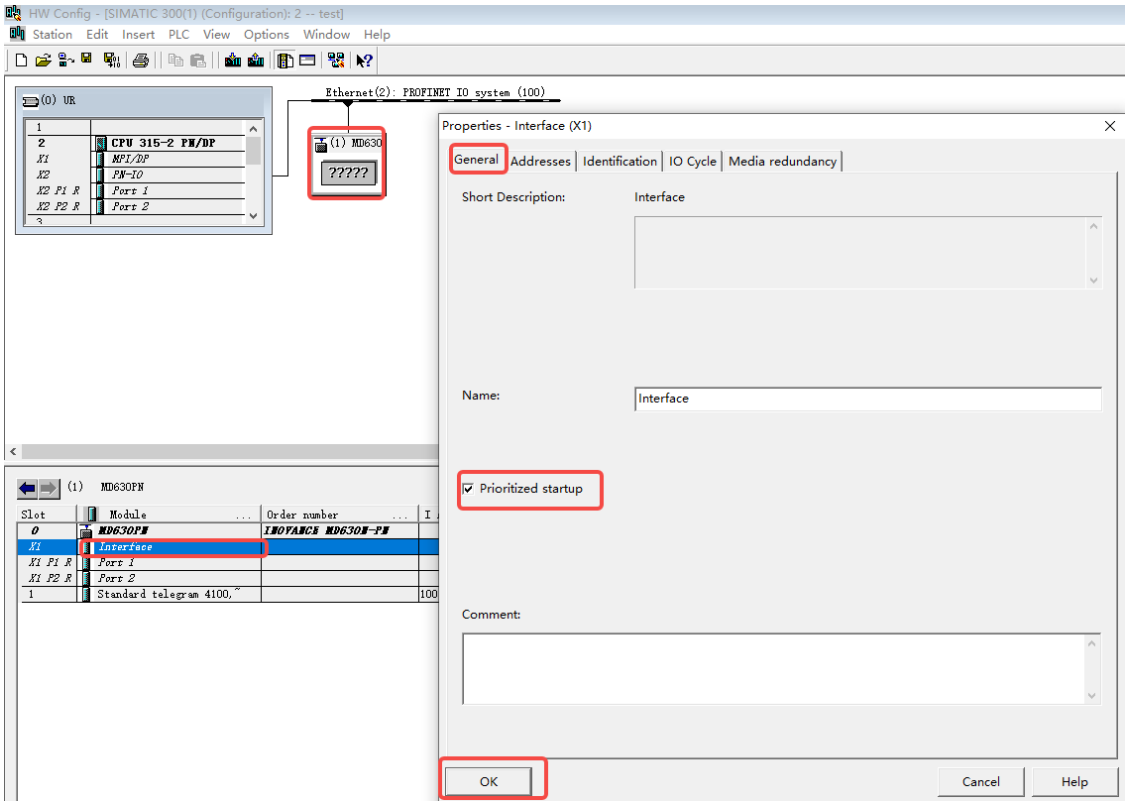
6.9.14.1 Configure the Boot Priority in TIA Portal

Select the slave. In “General”, select “Advanced Options”, and then select “Prioritized startup” in “Interface Options” to save and compile. Then download it to the master station.



6.9.14.2 Configuring the Boot priority function in STEP 7

1. Select the slave, double-click Interface, and select General in the Properties screen. Check "Start first" and click "OK".



2. After the configuration is completed, save the compilation and download it to the master.

6.10 Modbus TCP Drive Control

6.10.1 Overview

The device implements Modbus TCP communication over Ethernet, using the TCP/IP network protocol to achieve high-speed data exchange between devices, in compliance with the international standard for Modbus TCP industrial Ethernet. The device operates as a Modbus TCP server and can be integrated into a single-master multiple-slave PC/PLC control network, accepting control requests from Modbus TCP clients. You can carry out centralized control by using a PC or PLC and set the running commands, modify or read parameters, and read the operating status and fault information of the AC drive through the communication protocol. The protocol clearly defines the format and transmission method of the information content during the communication process. When a slave device encounters an error while receiving information or cannot complete the operation requested by the master device, it will generate the corresponding fault message and feed it back to the master device. This communication method significantly improves system communication efficiency and enhances the networking capability of the MD630N-INT series AC drive.

6.10.2 Communication Specifications

Item	Specification
Communication protocol	Modbus TCP slave communication protocol
Transmission mode	Master-slave communication mode
Communication mode	Full-Duplex Auto-Negotiation
Topology	Bus, Star
Transmission rate	100 Mbps adaptive
Transmission medium	Twisted pair
Transmission distance	Below 100 m
Communication Terminals	502 (TCP)
Modbus TCP frame length (bytes)	Ethernet frame length (64 to 1518) Modbus TCP maximum length is typically 260 bytes (7 bytes for MBAP header, 1 byte for parameter, and up to 252 bytes for data field).
Number of read-write parameters	12
ModbusTCP slave communication timeout (s)	0 to 6000 (default 0, setting to 0 means the communication timeout is invalid)
Maximum cable length (m)	Less than 100

6.10.3 Communication System Connections

For Modbus TCP communication, use shielded twisted pair cables that meet the TIA/EIA-568-B standard, such as Category 5e (Cat5e) or higher, with standard RJ45 connectors. The length of a single cable should be less than 100 meters.

The Modbus TCP supports multiple types of topologies, including the bus type and star type. Multiple types of networking can be achieved through the switch.

Bus connection

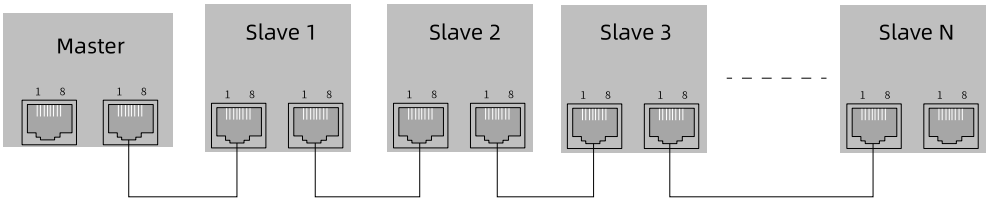


Figure 6-56 Bus topology

Star connection

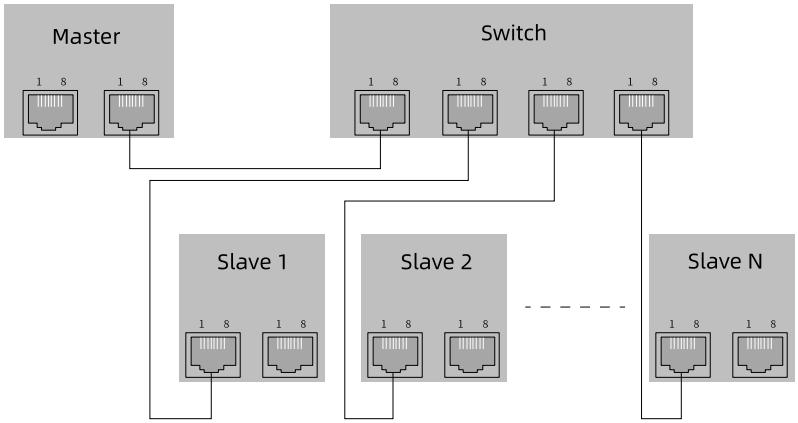


Figure 6-57 Star topology

6.10.4 Message

6.10.4.1 Message Structure

The Modbus TCP communication data format is as follows.

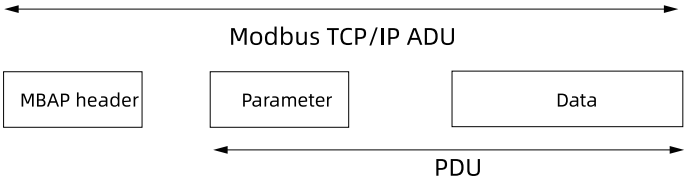


Figure 6-58 IP Modbus request/response over TCP

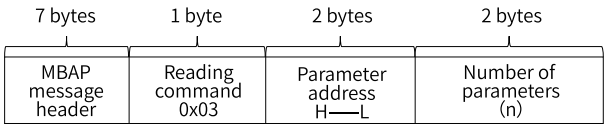
The MBAP header includes the following fields.

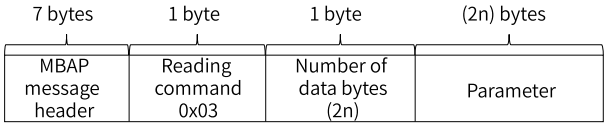
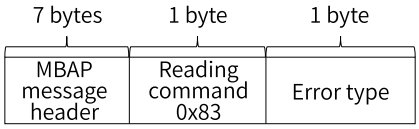
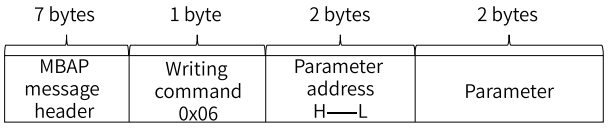
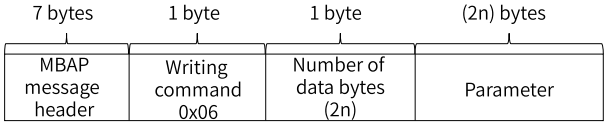
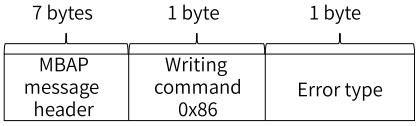
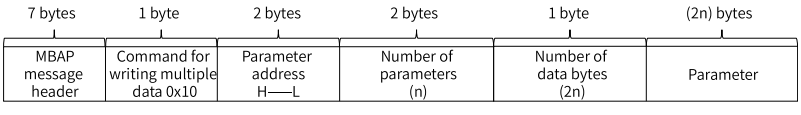
Field	Length	Description	Client	Server
Transaction meta identifier	2 bytes	Identifier of the Modbus request/response transaction	Started by the client	Recopied by the server from the received request
Protocol identifier	2 bytes	0: Modbus protocol	Started by the client	Recopied by the server from the received request
Length	2 bytes	Number of bytes of the next field	Started by the client (request)	Started by the server (response)
Unit identifier	2 bytes	Identifier of the remote slave connected on a serial link or other bus	Started by the client	Recopied by the server from the received request

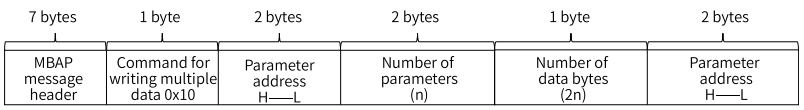
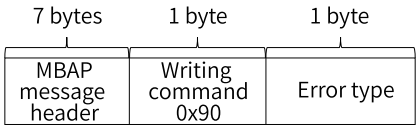
The AC drive supports reading or writing only of word type parameters, and does not support reading or writing of bytes or bits. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is 0x10.

Message Instances

The controller or the host controller sends read/write/multi-write request data frames to the AC drive. The AC drive sends normal response data frames when the command is processed correctly, and abnormal response data frames when errors occur.

<table>
<tr><td colspan="2">Read operation</td></tr>
<tr><td>Master read command frame</td><td>

In theory, the host controller can read or write a maximum of 12 consecutive parameters. However, these parameters must be in the same group. Otherwise, a response error occurs.</td></tr>
<tr><td>Slave read response frame</td><td>
</td></tr>
<tr><td>Slave read response error frame</td><td>
</td></tr>
<tr><td colspan="2">Write operation</td></tr>
<tr><td>Master write command frame</td><td>
</td></tr>
<tr><td>Slave write response frame</td><td>
</td></tr>
<tr><td>Slave write response error frame</td><td>
</td></tr>
<tr><td colspan="2">Multi-write operation</td></tr>
<tr><td>Frame of multi-write command from the master</td><td>
</td></tr>
</table>

Frame of slave response to multi-write command	
Frame of multi-write error returned from the slave	

Field	Status
Command code (CMD)	0x03: Read the slave parameters 0x06: Write the slave parameters 0x10: Multi-write the slave parameters
Parameter Address	It is the internal parameter address of the AC drive, expressed in hexadecimal format. The parameters include functional parameters and non-functional parameters (running status and running command). Low-order bytes follow high-order bytes during transmission.
Number of parameters	Number of parameters read in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission. This field is unavailable because this protocol allows only one parameter to be modified at a time.
Number of data bytes	Data length, which is twice the number of parameters
Parameter	Response data or data to be written. Low-order bytes follow high-order bytes during transmission.

6.10.4.2 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 853*.

6.10.4.3 Mapping table (AC drive)

For details, see *"6.5.3 Mapping Table" on page 854*.

6.10.5 Communication Terminals

The MD630N-INT supports Modbus TCP protocol. It adopts J9 (terminal mark IN) and J5 (terminal mark OUT) interfaces to communicate, such as the RJ45 directly facing the MD630N-INT. The two RJ45 interfaces are equivalent, regardless of direction.

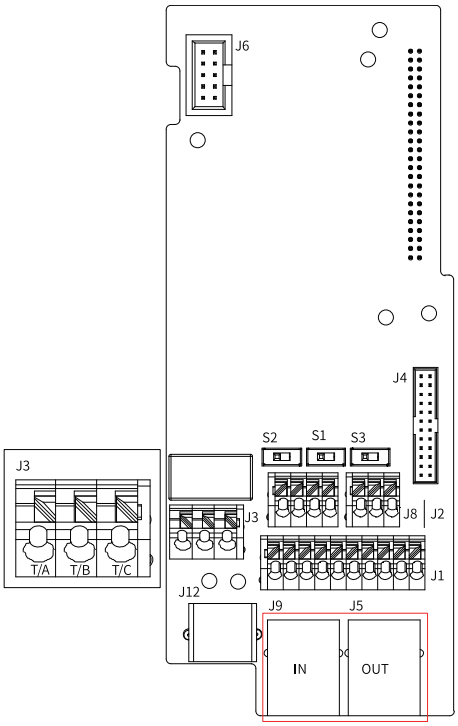


Table 6–36 Modbus TCP communication terminals

External Terminal	Type	Transmission Information Type	Terminal Mark	Name	Function
J9	RJ45 terminal	100M bus	IN	100 M bus cascaded terminal	ECAT/EIP/PN/ModbusTCP communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, the IN terminal is used. Direction is not distinguished for EIP/PN/ModbusTCP.
J5	RJ45 terminal	100M bus	OUT	100 M bus cascaded terminal	ECAT/EIP/PN/ModbusTCP communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, the IN terminal is used. Direction is not distinguished for EIP/PN/ModbusTCP.

6.10.6 Connect AC Drive to Bus System Through Ethernet Port

Modbus TCP adopts standard RJ45 interface. The cable should meet the TIA/EIA-568-B standard of Category 5 and above twisted pair with metal shield. The shield should be grounded properly, and the maximum cable length between the two devices is 100 meters.

Connecting steps:

1. Turn on system power supply.
2. Refer to the communication network topology in *“6.10.3 Communication System Connections” on page 1004* and connect the network cable to the terminal of the network port with a metal shield, as shown in *“Figure 6-59 Modbus TCP communication connection” on page 1009*. For communication interface specifications, see *“6.10.5 Communication Terminals” on page 1007*.

Note

For Modbus TCP communication, the IN and OUT communication port are direction-insensitive.

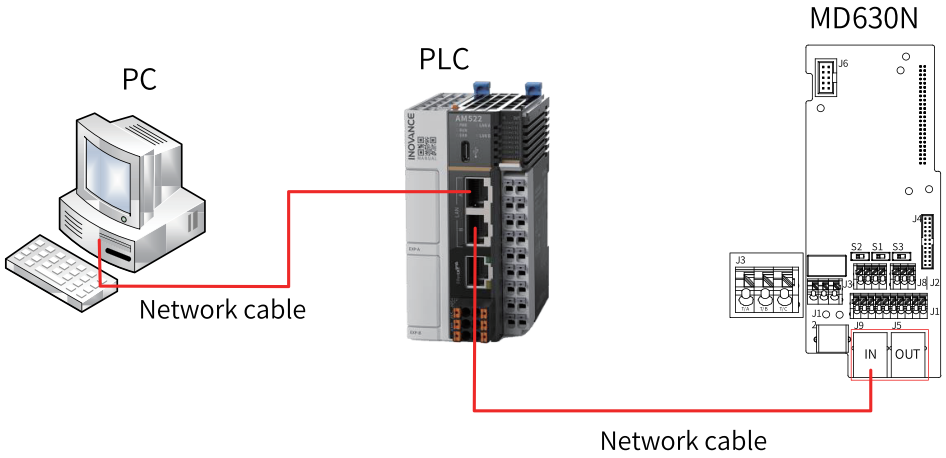


Figure 6-59 Modbus TCP communication connection

3. Set parameter n0-10 to 4.
4. Configure the IP address of n2-51 to n2-54, the subnet mask of n2-55 to n2-58, and the gateway address of n2-59 to n2-62.
5. Power on the device again.

6.10.7 Configure Communication Between AC Drive and Controller

When Modbus TCP communication is used, the controller must support the Modbus TCP protocol.

Modbus TCP communication requires the following basic operations on the AC drive:

1. Make sure that the wiring is correct as in *"6.10.6 Connect AC Drive to Bus System Through Ethernet Port" on page 1008*.
2. Switch the device communication mode to Modbus TCP communication (n0-10 = 4), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for channel 1 (b0-03 = 0, b5--00 = 9). (You can operate through the operating panel or the software.)
3. Wait for a few seconds until LED 0 (green) and LED 1 (yellow) to be on. This indicates that the Ethernet link is established successfully.
4. Configure the communication between the master station (controller) and the slave station (AC drive). For details, see *"6.10.10.1 Configuration for Modbus TCP Communication Between AC Drive and H3U" on page 1013*.

6.10.8 Communication Parameters

Param.	Name	Default	Value Range	Change Mode	Description
n2-51	Most significant byte of Modbus TCP IP address	0	0 to 255	Change at stop	Defines the most significant byte of the IP address. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-52	Second most significant byte of Modbus TCP IP address	0	0 to 255	Change at stop	Defines the second most significant byte of the IP address. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-53	Third byte of Modbus TCP IP address	0	0 to 255	Change at stop	Defines the third byte of the IP address. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-54	Least significant byte of Modbus TCP IP address	0	0 to 255	Change at stop	Defines the least significant byte of the IP address. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-55	Most significant byte of Modbus TCP subnet mask	0	0 to 255	Change at stop	Defines the most significant byte of subnet mask. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-56	Second most significant byte of Modbus TCP subnet mask	0	0 to 255	Change at stop	Defines the second most significant byte of subnet mask. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-57	Third byte of Modbus TCP subnet mask	0	0 to 255	Change at stop	Defines the third byte of the subnet mask. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-58	Least significant byte of Modbus TCP subnet mask	0	0 to 255	Change at stop	Defines the least significant byte of subnet mask. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.

Param.	Name	Default	Value Range	Change Mode	Description
n2-59	Most significant byte of Modbus TCP gateway	0	0 to 255	Change at stop	Defines the most significant byte of the gateway. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-60	Second most significant byte of Modbus TCP gateway	0	0 to 255	Change at stop	Defines the second most significant byte of gateway. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-61	Third byte of Modbus TCP gateway	0	0 to 255	Change at stop	Defines the third byte of the gateway. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-62	Least significant byte of Modbus TCP gateway	0	0 to 255	Change at stop	Defines the least significant byte of gateway. Note: The setting range is 0–255. The actual setting is based on the actual scenario. After modifying the parameters, the device needs to be restarted for the changes to take effect.
n2-69	Modbus TCP communication timeout	0.0	0.0 to 6000.0	Real-time change	Sets Modbus TCP timeout time. **Note:** 1 .When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set this parameter to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. 2 .If this parameter is set to a valid value and the communication interval between the current communication and the next communication exceeds the value of n2-69, the system reports a communication fault. 3 .After modifying the parameters, the device needs to be restarted for the changes to take effect.

6.10.9 Communication Fault Diagnosis

Fault Code	Fault Name	Cause	Check Method	Solution
E169.1	Ethernet communication timeout	The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. If the voltage is still unstable after preceding measures are taken, replace the power supply.
		A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Use the ifconfig command to check whether the network bandwidth meets the requirement or use the Wireshark to capture and analyze whether data is missing.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth. 3. Contact Inovance for technical support.
		The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.
E169.2	Ethernet hardware error	The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

Fault Code	Fault Name	Cause	Check Method	Solution
E169.3	The MAC address is not programmed.	MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support personnel.
E169.4	IP addresses conflict	IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

6.10.10 Communication Configuration Examples

6.10.10.1 Configuration for Modbus TCP Communication Between AC Drive and H3U

Prerequisite

1. Log in to Inovance website ***https://www.inovance.com/portal/serviceSupport/download*** and download the AutoShop PLC programming software.
2. Equipments: the AC drive, H3U PLC, and cables.
3. Ensure that the controller and the AC drive are connected correctly (H3U as Modbus TCP master and MD630N-INT as Modbus slave). Using a standard network cable, connect the network port of the H3U to the network port 1 or 2 of the AC drive. For details, see *"6.10.6 Connect AC Drive to Bus System Through Ethernet Port" on page 1008*.

Configuration steps

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   - 0: Frequency (UInt16)
   - 1: Frequency (Int16)
   - 2: Speed (Int16)
   - 3: Percentage (corresponds to rated frequency/Int16/2 decimal places)
   - 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.

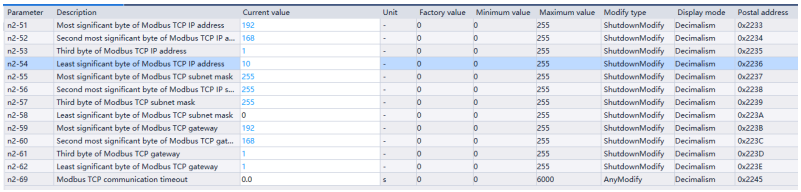
- 0: Frequency (UInt16)
- 1: Frequency (Int16)
- 2: Speed (Int16)
- 3: Percentage (corresponds to rated frequency/Int16/2 decimal places)
- 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

Step 3: Establish Modbus TCP communication connection

1. Set n0-10=4, and select Modbus TCP as the communication type.

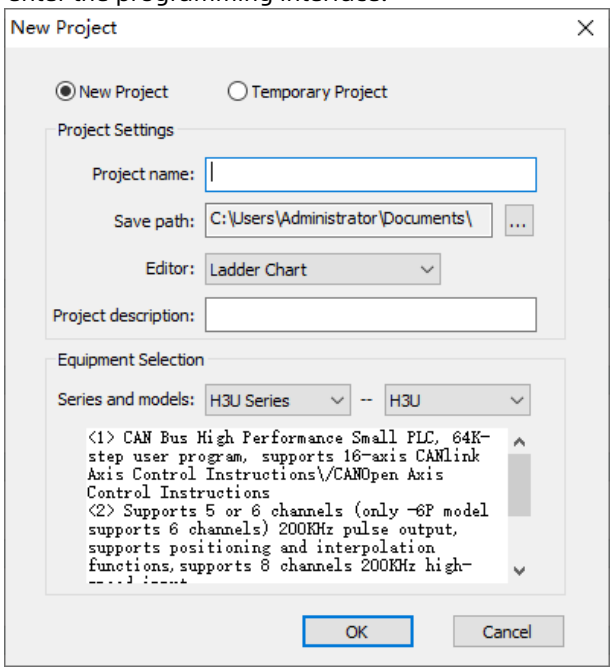


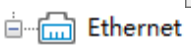
2. Set n2-51 to n2-62 and IP-related address. After the setting is complete, power MD630N-INT on again.



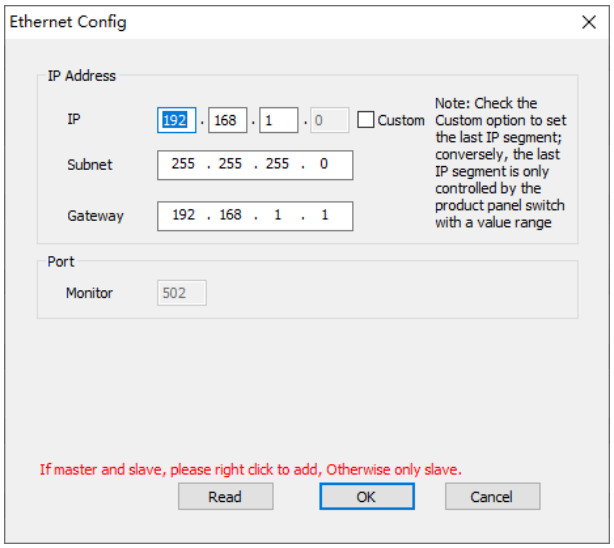
Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
n2-51	Most significant byte of Modbus TCP IP address	192	-	0	0	255	ShutdownModify	Decimalism	0x2233
n2-52	Second most significant byte of Modbus TCP IP a...	168	-	0	0	255	ShutdownModify	Decimalism	0x2234
n2-53	Third byte of Modbus TCP IP address	1	-	0	0	255	ShutdownModify	Decimalism	0x2235
n2-54	Least significant byte of Modbus TCP IP address	10	-	0	0	255	ShutdownModify	Decimalism	0x2236
n2-55	Most significant byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2237
n2-56	Second most significant byte of Modbus TCP IP s...	255	-	0	0	255	ShutdownModify	Decimalism	0x2238
n2-57	Third byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2239
n2-58	Least significant byte of Modbus TCP subnet mask	0	-	0	0	255	ShutdownModify	Decimalism	0x223A
n2-59	Most significant byte of Modbus TCP gateway	192	-	0	0	255	ShutdownModify	Decimalism	0x223B
n2-60	Second most significant byte of Modbus TCP gat...	168	-	0	0	255	ShutdownModify	Decimalism	0x223C
n2-61	Third byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223D
n2-62	Least significant byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223E
n2-69	Modbus TCP communication timeout	0.0	s	0	0	6000	AnyModify	Decimalism	0x2245

3. Open the PLC programming software AutoShop, click **New Project**, check that **Series and models** is **H3U**, and click **OK** to enter the programming interface.

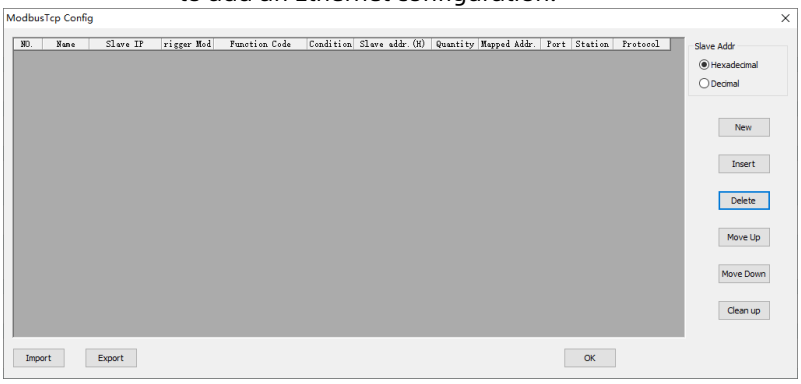


4. Click 

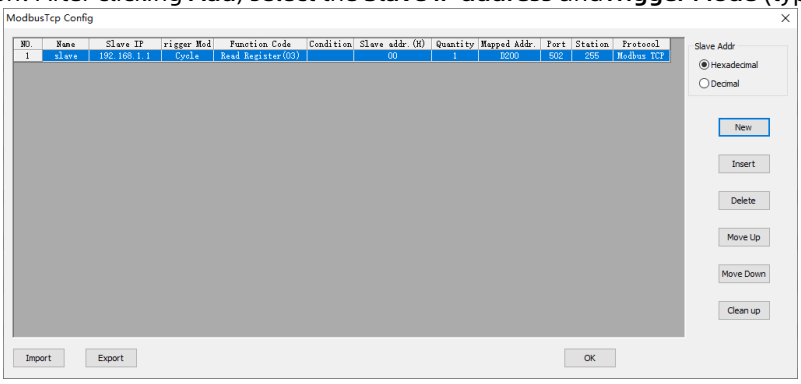
on the left side of the window to enter the Ethernet interface of the PLC. Note that the IP needs to be set to the same network segment as MD630N-INT.



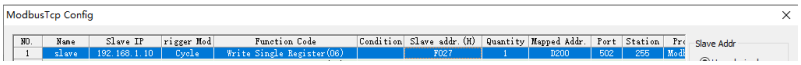
5. Right-click Ethernet to add an Ethernet configuration.



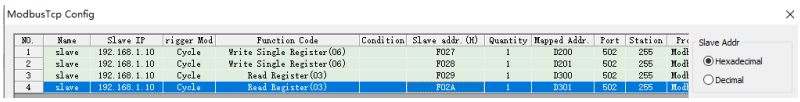
6. Write operation: After clicking **Add**, select the **Slave IP address** and**Trigger Mode** (typically **Cycle**).



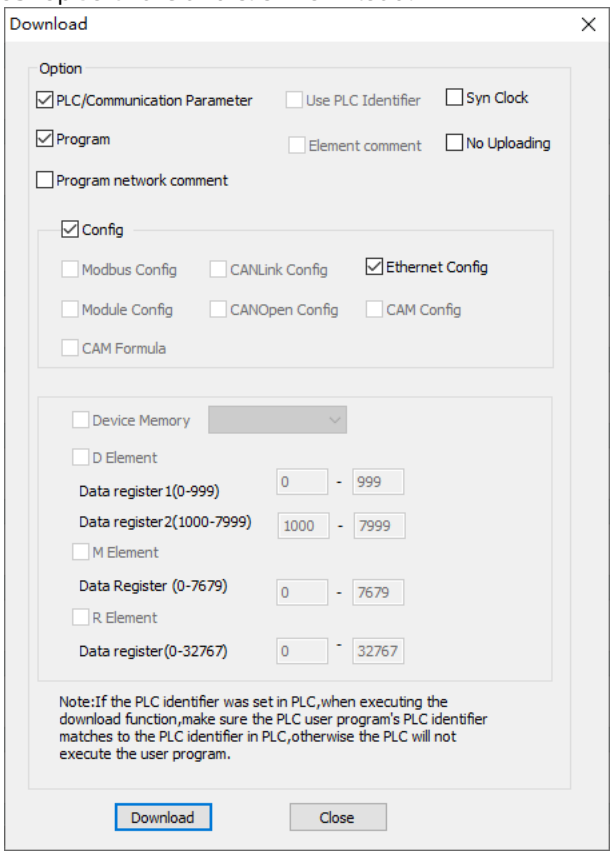
As shown in the figure, take writing the multi-reference value 0 as the example. The slave IP is 192.16.1.10. Set communication Mode to **Cycle** and Function Code to **Write single register (06)**. Set the **Quantity** to 1, otherwise the write operation may fail. The register address of the multi-reference value 0 in the AC drive is 0xF027.



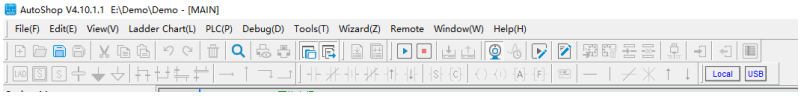
7. Read operation: After clicking **Add**, select the **Slave IP address** and **Trigger Mode** (typically **Cycle**). As shown in the preceding figure, take reading the multi-reference value 2 and 3 as the example. The slave IP is 192.16.1.10. Set **communication Mode** to **Cycle** and **Function Code** to **Read Register**; otherwise, the read operation will fail. Set **Quantity** to **1**, indicating only read a register. The register address of multi-reference 2 and 3 are 0xF029 and 0xF02A.



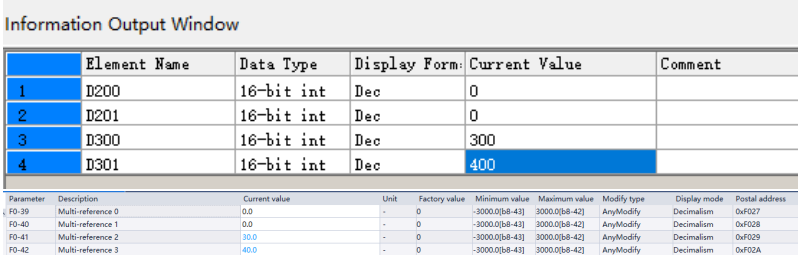
8. After the read and write operation settings, click **OK** to return to the programming interface.
9. Select "PLC" in the AutoShop software and click Download.



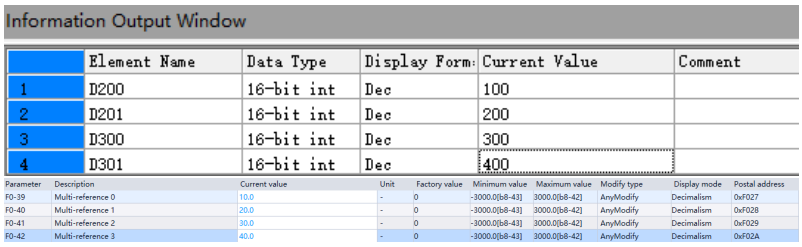
10. Click the monitor icon in the AutoShop software, and then the component monitoring interface appears in the “Information Output Window”.



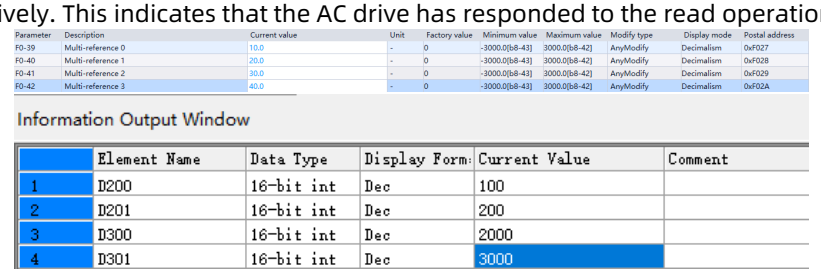
11. Fill the component monitoring interface with the mapped address of each register in step 5. The background software of the AC drive reveals that the multi-reference values 0, 1, 2, and 3 are all 0, which is consistent with the values of the mapped address in the PLC.



12. In the background software of the PLC, change the current value of D200 to 100, and the current value of D201 to 200. Then in the software of the AC drive, the multi-reference value 0 and 1 are written to 10.0 and 20.0 respectively (the parameter takes a value with one decimal place), indicating that the PLC write request has been received correctly.

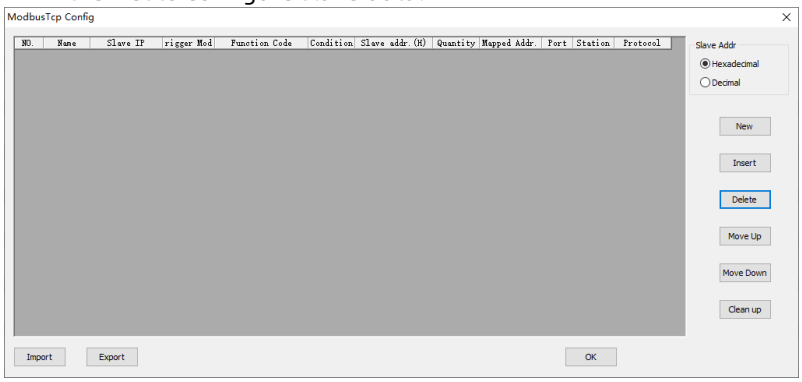


13. In the background of the AC drive, change the multi-reference values 2 and 3 to 200 and 300 respectively. In the background of the PLC, you can see that D300 and D301 change to 2000 and 3000 respectively. This indicates that the AC drive has responded to the read operation of the PLC.

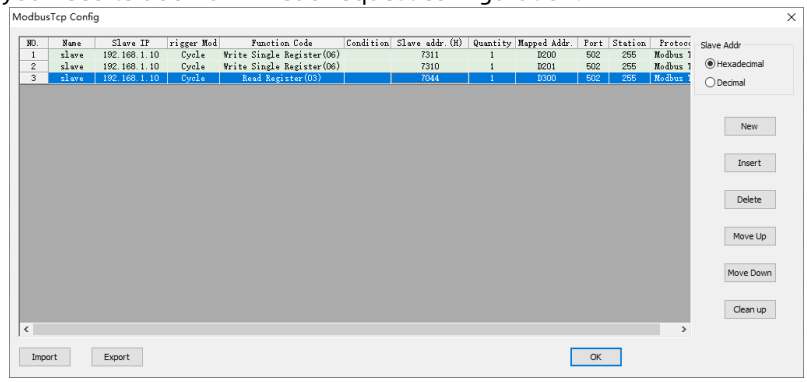


Step 4: Control AC drive through communication

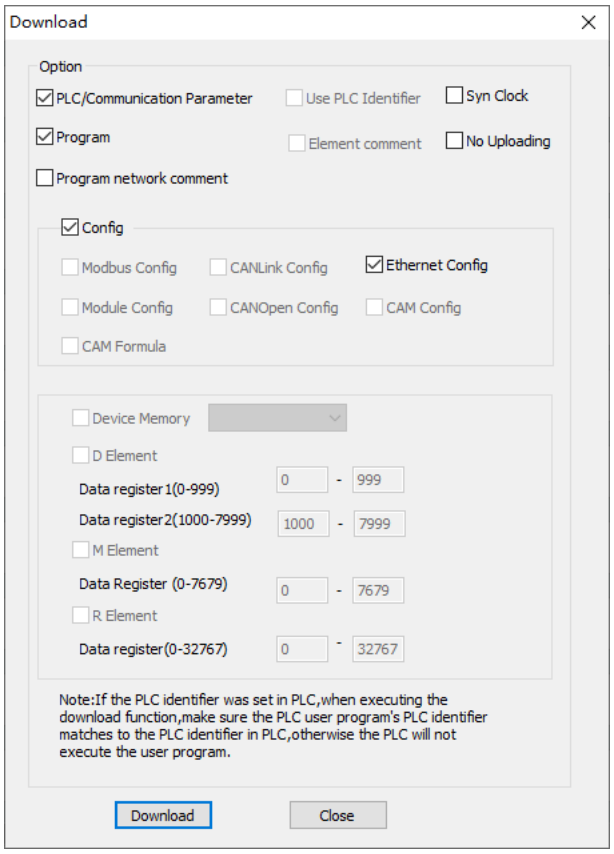
1. Right-click New in Ethernet to configure slave data.



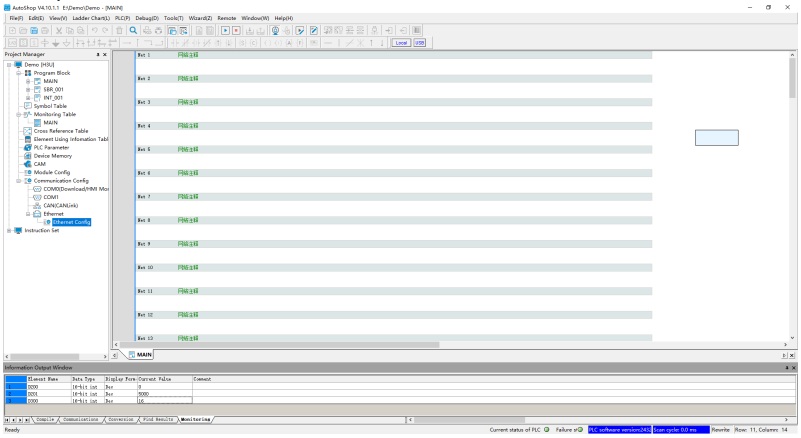
2. Select 192.16.1.10 for slave station IP and **Cycle** for Trigger Mode For start/stop control and setting frequency or torque using Modbus TCP communication, read and write specific communication addresses of the AC drive. For start/stop control and setting frequency or torque, write request of addresses 7311H and 7310H need to be configured. In order to know the operating state of the AC drive in time, you need to add 7044H read request configuration.



3. Select "PLC" in the AutoShop software and click Download.



4. Click the monitoring icon and set the values of the control instructions in the Information Output Window, that is, add D200, D201, D300. These three registers correspond to the values of 7311H, 7310H, and 7044H parameter addresses. Observe the feedback value of D300 as set below.



Description of the communication address: The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description of the communication address
AC drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit00: Running state 0: Stop 1: Run bit01: Run direction 0: Forward 1: Reverse bit02: Fault status 0: No Fault 1: Fault bit 03: Frequency reached 0: Not reached 1: Reached bit04: Reserved bit05 to bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

7 Troubleshooting

7.1 Troubleshooting Procedure

The following table demonstrates the specific procedure for troubleshooting.

No.	Description
Step 1	Check the following items before troubleshooting: a. Input and output state b. Device actions (such as stop, operation, and vibration) c. Parameters d. Wiring state e. DIP switch state
Step 2	Check the operating panel or the iFA Drive software to see if an issue is reported. See *"7.7 Common Fault Troubleshooting" on page 1035* and *"7.9 Fault Code List" on page 1067* to solve the issue.
Step 3	See *"7.5 Fault Reset" on page 1030* to reset the issue. If the reset fails, restart the power supply module.
Step 4	If the issue persists, contact the technical support.

7.2 Fault Type and Level

7.2.1 Fault Types

The AC drive enters an abnormal state when it reaches certain limits. The faults of the MD630 series AC drive can be divided into four categories, ranked from most severe to least severe: Fault (E) > Light fault (L) > Alarm (A) > Prompt (or notification) (N). The following table introduces these types.

Issue Type	Display Format	Description
Fault (E)	Example: E015.1	1 .Meaning: The system is faulty and fails to keep operating. 2 .Manifestation:The AC drive immediately stops operating. 3 .Solution: a. Troubleshoot the fault. b. Reset the fault. c. If the fault persists, contact the technical support.
Light fault (L)	Example: L015.1	1 .Meaning: The system encounters a light fault but can continue to operate after derating. However, the operating results may deviate from the settings. 2 .Manifestation:Speed-limited operation, power-limited operation, current-limited operation, and torque-limited operation. 3 .Solution: a. Troubleshoot the light fault. A light fault can be automatically reset, with no need to reset manually. b. If the light fault persists, contact the technical support.
Alarm (A)	Example: A015.1	1 .Meaning: A minor abnormality occurs, which does not affect the AC drive operation. The user can configure the output terminal to signal an alarm. 2 .Manifestation:An alarm does not affect the operation state. The user can determine the solution. 3 .Solution: a. Troubleshoot the alarm. An alarm can be automatically reset, with no need to reset manually. b. If the alarm persists, contact the technical support.
Prompt (N)	Example: N015.1	1 .Meaning: A minor issue occurs, which does not affect the operation of the AC drive and is only prompted on the operating panel or commissioning software. The user can not configure the output terminal to signal a notification [Note 1]. 2 .Manifestation:A notification does not affect the operation state. The user can determine the solution. 3 .Solution: a. Troubleshoot the notification. A notification can be automatically reset, with no need to reset manually. b. If the notification persists, contact the technical support.

Note

[Note 1] The output terminal signal of a issue can be configured by E1-04 (DO1 output function selection):

- E1-04 = 2 (output upon a fault): When the AC drive stops due to a fault (coast-to-stop, maximum-capability stop, quick stop, or decelerate-to-stop), the terminal outputs an active signal.
- E1-04 = 38 (output upon a fault/light fault/alarm): When the AC drive encounters a fault, a light fault, or an alarm, the terminal outputs an active signal.
- E1-04 = 41 (output upon an issue excluding undervoltage): When the AC drive encounters a fault, a light fault, or an alarm (excluding undervoltage), the terminal outputs an active signal.
- E1-04 = 43 (output upon a light fault/alarm): When the AC drive encounters a light fault or an alarm, the terminal outputs an active signal.

7.2.2 Fault Level Description

There are 11 fault levels of the MD630-INT series AC drive, so that the AC drives can react differently when a fault occurs.

Ranked from most severe to least severe, the fault levels can be divided into: coast-to-stop > maximum-capacity stop > quick stop > decelerate-to-stop > limited operation (with limited speed, power, current, and torque) > alarm > notification > ignorable fault. For details, see the following table.

Fault level	Description
Coast to stop	After a fault occurs, the AC drive stops output and the load coasts to stop due to its inertia.
Maximum-capacity stop	After a fault occurs, the AC drive outputs at maximum capacity to stop the load in the shortest time. The fixed deceleration time for maximum-capacity stop is 50 ms.
Quick stop	After the fault occurs, the AC drive stops according to the quick stop deceleration time set by b7-34.
Decelerate-to-stop	After a fault occurs, the AC drive stops according to the specified deceleration time. The optional parameters involved are as follows (depending on the deceleration time selected by the user): b7-05 (Ramp 1 deceleration time) b7-11 (Ramp 2 deceleration time) b7-17 (Ramp 3 deceleration time) b7-23 (Ramp 4 deceleration time)
Run with speed restriction	After a fault occurs, the AC drive keeps running according to H1-60 (speed-limit running mode) and the following associated parameters: H1-61 (designated safety frequency) H1-62 (maximum forward frequency limit) H1-63 (maximum reverse frequency limit)
Run with power restriction	After a fault occurs, the AC drive keeps running with a power not exceeding H1-64 (maximum motoring power limit) and H1-65 (maximum regenerative power limit).
Run with current restriction	After a fault occurs, the AC drive keeps running with a current not exceeding H1-68 (maximum current limit).
Run with torque restriction	After a fault occurs, the AC drive keeps operating with a torque not exceeding H1-66 (maximum forward torque limit) and H1-67 (maximum forward torque limit).
Alarm	After a fault occurs, the AC drive displays the alarm code, which has no effect on running.

Fault level	Description
Notification	After a fault occurs, the AC drive displays the notification code, which has no effect on running.
Ignorable fault	A fault that is ignored by the AC drive.

Caution

- When an ignorable issue occurs, no prompts will be displayed. Therefore, this setting should be used with caution.
- The user can modify the issue level and the corresponding action based on actual needs to achieve the desired state of the AC drive after an issue occurs. For details, see *"7.2.4 Issue Level Modification" on page 1024*. Not all issues support every issue level. The AC drive will automatically determine whether the configured issue level is valid.

7.2.3 Correspondence Between Fault Types and Levels

The following table describes the correspondence between fault types and levels (actions).

Table 7–1 Correspondence between fault types and levels

Issue Type	Issue Level
Fault	Coast-to-stop
	Maximum-capability stop
	Quick stop
	Decelerate-to-stop
Light fault	Operation with limited speed
	Operation with limited power
	Operation with limited current
	Operation with limited torque
Alarm	Alarm
Prompt	Notification
-	Ignorable issue

7.2.4 Issue Level Modification

Scenarios

The user can modify the issue level and the corresponding action based on actual needs to achieve the desired state of the AC drive after an issue occurs.

- To make the AC drive stop when an issue occurs, the issue action can be set to coast-to-stop, maximum-capability stop, quick stop, or decelerate-to-stop.
- To make the AC drive operate in limited mode when an issue occurs, the issue action can be set to operation with limited speed, power, current, or torque.
- To make the AC drive keep operating when an issue occurs, the issue action can be set to alarm, notification, or ignorable issue.

Modification method

The user can modify the issue level of the issue code or subcode.

1. Modifying the level of the issue code

Parameters H1-00 (issue protection action selection 0) to H1-18 (issue protection action selection 18) can be used to uniformly set all issue levels under a specified issue code. With this method, however, all issue levels under an issue code can only be set the same.

Take the fault code E021 as an example. The user can modify the hundreds place of parameter H1-03 (see the following table) to set all fault levels of code E021.X. Note that this method can only set the fault levels under E021 to the same. It is not allowed to set the fault levels of certain codes (such as E021.1) to coast-to-stop and others (such as E021.2) to decelerate-to-stop.

Parameter	Parameter Name	Default Value	Value Range
H1-03	Issue protection action selection 3	0	Ones place: Parameter auto-tuning fault (E019) 0: Coast-to-stop Tens place: Reserved 0: Coast-to-stop Hundreds place: EEPROM fault (E021) 0: Coast-to-stop 1: Maximum-capability stop 2: Quick stop 3: Decelerate-to-stop Thousands place: Power unit EEPROM fault (E186) 0: Coast-to-stop 1: Maximum-capability stop 2: Quick stop 3: Decelerate-to-stop F: Not detected

2. Modifying the level of the issue subcode

Parameters H1-30 (setting of issue codes in group 1) to H1-49 (setting of issue level in group 10) can be used to set the issue level of a specified issue subcode.

For example, parameters H1-30 (setting of issue codes in group 1) and H1-31 (setting of issue level in group 1) can be used to set the fault level of E021.1 to 0 (coast-to-stop). Parameters H1-32 (setting of issue codes in group 2) and H1-33 (setting of issue level in group 2) can be used to set the fault level of E021.2 to 2 (quick stop). The corresponding parameters are as follows:

- H1-30 = 21.1
- H1-31 = 0 (coast-to-stop)
- H1-32 = 21.2
- H1-33 = 2 (quick stop)

Note:

- When modifying the issue level of a specified issue subcode, the setting range must be within the issue levels of the corresponding issue code.

For example, the hundreds place (E021: EEPROM fault) of parameter H1-03 can only be set to 0 (coast-to-stop), 1 (maximum-capability stop), 2 (quick stop), or 3 (decelerate-to-stop). Therefore, the fault level of any fault subcode under E021 can only be set to 0, 1, 2, or 3. Other levels (such as 9: operation with limited speed) cannot be set.

- The issue level of a specified subcode set by H1-30 to H1-49 prevails over that under a code set by H1-00 to H1-18 when there is an inconsistency between the two (provided that the former issue level is within the levels of the corresponding issue code), as shown below.

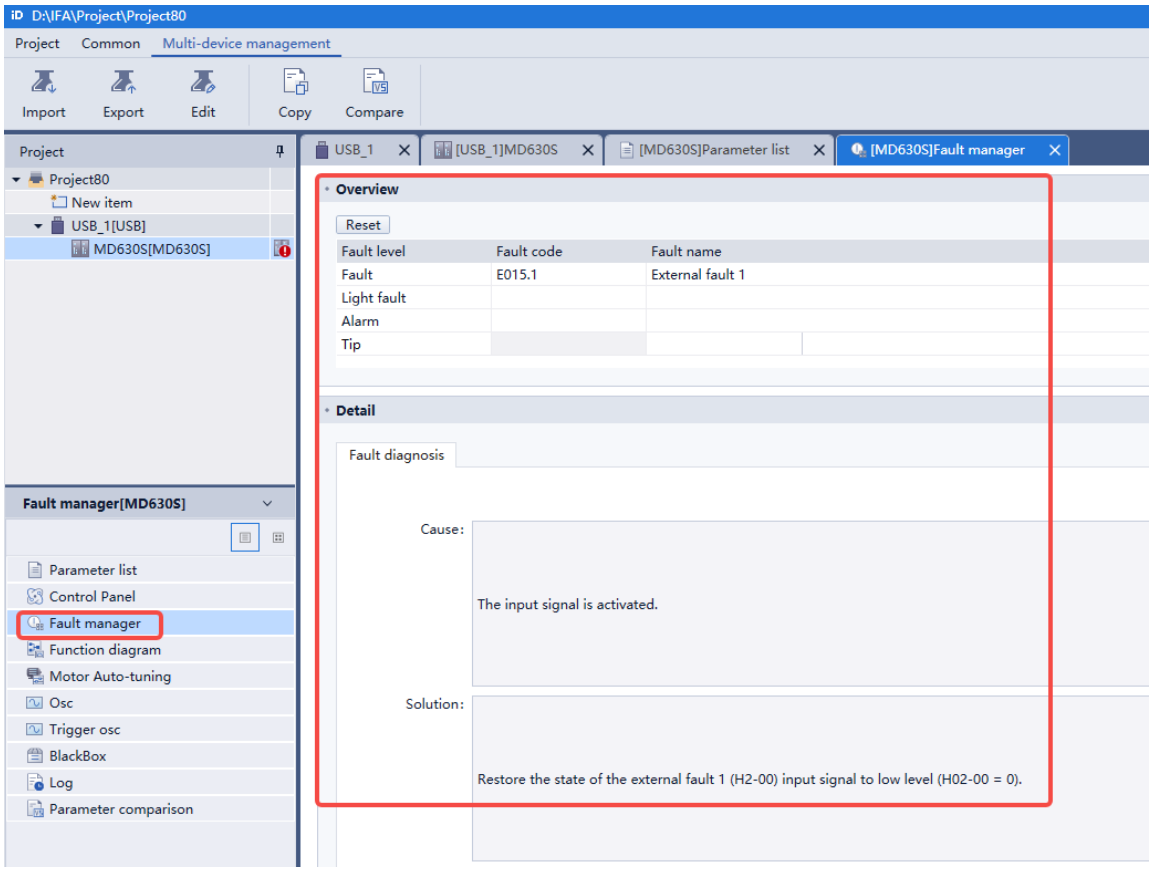
Modifying the Level of the Issue Code	Modifying the Level of the Issue Subcode	Issue Level
The hundreds place of H1-03 (E021: EEPROM fault) is set to 0 (coast-to-stop).	H1-30 = 021.1 H1-31 = 2 (quick stop) Note: 2 (quick stop) is within the range of the fault level (0 to 3) of the hundreds place of H1-03.	The fault level of E021.1 is 2 (quick stop). The fault levels of the other fault subcodes under E021 is 0 (coast-to-stop).
	H1-30 = 021.1 H1-31 = 9 (operation with limited speed) Note: 9 (operation with limited speed) is not within the range of the fault level (0 to 3) of the hundreds place of H1-03.	The fault levels of E021.1 and the other fault subcodes under E021 are all 0 (coast-to-stop).

7.3 Fault Display

When the AC drive is in an abnormal state, the fault protection action is performed according to the fault level set in group H1. In the meanwhile, the operating panel displays the corresponding fault code. When a fault occurs, the AC drive cuts off the output. The contact of the fault replay acts (provided that the relay contact function is selected as the default fault output). The fault indicator ⚠ on the operating panel is on. As shown in the following figure, E015.1 (external fault 1) is displayed.



The fault code can also be displayed on the iFA Drive commissioning software, as shown in the following figure.

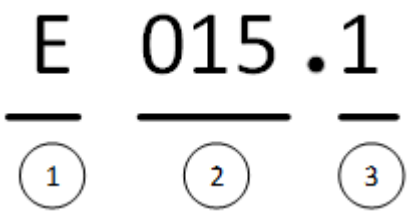


Display logic

1. When multiple faults occur, the operating panel displays the fault occurred first. When this fault is reset, the panel displays the fault occurred first among the remaining faults.
2. When multiple types of faults occur simultaneously, the operating panel displays the fault with the highest severity. For example, when faults and alarms occur simultaneously, the panel only displays the fault code. Only when all faults are reset will the panel displays the alarm code.

Display format

An fault code is displayed in three segments, representing fault type, fault code, and fault subcode, as shown in the following figure.



① indicates the fault type. "E" for a fault, "L" for a light fault, "A" for an alarm, and "N" for a notification.

② indicates the fault code with three digits.

③ indicates the fault subcode with one digit. Each fault code supports a maximum of nine subcodes (1 to 9).

7.4 Fault Record Query and Clearance

Faults are divided into current ones and historical ones.

- Current faults refer to those that have occurred but have not been solved.
- Historical faults refer to those that have occurred and have been solved.

Current fault record query

The MD630-INT series AC drive can record up to six current faults of the same type (fault, warning, minor fault, and prompt). When more than six faults occur simultaneously, only the earliest six faults will be recorded.

There are two methods to query the current fault record: through the A1 group parameters and through the operation panel.

- Method 1: Querying the current faults through group A1 parameters

Table 7–2 Parameters related to the current fault information

Fault type		Parameter of fault code	Parameter of additional information
Fault	Current fault 1	A1-00	A1-01
	Current fault 2	A1-02	A1-03
	Current fault 3	A1-04	A1-05
	Current fault 4	A1-06	A1-07
	Current fault 5	A1-08	A1-09
	Current fault 6	A1-10	A1-11
Minor fault	Current minor fault 1	A1-12	A1-13
	Current minor fault 2	A1-14	A1-15
	Current minor fault 3	A1-16	A1-17
	Current minor fault 4	A1-18	A1-19
	Current minor fault 5	A1-20	A1-21
	Current minor fault 6	A1-22	A1-23
Warning	Current waring 1	A1-24	A1-25
	Current waring 2	A1-26	A1-27
	Current waring 3	A1-28	A1-29
	Current waring 4	A1-30	A1-31
	Current waring 5	A1-32	A1-33
	Current waring 6	A1-34	A1-35
Prompt	Current prompt 1	A1-36	A1-37
	Current prompt 2	A1-38	A1-39
	Current prompt 3	A1-40	A1-41
	Current prompt 4	A1-42	A1-43
	Current prompt 5	A1-44	A1-45
	Current prompt 6	A1-46	A1-47

- Method 2: In the fault menu on the operating panel, press or to view the current fault. The operation diagram is shown in the following figure.

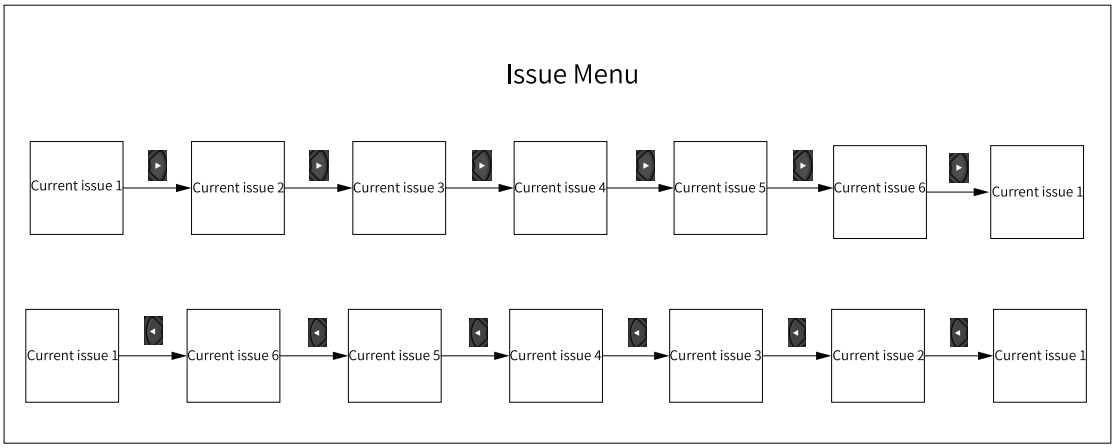


Figure 7-1 Viewing the current fault

Historical fault record query

The MD630-INT drive supports viewing six historical fault records and information about the drive when a fault occurs. When there are more than six historical faults, only the latest six faults are recorded. You can query the historical fault record through the parameters in group H6 (historical fault record 1) and group Hb (historical fault record 6), as shown in the following table.

Table 7–3 Parameters related to historical faults

Parameter group	Parameter name	Remarks
H6	Historical fault record 1	Record the code and related information of the historical fault 1.
H7	Historical fault record 2	Record the code and related information of the historical fault 2.
H8	Historical fault record 3	Record the code and related information of the historical fault 3.
H9	Historical fault record 4	Record the code and related information of the historical fault 4.
HA	Historical fault record 5	Record the code and related information of the historical fault 5.
Hb	Historical fault record 6	Record the code and related information of the historical fault 6.

Fault log clear

You can clear the historical fault information of the H6 to Hb by setting parameter A0-00 (parameter initialization). Set A0-00 to 2, 5 or 503 to clear historical fault information. The differences are as follows:

- A0-00=2 (Clear records): Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared.
- A0-00=5 (Clear fault information): Fault record information of H6 to Hb are cleared.
- A0-00=503 (Restore parameters including motor parameters to factory settings and clear records): Except for specific parameters that are not allowed to be restored, other drive function

parameters, including motor parameters and recorded information, are restored to factory settings.

Note

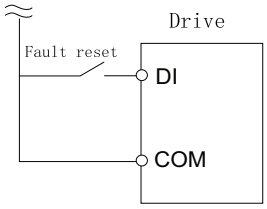
With the above-mentioned methods, the records of the current and historical issues can be cleared.

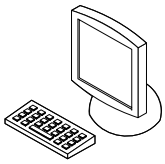
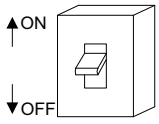
7.5 Fault Reset

After troubleshooting, it is necessary to reset the fault to make the AC drive exit the abnormal state. The reset solutions can be divided as follows:

- When a light fault, alarm, or notification occurs, the AC drive automatically resets the fault after troubleshooting, with no need to reset manually.
- When a fault occurs, the faulty state remains after troubleshooting. A manual reset operation is required; that is, an external reset command must be given to the AC drive to clear the fault.
- Some special faults must be reset by powering off and on the AC drive after troubleshooting.

All fault codes can be reset manually. The following table describes the manual reset methods.

No.	Manual Reset Method	Description	Applicable Scenario
1	Reset through the operating panel	In the stop state, click the STOP key to reset the fault. 	This method is applicable to scenarios where it is readily available to directly touch the operating panel.
2	Reset through terminals	Set the function of any DI terminal to 9 (fault reset). In this way, the faults can be reset when an active signal is sent to the DI terminal. 	This method is applicable to scenarios where terminals are used for multi-speed control.

No.	Manual Reset Method	Description	Applicable Scenario
3	Reset through communication	When the main command source (set by F0-03/b1-00 for channel 1, b3-00 for channel 2) is set to 2 (communication), the faults can be reset by writing a reset command to the communication control word address from the host controller. Take the Modbus-RTU communication as an example, the user can write 7 (fault reset command) to 7311H to reset faults. 	This method is applicable to scenarios where the AC drive is difficult to access and is located far from the host controller.
4	Reset through custom signals	For the current control channels, the corresponding custom fault reset source 1 (set by b1-05 and b3-05), source 2 (set by b2-04 and b4-04), and source 3 (set by b2-05 and b4-05) can be set to enable custom reset signals. The faults can be reset by applying the custom reset signal. The custom fault reset source 1 is valid only when the main command source (set by F0-03/b1-00 for channel 1 and b3-00 for channel 2) is set to 3 (custom).	This method is applicable to scenarios where the reset signal source can be flexibly configured as a custom signal source.
5	Reset through iFA Drive commissioning software	Click the fault reset button on the fault management interface or the operating panel of the iFA Drive software to reset the faults.	This method is applicable to scenarios where the iFA Drive software is used for AC drive commissioning.
6	Reset through restarting the AC drive	Disconnect the main circuit power supply. Wait until the fault code on the operating panel disappears, and then connect the power supply again. 	This method is applicable to scenarios where the faults cannot be reset using the above-mentioned methods.

Caution

The manual reset command is effective only on the rising edge of the reset signal. Do not keep it at high level.

7.6 Automatic Fault Reset

In certain applications, a limited number of automatic fault resets can be set to ensure continuous application when a fault occurs.

Note

The fault code E009.1 has the independent automatic reset function.

The following fault codes require that the function code n0-16 is set to 1 to start the automatic reset function (default configuration is 1):

- Standard version E160.1, E161, E162, E164
- Bus version: E165, E166, E167; E168, E169, E197

The MD630-INT fault automatic reset function is disabled by default. To enable the automatic fault reset function, configure the following parameters. For other related parameters, see Table Automatic fault reset parameters.

- Set H3-00 (Automatic fault reset) to 1 (enable).
- Set H3-01 (Number of automatic fault resets). You can set the appropriate number according to the requirements.
- Set H3-02 (interval for automatic fault reset). This parameter is used to set the duration from the time when the drive reports a fault to the time when automatic fault reset is performed. You can set an appropriate time interval according to the actual requirements.

Most fault codes of MD630-INT drives can be configured for automatic reset, except in the following cases:

- Fault codes that cannot be configured for automatic reset are E032.8, E032.9, E047.5, E060.1, E177.1 and E177.2.
- You can configure ten faults that are inhibited from automatic fault reset through H3-13 (fault code 1 inhibited from automatic fault reset) to H3-22 (fault code 10 inhibited from automatic fault reset). These codes cannot be reset automatically even if the automatic fault reset function is enabled.

Related parameters

Table 7–4 Parameters related to automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-00	Automatic fault reset	1	0: Disable 1: Disable	This parameter sets whether to enable automatic fault reset. Value description 0: Automatic fault reset is disabled. 1: Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	This parameter sets the number of automatic fault resets. Remarks: If the number of reset times exceeds the value of this parameter, the AC drive remains in the faulty state.

Parameter code	Parameter name	Default value	Range	Description
H3-02	Time interval for automatic fault reset	1	0.1 to 600	This parameter sets the time interval for automatic fault reset. Remarks: This parameter sets the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.
H3-03	Automatic reset disabled when manual reset applies	1	0: Automatic reset terminated 1: Automatic reset continues	This parameter sets whether automatic reset can be terminated by manual reset during the automatic reset process. Value description 0: Automatic reset is terminated upon manual reset. 1: Automatic reset continues after manual reset.
H3-04	Time for restoring the number of automatic fault resets	10	0 to 6000	This parameter sets the time for restoring the number of automatic fault resets. Remarks: When it is not set to 0, the number of automatic fault reset times is restored after the time set by H3-04 elapses; when it is set to 0, the number of automatic fault reset times is restored all the time.
H3-05	Cumulative number of automatic fault resets	0	-	This parameter displays the cumulative number of automatic fault resets, which cannot be modified. When the number of manual resets and automatic resets are reached, the number will be cleared.
H3-06	Action when the number of automatic fault resets reaches	0	0: Number of automatic fault resets restored. 1: Number of automatic fault resets not restored.	This parameter sets whether to restore the number of automatic fault resets after the number is exhausted. Value description 0: When the number of automatic fault resets is exhausted and time for restoring the number of automatic fault resets reach, the number of automatic fault resets can be restored automatically. 1: When the number of automatic fault resets is exhausted, the number cannot be restored automatically.
H3-07	Fault output selection	0	0: No output during automatic fault reset 1: Output during automatic fault reset	This parameter sets whether there is output during automatic fault reset. Value description 0: No output during automatic fault reset 1: Output during automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-13	Fault code 1 inhibited from automatic fault reset	0	0 to 255.9	This parameter specifies the fault code 1 that is inhibited from automatic fault reset. Remarks: For example, after the main code and subcode of the fault, such as 187.1, is set, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-15	Fault code 3 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-16	Fault code 4 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-17	Fault code 5 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-18	Fault code 6 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-19	Fault code 7 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-20	Fault code 8 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-21	Fault code 9 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-22	Fault code 10 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13

7.7 Common Fault Troubleshooting

Table 7–5 Troubleshooting of common faults (function)

No.	Symptom	Possible cause	Check Method	Solution
1	There is no display upon power-on. 	The mains voltage is too low.	Measure the input power supply and check whether the voltage is lower than the undervoltage threshold of the AC drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		The control board or operating panel is faulty.	/	1. Replace the control board or operating panel. 2. Contact the agent or Inovance for technical support.
		The switching power supply on the drive board of the drive is faulty.	Measure the voltage values of the 24V and 10V output interfaces on the drive board to check whether the values reach 24 V and 10 V. Excessive deviation indicates abnormalities.	Ask for technical support.
		The pre-charge resistor of the drive is damaged.	/	Ask for technical support.
		The rectifier bridge is damaged.	Measure the DC bus voltage of the AC drive to see if it is below A3-56 (effective value for undervoltage). If so, the bridge is damaged.	Ask for technical support.
2	"-H-C" is displayed upon power-on. 	The output circuit of the drive is grounded or short-circuited.	Use a tramegger to measure the U/V/W voltage at the output of the drive. If the voltage is close to 0, short circuit occurs.	Replace the UVW cables at the output terminals and re-connect them.
		The mains voltage is too low.	Measure the input power supply and check whether the voltage is lower than the undervoltage threshold of the AC drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		Related components on the control board are damaged.	If the error is still reported after the above causes have been resolved, the device on the control board may be damaged.	Ask for technical support.

No.	Symptom	Possible cause	Check Method	Solution
3	"-sto" is displayed upon power-on. 	The STO input signal is disconnected.	Check whether the STO input switch is open.	Close the STO input switch.
		The wiring or power supply of the STO circuit is faulty.	Check whether the STO circuit wiring and power supply are normal.	Ensure that the STO circuit wiring and power supply are normal.
4	The display is normal upon power-on. However, after the drive starts to run, "-H-C-" is displayed and the drive stops immediately. 	The peripheral control terminal is short-circuited.	Measure the voltage of the external control terminal to determine whether short circuit occurs.	Reconnect the terminal that is shorted.
		The fan is damaged or shorted.	1 .Check whether the fan operates properly. 2 .Check whether the circuit voltage is close to 0. If yes, short circuit occurs.	1. Re-connect the cable. 2. Replace the damaged fan.
		The AC drive is damaged.	If the error is still reported after the above causes have been resolved, the AC drive may be damaged.	Ask for technical support.
5	The motor does not rotate after the AC drive runs.	The drive and the motor is wired incorrectly.	Check whether the drive and the motor is wired correctly.	Re-connect the drive and the motor according to the wiring diagram in the user guide.
		The motor control method or mode is set incorrectly.	Check whether motor control parameters are set correctly.	Set motor control parameters according to the operating conditions, such as F0-01 (motor control method) and F0-02 (motor control mode).
		Motor parameters of the AC drive are set incorrectly.	Check whether the rated motor parameters (C4-01 to C4-11) are consistent with those on the motor nameplate, such as the rated motor frequency and rated motor speed.	Set the motor rated parameters (C4-01 to C4-11) according to the motor nameplate.
		V/f control parameters are set incorrectly.	For startup at overload in the V/f control mode, check whether the drive can drive the motor. If not, the value of parameter d2-14 (manual torque boost) is too small.	Increase the value of d2-14 (manual torque boost) properly.
		The driver board is faulty.	If the parameters are set correctly and the wiring is proper, the drive board may be faulty.	Ask for technical support.

No.	Symptom	Possible cause	Check Method	Solution
6	The DI is inactive.	The related parameters are set incorrectly.	Check the terminal setting parameters (group E0) to verify whether the DI terminal setting is correct.	Reset parameters related to terminal settings (E0 group).
		External signals are incorrect.	Check whether the external signal wiring is correct.	Reconnect the external signal cable by referring to "*Connecting Control Cable" on page 97*.
		The control board is faulty.	If the parameters are set correctly and the external signal cable is connected properly, the control board may be faulty.	1. Replace the control board. 2. Contact the agent or Inovance for technical support.

Table 7–6 Troubleshooting of common faults (performance)

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
1	Issues on the input side	The input power factor on the grid side is low.	The absence of a line reactor and a DC reactor can result in high harmonic currents on the grid side, which in turn can cause a low power factor.	Check that the selected model matches the actual demand.	If a proper power factor is required on the network side, select a model with the reactor. If the model with the reactor is unavailable, an external input reactor is required. **Notes:** There is no obvious correlation between the rectification power factor and efficiency. Common diode rectifiers have low power factors but high efficiency.
		The input current measured by the clamp meter deviates greatly from the theoretical value.	The grid-side current harmonics are relatively large, and the current waveform is not a standard sine wave. Therefore, measuring the input current directly using a clamp meter will result in significant deviations.	Check whether the rectifier unit of the drive is AFE (active front end).	Measure the input current using an oscilloscope current clamp in RMS (root mean square) mode. Measure the input current using the current clamp of a power quality analyzer.
		The three-phase current on the grid side is unbal anced.	Unbalanced grid-side impedance can cause fluctuations at twice the grid frequency (that is, 100 Hz fluctuations for a 50Hz grid), resulting in unbalanced current.	Check whether the bus voltage fluctuates at 100 Hz and ensure that no phase loss occurs on the input side. The built-in DC input reactor may resonate with unbalanced grid impedance, resulting in grid harmonics at twice the grid frequency.	The power supply unit is designed with sufficient margin to accommodate unbalanced grid impedance. If the three-phase input current imbalance is within 10% of the driver's rated current, no action is required. To address three-phase input current imbalance, use a three-phase reactor on the input side or select models without DC input reactors.
			The rectifier diode is damaged.	Set the multimeter to the diode test mode. Connect the red probe to R/S/T and the black probe to the positive bus to measure the upper bridge. Connect the black probe to R/S/T and the red probe to the negative bus to measure the lower bridge. A consistent voltage drop of around 0.25 V to 0.6 V indicates that the rectifier diode is normal. A damaged diode typically features a voltage drop of 0 or infinite.	Contact Inovance for technical support.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
1	Issues on the input side	The input grid voltage is normal when the drive is stopped. However, when the drive operates under load, the output voltage is low, and both input and output currents are high.	1 .The grid is a weak grid. 2 .There is a reactor on the input side and the voltage drop across the reactor is significant.	During motor startup, check whether the bus voltage decreases significantly as the output power increases.	• Appropriately increase the overmodulation coefficient (A5-06) to a value not exceeding 108% to increase the output voltage and reduce the output current. • Select a reactor with moderate inductance. Excessive inductance results in voltage drop when input current rises, thereby influencing the input voltage. • Increase the grid voltage. For example, the user can adjust the transformer tap to increase the grid voltage by 5%. Most transformers are equipped with a tap that can slightly increase the grid voltage, but not all.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
2	Issues on the output side	The output voltage and output current fluctuate significantly.	1 .The filter levels for the output voltage and output current are inconsistent. 2 .The motor fluctuates.	1 .Compare the fluctuation amplitude of the output voltage and output current within the same filter time. 2 .For actual motor speed fluctuation, targeted analysis and optimization are required.	1. Check the filtered output current and set the filter time properly (Ab-94 to Ab-98 for group U0). 2. Contact Inovance for technical support.
		The output voltage of the drive exceeds the rated voltage of the motor.	The input grid voltage is excessively high, resulting in high bus voltage.	Check whether the grid output voltage is significantly higher than the rated voltage of the motor, which is certain to occur when the motor is operating at high speed and under heavy load.	This is a normal phenomenon requiring no action. The output phase voltage of the drive is a square wave pulse voltage over the carrier frequency cycle. The amplitude of the square wave voltage matches the bus voltage. Different output voltages result in different pulse widths. The voltage shock to the motor is directly related to the bus voltage, not the output voltage. Therefore, it is recommended to maximize the output voltage to save energy.
		The output current at the low speed is low after measured by the oscillo scope + AC current clamp or clamp meter, and the oscillo scope shows distortion of the waveform.	Both the clamp meter and AC current clamp are based on AC inductive principle. The AC magnetic field generated by low frequency output current is weak, so there will be deviations and distortion in the low frequency stage.	1 .Increase the output frequency to see if the output current waveform and current are correct. 2 .Decrease the frequency to see whether the internal output current of the drive fluctuates.	It is recommended to use a DC current probe to measure the output current. **Notes:** The low frequency current waveform is based on the drive waveform. The drive can obtain the DC current through correct sampling.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
3	Abnormality in the V/f control mode	Oscillation occurs during stop.	Abrupt acceleration during stop causes torque change.	1 .Increase the deceleration time to see if the oscillation decreases. 2 .Set b7-09 [Ramp deceleration end arc time] to see if the oscillation decreases.	1 .Enable the S-curve function (F0-45=1) of RFG, and set b7-09 [Ramp 1 Deceleration End Arc]. If the deceleration time is fast, you also need to set b7-08 [Ramp 1 Deceleration Start Arc]. 2 .Increase D0-28 [Waiting time of DC braking at stop] appropriately.
		The DI is used as the stop signal source to indicate deceleration to stop. The motor stop position exceeds the limit.	1 .The stop signal is delayed during transmission to the drive. 2 .The drive filters the input instruction signals such as DI. 3 .Deceleration time and actual mechanical demand do not match. 4 .Power generation causes overvoltage suppression or overcurrent suppression. 5 .Deceleration capability is low, which may be caused by torque or current limit reaching.	1 .Check whether the stop signal through the PLC is delayed during transmission, such as a delay in the PLC scan cycle. 2 .Check the DI input filter time 1 (E0-16). If the deceleration time is very short (for example, 100 ms), set the DI filter time to 0. 3 .Check the actual deceleration time. The default deceleration/acceleration time reference value is the time corresponding to the maximum frequency. 4 .Monitor the waveform. Power is generated during deceleration. If the bus voltage reaches d1-55 [overvoltage suppression point], the feedback speed will not follow the given value. This can result in position overshoot. You can disable overvoltage suppression [d1-54=0] and run the drive multiple times to see if overvoltage occurs. 5 .Check whether the monitored waveform vector control output torque has reached the limit point (F2-30/F2-31), and check whether the output current has reached the overcurrent suppression point (d2-27) in the V/f control mode.	1 .The DI for deceleration to stop is recommended to connect directly to the drive for fast response. 2 .Check the DI input filter time 1 (E0-16) and set the DI filter time to 0. 3 .If the deceleration time may be too short, you can reduce the value of F0-49 to reduce the ramp 1 deceleration time. 4 .Enable overexcitation (d0-39 is dedicated to vector control. If D0-41 is not 0, overexcitation is enabled in the V/f control mode. By default, overexcitation is enabled in the V/f control mode). Try to increase the overexcitation coefficient (d0-40 for vector control and d0-41 for V/f control). If the process allows, increase the deceleration time. If the fault persists, install the braking resistor. Increase the value of d2-27 (Overcurrent suppression). 5 .The preceding solutions also apply to the vector control mode. Adjust the torque limit properly (d1-09/d1-10) in the vector control mode.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
3	Abnormality in the V/f control mode	The output current is large.	1 .The load is too heavy. 2 .Torque boost in the V/f control mode is large. 3 .For wind turbine and water pumps, if the power saving control is not activated, the output current will be large. 4 .If the current is large only under high-speed weak magnetic heavy load running scenario, the grid voltage may be low. 5 .Incorrect motor rating parameters or incorrect wiring of the Y or the △ type of the motor result in abnormal motor operation. 6 .The output current deviation is small, which may be caused by current sampling deviation.	1 .For drives with the same power rating, change and compare the output current. If only a single machine experiences high output current, it may be a mechanical problem. 2 .Insufficient torque increase may result in low frequency and large output current during low-speed heavy load startup in the V/f control mode. 3 .Check whether energy saving control is activated for the wind turbine or water pump. 4 .Check whether the grid voltage is low. If it is low, try to increase the overshoot. 5 .Check whether the basic parameters of the motor are abnormal. If the motor runs without load in V/f control mode and the output current is large, there may be a problem with the rated parameters of the motor. 6 .The output current sampling of the AC drive may have a deviation of about 1%. If there is a small current deviation, it is recommended to use the same current clamp to test whether the output current is too large due to the current sampling deviation.	1 .If the problem is caused by machine, you need to optimize the mechanical design and assembly. If the problem cannot be solved, you may need to replace the drive with a larger power rating. 2 .Increase the torque increase coefficient properly. Too large torque increase will result in high output current. 3 .For steady loads such as the wind turbine and water pump, it is recommended to enable asynchronous machine energy saving control (d5-25=1), which can effectively reduce energy consumption. 4 .For high-speed weak magnetic field, increase the over-modulation (A5-06 = 107%), improve the voltage utilization and reduce the output current. 5 .Set accurate motor rating parameters. Some motor nameplates indicate multiple sets of motor parameters. Select the correct motor parameter group. If the motor parameters are correct but the current is still high, the rated motor voltage can be reduced. 6 .Use the same clamp to test the output current.
		The output voltage is small under weak magnetic operation compared to other machines.	The grid power supply voltage is low, or there is a voltage drop after a weak load is added on the grid. Under the same load conditions, the output voltage is low and the output current is high.	During operation, observe the bus voltage value and see if the bus voltage drops significantly after the load is heavy.	1 .It is recommended to increase the overshoot coefficient (A5-06 = 107%). 2 .The input voltage can be increased appropriately by changing the transformer tap.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
3	Abnormality in the V/f control mode	The speed accuracy is insufficient in the V/f control mode.	After the motor is loaded in the V/f control mode, there is a deviation (slip difference) between the speed of the asynchronous rotor and the given frequency. If no slip compensation is set, there will be a deviation between the final rotor output speed and the given speed.	Use a spectrum analyzer to check whether the actual motor speed is significantly different from the set value.	V/f slip compensation response is slow. For steady loads,enable the slip compensation (d2-41=1), which can effectively improve the speed accuracy of the asynchronous machine in the V/f control mode. If the load changes quickly, high speed accuracy is required, and vector control operation is required.
3	Abnormality in the V/f control mode	Slow startup occurs during fast startup.	1 .The start instruction has a delay. 2 .Torque increase in the V/f control mode is inappropriate, resulting in insufficient starting torque. 3 .The output current limit is small, resulting in the output acceleration frequency being unable to follow the given value. 4 .Setting the start frequency or DC braking start will result in a delay during start.	1 .The start/stop control is extremely fast. Check that the DI terminal filter time is set to 0 ms. 2 .Increase the torque boost appropriately, and observe whether the start delay shortens. 3 .Observe whether the output current transient value reaches the set overcurrent suppression point. 4 .Check whether DC braking is activated (d0-25=0s) and whether the start frequency holding time is set (d0-24=0s).	1 .Ensure that the DI terminal filter time (E0-16) is 0 ms. 2 .Appropriately increase the torque boost (d2-14) with the value not exceeding 6%. An excessive value will result in large current flow and overload. 3 .Increase the overcurrent suppression point (d2-27) appropriately. If the limit of the drive is reached, select a drive with a large power rating. 4 .Set the DC braking start (d0-25=0s) and the start frequency holding time (d0-24=0s).
		When multiple drives with their respective motors drive the same load, the output current among the drives is uneven.	If multiple drives are used to drive the same load, each drive is configured with the control speed independently. In this case, small mechanical error will result in a large deviation in the load between two motors.	Check whether load balancing control is enabled. If speed control for each drive is independent, problems can easily occur.	If multiple drives with their respective motors drive the same load, you need to use droop control to balance the current among the drives. Otherwise, the output current cannot be balanced. It is recommended that the droop rate be set to the rated slip percentage of the motor. For details, see *"5.3.2.10 V/f Droop Control" on page 510*.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	The motor speed is reversed during deceleration to stop.	1 .The Ti integral time of the speed loop is too small, and the Kp is too small, resulting in integral overshoot and reversal of the motor running speed. 2 .Some machines are elastic. When the machine stops suddenly and quickly, the output torque changes to 0, and the elastic mechanism will bounce back, causing the mechanism to reverse. This causes the mechanical end to shake.	1 .Adjust the integral time (F2-03) to 0.5s, or to 1.0s for machines with large inertia. Then gradually increase Kp (F2-02) to observe whether the speed overshoot decreases. 2 .Enable the S-curve function (F0-45=1) of RFG, which is used to gradually release the elastic torque and reduce the impact caused by sudden acceleration change.	1 .Adjust the integral time (F2-03) to 0.5s, or to 1.0s for machines with large inertia. Then gradually increase Kp (F2-02). 2 .Enable the S-curve function (F0-45=1) of RFG to reduce the deformation caused by sudden output torque change and allow the elastic energy to be released slowly. Set F0-53 (Ramp 1 Deceleration End Arc Time) to a small value. Set d0-16 (stop delay time) to a small value, and power off the machine after it stops stable. Set d0-29 (Stop DC braking) properly to see if the problem is resolved.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	The output current is high in the vector control mode.	1 .The load is too heavy. 2 .For wind turbines and water pumps, if the power saving control is not activated, the output current will be large. 3 .If the current is large only under high-speed weak magnetic running scenario, the grid voltage may be low. 4 .Incorrect motor rating parameters or incorrect wiring of the Y or the △ type of the motor result in abnormal motor operation. 5 .When the output current is slightly large, it may be caused by current sampling deviation. 6 .Dynamic auto-tuning is not performed. 7 .The output current of the synchronous motor in the SVC mode at the low speed is large. 8 .If overmodulation is enabled for the asynchronous motor in the vector control mode, the output current in the unloaded weak magnet area is slightly large. 9 .The output current is too high during normal operation.	1 .For drives with the same power rating, change and compare the output current. If only a single machine experiences high output current, it may be a mechanical problem. 2 .Check whether energy saving control is activated for the wind turbine or water pump. 3 .Check whether the grid voltage is low. If it is low, increase the overshoot. 4 .Check whether the basic parameters of the motor are abnormal. If the motor runs without load in V/f control mode and the output current is large, there may be a problem with the rated parameters of the motor. 5 .The output current sampling of the AC drive may have a deviation of about 1%. If there is a small current deviation, it is recommended to use the same current clamp to test whether the output current is too large due to the current sampling deviation. 6 .It is recommended to perform complete dynamic parameter auto-tuning for motors in the vector control mode. For batch application for the first time debugging, complete auto-tuning without load is recommended. For batch copying, download the complete parameter file. 7 .The synchronous motor has injection current at the low speed in the SVC mode to ensure stable control. 8 .The weak magnetic depth for the asynchronous motor decreases under high-speed no-load conditions, the output current without load increases slightly, the load capacity improves, and the output current with the load decreases. 9 .There are multiple possible causes.	1 .If the problem is caused by machine, you need to optimize the mechanical design and assembly. If the problem cannot be solved, you may need to replace the drive with a larger power rating. 2 .For steady loads such as the wind turbine and water pump, it is recommended to enable asynchronous machine energy saving control (d5-25=1), which can effectively reduce energy consumption. 3 .For high-speed weak magnetic field, increase the over-modulation (A5-06 = 107%), improve the voltage utilization and reduce the output current. 4 .Set accurate motor rating parameters. Some motor nameplates indicate multiple sets of motor parameters. Select the correct motor parameter group. If the motor parameters are correct but the current is still high, the rated motor voltage can be reduced. 5 .Use the same clamp to test the output current. 6 .Output current can be decreased slighted through dynamic auto-tuning or downloading all parameters after dynamic auto-tuning. 7 .It is normal and no optimization is required. 8 .It is normal and no optimization is required. 9 .Multiple causes exist. Contact technical support.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	The deceleration time is too long for machines with large inertia.	1 .The set deceleration time does not match the deceleration time required by the user. 2 .Power is generated when the motor without the braking resistor decelerates. This causes the busbar voltage to rise, resulting in overvoltage suppression and slow deceleration. 3 .The generating torque limit is small.	1 .Check whether U6-00 (feedback speed) follows U6-01 (set speed). If the feedback speed can follow the set speed but the deceleration time is long, the set deceleration time is inappropriate. 2 .If the bus voltage (L32-48) rises to the overvoltage suppression point (F2-40), and the feedback speed cannot follow the given speed, the long deceleration time is caused by overvoltage suppression. 3 .Increase the value of F2-30/F2-31 appropriately, and observe whether the deceleration time becomes short. The situation of insufficient generating torque is generally rare.	1 .Decrease the value of F0-49 (ramp 1 deceleration time). 2 .By default,overvoltage suppression is disabled in the vector control mode. You can enable overexcitation (d0-39) to shorten the overvoltage suppression time. If this problem cannot be completely resolved, it is recommended to install the braking resistor. 3 .Increase the value of F2-30/F2-31 appropriately and increase the generating torque limit to check whether the braking resistor can consume energy in time and whether there is any risk of overvoltage in case of rapid power generation.
		The speed fluctuates under weak magnetic operation. If the speed decreases, the operation is normal.	Bandwidth is insufficient under weak magnetic control, causing motor resonance.	Motor resonance occurs after the motor enters the weak magnet area. When the output voltage no longer increases as the speed increases, the weak magnet area is reached.	Set d4-17 to 5 and try again.
		The actual speed under high-speed weak magnetic operation cannot reach the set speed.	1 .The torque is limited. 2 .Torque limit results in insufficient output force.	1 .Observe whether the output torque reaches the torque limit (d1-09). 2 .Increase the breakdown torque coefficient (d1-23) to check the speed following condition.	1 .Increase the torque limit (d1-09). 2 .Increase the breakdown torque coefficient (d1-23).

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	During rapid acceleration and deceleration, the motor output torque is unstable, and abnormal noise occurs.	Acceleration/deceleration is too fast, and the current following encounters a deviation.	Set d4-17 to 5 to restart the drive.	Set d4-17 to 5 to restart the drive.
		The motor rotates reversely at startup.	1 .The tuned magnetic pole position of the synchronous motor is incorrect. 2 .The SVC control is unstable at the low speed. 3 .There is additional torque in the reverse direction, which can cause the motor to rotate reversely at startup. 4 .There is the active load. When the output torque is unable to to drive the load, the motor rotates reversely. This often occurs in the scenario with the brake.	1 .Keep the motor stopped. Set the motor to zero speed and start the motor several times. Check whether the magnetic flux angle (which is the magnetic pole position tuned angle) is stable. 2 .Check whether the feedback speed fluctuates significantly and the output torque is too large. 3 .Check whether the additional torque is set (b5-24/b5-25/b5-26/b5-27). After the additional torque is set, abnormal shock will occur at motor start-up. 4 .Active loads are mainly lifting loads or elastic loads. The release of gravity potential energy or elastic potential energy at start-up will cause the motor to rotate reversely.	1 .Increase the magnetic pole position tuned current (d0-75/D6-53). 2 .Contact the technical support personnel. 3 .Set b5-24/b5-25/b5-26/b5-27 to 0, which is the default value. 4 .Increase the speed loop Kp (F2-02) value for fast response. Or set an appropriate start frequency and start frequency running time for fast response (d0-23/d0-24).

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	The torque is small when the motor is started in the SVC mode. The output torque is much larger than the actual load.	1 .The motor inductance is incorrect. 2 .The back BMF of the synchronous motor or the motor stator resistance is incorrect. Inaccurate back BMF and stator resistance can affect the torque at the low speed in the SVC mode. 3 .The drive model and the real model do not match, resulting in incorrect tuned parameters and abnormal operation of the motor.	1 .Check whether complete parameter auto-tuning is performed. 2 .Disconnect the motor and perform complete no-load auto-tuning to obtain accurate motor parameters. 3 .Check whether the model parameters match those on the machine nameplate (A3-02 to A3-04).	1 .It is recommended to perform complete parameter auto-tuning. The recommended value of the motor manufacturer may differ significantly from the tuned value. In this case, the tuned value prevails. 2 .Disconnect the motor and perform complete no-load auto-tuning to obtain accurate motor parameters. 3 .Make sure that the model parameters (A3-02 to A3-04) match those on the machine nameplate.
		The load capacity is insufficient during startup in the SVC mode and stalling occurs occasionally.	1 .Motor model parameters are incorrect. 2 .The acceleration time is too long in the SVC mode and the motor runs too long near zero speed. Divergence occurs occasionally. 3 .The value of the speed loop gain at zero speed is low, resulting in slow output torque rise and long-time operation at zero speed. In this case, divergence occurs. 4 .Incorrectly-tuned magnetic pole position results in low starting torque.	1 .It is recommended to perform complete dynamic parameter auto-tuning to see if the problem is resolved. Check whether the drive model setting is accurate. 2 .Shorten the acceleration time and check if the problem of the startup stalling in the SVC mode is resolved. 3 .Increase the value of d3-07 and reduce the value of d3-08 to increase the value of the speed loop gain at zero speed to check if the problem of the startup stalling in the SVC mode is resolved. 4 .Increase the initial position detection current of the synchronous motor (d0-75/D6-53) to check if the problem of the startup stalling in the SVC mode is resolved.	1 .Ensure that the drive model is accurate and the tuned motor parameters are accurate. It is recommended to perform complete no-load auto-tuning. If complete no-load auto-tuning is not allowed by the synchronous motor, write the correct back EMF and then perform static auto-tuning (C2-00 = 13). 2 .If the system is not sensitive to acceleration time, you can appropriately reduce the acceleration time coefficient (b7-41) in the low-speed phase and set b7-42 to 3%, so that the drive accelerates faster in the low-speed phase. 3 .Increase the value of d3-07 and reduce the value of d3-08 to increase the value of the speed loop gain at zero speed. 4 .Increase the initial position detection current of the synchronous motor (d0-75/D6-53).

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the vector control mode	The operating speed overshoot is large.	The main reason for running speed overshoot in the vector control mode is that the value of speed loop gain is too high (small value of integral Ti and Kp). This results in slow integral cancellation and output overshoot.	Increase the values of Kp (F2-02) and Ti (F2-03) to check whether the problem of overshoot is resolved.	1 .Increase the values of Kp (F2-02) and Ti (F2-03). 2 .Enable feedforward control by referring to *"5.3.1.3.4 Acceleration Feedforward Torque" on page 450*.
		Acceleration is slow for machines with large inertia.	1 .The output torque limit is small, resulting in low average output torque during acceleration. 2 .The value of the speed loop gain is low, resulting in a long time for the torque to increase to the maximum value.	1 .Increase the output torque limit appropriately (F2-30/F2-31) to observe whether the acceleration time is prolonged. 2 .Increase the value of speed loop Kp (F2-02) appropriately to see if the acceleration time is prolonged.	1 .Increase the output torque limit appropriately (F2-30/F2-31). 2 .Increase the value of speed loop Kp (F2-02) appropriately.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
4	Abnormality in the SVC control mode	The motor will creep when it runs at zero speed in the SVC mode. Occasionally, high current occurs and a fault is reported.	The back EMF is low when the motor runs at the low speed in the SVC mode, and the observed speed is inaccurate. Long-term running at zero speed can easily result in model dispersion and overload.	If the motor speed is increased by a bit (2%), the motor runs stably. If the set speed is 0, the motor runs unstably. If the IF mode is not activated when the speed is set to 0 and the motor runs in the SVC mode, problems will occur.	If the synchronous motor runs in the SVC mode, enable IF control (tens place of d0-85 set to 1). This can ensure that the motor speed is stable at zero speed. If the asynchronous motor runs in the SVC mode, enable the motor at the zero speed to enter the DC mode (d6-27=2) to ensure that the motor speed is stable at zero speed.
		There is a significant delay in the actual operation of the motor after the start key is pressed.	1 .The pre-excitation delay is started for the asynchronous motor. 2 .The DC braking start time and start frequency time are set.	1 .Check that the motor starts acceleration after an operation command is given through the oscilloscope. During acceleration, the feedback speed can follow a given speed. 2 .Check that the DC braking start time and start frequency time are not 0.	1 .Increase the pre-excitation current (d0-19) properly to speed up the start process. 2 .Set the DC braking start time and start frequency time to 0 (d0-24=0, d0-25=0).
		Multiple asynchronous motors receive the start command simultaneously, but start at different time.	Asynchronous motors are different in size and pre-excitation completion time is different. Therefore, even if the start command is given at the same time, acceleration is not started at the same time.	Because of different motor size and specifications, startup for these motors is not synchronized.	Set the pre-excitation mode of all drives to excitation by time (d0-17=0), and set the same pre-excitation time (d0-18).

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
5	Motor abnor malities	The motor bearing encounters electrical corrosion.	Electrical corrosion of motor bearings mainly occurs on large motors. This is because the motor is not well grounded, and the non-drive segment of the motor bearing is non-insulated.	The inner and outer ring of the bearing and the bearing bead show signs of hollow and decolor of metal burning.	The motor ground terminal must be connected to the drive ground terminal, and the drive ground to earth must be reliably grounded. The non-drive segment of the motor needs to be equipped with insulating bearings.
		Synchro nous motor demagneti zation	1 .Insufficient carrier frequency results in large current harmonics and abnormal motor temperature rise. 2 .The motor is oscillating and the motor heat is abnormal. 3 .Motor back EMF harmonics are large, and coercivity is low, which makes the motor be easily exposed to demagnetization. 4 .The environment for the motor is not ventilated.	1 .Use the oscilloscope to observe whether the current sine wave of the U/V/W phase is normal. 2 .Check whether the carrier frequency is high enough (at least larger than maximum output frequency x 12). 3 .For high-speed motors and low inductive motors, select the appropriate reactor or LC filter. 4 .During operation, measure whether the temperature rise of the motor is normal.	1 .Perform complete parameter auto-tuning. 2 .The carrier frequency must be greater than the result of maximum output frequency x 12. 3 .For high-speed motors and low inductive motors, select the appropriate reactor or LC filter. During operation, observe whether the excitation current, torque current and the speed of the rotor fluctuate significantly. Generally, torque current fluctuation higher than 6% is large. 4 .Make the environment well-ventilated. Increase the flow of water-cooled motors to reduce the water temperature. For air-cooled motors, avoid hot air circulation to the cooling fan. Keep the motor away from other heat sources and check if the air ducts are blocked.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
5	Motor abnor malities	Low system efficiency	Process mismatch results in poor efficiency. The head and the actual optimum efficiency point of the pump do not match, and the pipe design is unreasonable, resulting in energy loss. Inappropriate process parameters result in high pressure flow fluctuation.	1 .Check whether the drive speed encounters regular fluctuation in a wide range. 2 .Check whether there is a large difference between the actual efficiency and the design efficiency.	Contact the technical support personnel.
			The misalignment of the motor output shaft causes energy loss.	1 .Use the alignment instrument to measure whether the motor is aligned. 2 .Measure the radial run-out with a micrometer.	Ensure that the installation is aligned and re-test the efficiency.
			Incorrect settings of the debugging parameters of the drive result in poor system efficiency.	Under good mechanical conditions, observe whether the motor speed is subject to significant periodic fluctuations.	Follow the process again to complete the debugging. If this problem is not resolved, contact technical support.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
5	Motor abnormalities	The noise is loud.	1 .Mechanical noise is loud. The mechanical mounting axis is not aligned, or the mechanical damage occurs. 2 .The electromagnetic noise is loud.	1 .For mechanical noise, make the machine run at a high speed and then make the machine coast to stop. Check whether noise still exists during the process of coasting to stop. 2 .For electromagnetic noise, change the carrier frequency and check whether the noise changes.	1 .Optimize the machine. 2 .Increase the value of A5-01 (carrier frequency) appropriately. In the V/f control mode, enable random PWM (using A5-11 to set different depths).
		The motor vibration is large.	1 .Jitter occurs in the speed control mode. 2 .The motor mounting axis is not well aligned, resulting in jitter. 3 .The load segment jitter causes the motor to vibrate heavily. 4 .The motor cogging torque fluctuation causes speed fluctuation.	1 .Observe the output torque and output speed for oscillation through the background waveform. 2 .Remove the coupling and check whether there is still jitter. 3 .Make the motor run at a high speed and then make the motor coast to stop. Check whether vibration exists when the motor coasts to stop. 4 .When the motor runs without load, significant torque fluctuation occurs, especially at a low speed. The fluctuation decreases after the speed increases.	1 .Adjust the control of the drive. If the problem is still not resolved, seek technical support. 2 .Ensure that the motor axis is correctly aligned. 3 .Analyze mechanical causes. 4 .Ask for technical support.
		The motor temperature rise is too high.	1 .The output current is large and the load is heavy. 2 .The motor is not well ventilated. 3 .The carrier frequency is low and the current harmonics are large. 4 .High input voltage results in high bus voltage and large voltage harmonics result in large current harmonics. 5 .Long cables lead to large current harmonics and high motor temperature.	1 .Verify whether the motor load is heavy. 2 .Check whether the cooling fan of the motor is functioning properly, whether the air duct is blocked, and whether the cooling water temperature and flow of the water-cooled motor meet the requirements. 3 .Check whether the carrier frequency of the drive meets the control requirements and whether the carrier ratio is greater than 12. 4 .Check whether the grid voltage is high (for example, higher than 420 V). 5 .Capacitance to ground exists for long cables. If the cable is long, natural reflection will occur, resulting in large output current harmonics. The higher the carrier frequency, the larger the current harmonics, and the higher the temperature rise.	1 .Reduce the load appropriately. 2 .Ensure that the fan is functioning properly, the air ducts are not blocked, and the cooling water temperature and flow meet the requirements. 3 .Ensure that the carrier ratio is greater than 12 and that the carrier frequency meets the motor requirements. 4 .If the motor temperature increases due to high grid voltage, increase the carrier frequency (A5-01) appropriately. 5 .For long cables, reduce the carrier frequency appropriately to effectively reduce motor temperature and reduce overvoltage shock caused by voltage reflection.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
5	Motor abnor malities	Noise occurs when the motor starts, but the noise disappears when the motor is running.	1 .Asynchronous motor: By default, the motor starts with the current excitation. Some motors will experience excitation noise when the pre-excitation current is high. 2 .Synchronous motor: When the magnetic pole position auto-tuning based on pulses is performed, there is a "thud".	1 .Asynchronous motor: Check whether the pre-excitation method is based on time. 2 .Synchronous motor: Check the magnetic pole position auto-tuning method and use high-frequency injection.	1 .Asynchronous motor: Set the pre-excitation mode to excitation by time (d0-17=0), and increase the pre-excitation time appropriately. 2 .Synchronous motor: Tune magnetic pole position by using the high-frequency injection method (d0-71=1) to lower the initial position auto-tuning volume.
		Motor resonance	Mechanical oscillation frequency exists. When the motor runs close to this point, it will cause resonance between the motor and the machine. This may be related to motor and mechanical installation and manufacturing.	Motor resonance is usually near a certain speed point, at which the speed and torque of the motor fluctuate significantly. When the speed is adjusted a bit, the operation is normal.	1 .Set the jump frequency to prevent the target speed from being equal to the resonance point frequency, and prevent the mechanical operation from being in a resonant state for a long time. 2 .Decrease the speed loop Kp (F2-02) appropriately and increase the Ti. 3 .Set the torque current filter time to a small value, such as setting d3-48 to 5ms. The preceding solutions can reduce the effect of the resonance point. To eliminate the resonance, find the cause from the machine.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
6	Abnormality in the FVC control mode	The motor is blocked during operation in the FVC mode.	1. The encoder slips. 2. The encoder is subject to severe interference.	1. In the SVC mode, check whether there is a speed deviation between the actual speed of the L3000 motor and the feedback speed of the L3004 encoder during acceleration, deceleration, and at high speed. If the L3000 is normal, but the L3004 shows a significant deviation, the encoder slips. 2. In the SVC mode, check whether there is significant burr at the encoder feedback speed. The more burrs, the more serious the interference. Note that even the occasional single burr needs to be handled.	1. Tighten the encoder. Set C2-00 to 12 (no-load dynamic complete auto-tuning of permanent magnet motor) to perform parameter auto-tuning again. 2. The encoder shield is grounded through the encoder card. The motor ground terminal and the drive input terminal need to be grounded. If interference still exists, you can ask for technical support.
		The output current of the synchronous motor is large and the load-carrying capacity is weak.	1. The load is too heavy. 2. The motor is demagnetized. 3. Large friction or large load inertia exists in the system. 4. Motor parameters are incorrect or not tuned. 5. The directional angle is incorrect.	1. Verify the mechanical connection and system structure. Verify that the output torque has reached the set torque limit. 2. Record the current back EMF [F1-12], and perform no-load complete auto-tuning again. Check whether the tuned back EMF is lower than the initial value. 3. Verify the output torque when the motor runs under no load or light load. If the value is high, the friction torque is present in the system. When the motor runs to a high speed and then coasts to stop, the load inertia is large if the slip stop time is long. 4. Check the motor nameplate parameters and confirm whether the F1 group parameters are updated. 5. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again.	1. Adjust the load. If the output torque reaches the limit, replace the motor with a higher power level. If the drive is overloaded, reconfirm the drive selection. 2. Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the motor is replaced directly, demagnetization may occur again. If the fault persists are preceding measures are taken, use a drive with higher power rating. 3. Use the RFG feedforward torque coefficient to select d3-39 to increase the feedforward torque coefficient for inertia compensation. 4. Confirm the motor nameplate parameters, and perform no-load complete auto-tuning again. 5. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
6	Abnormality in the FVC control mode	The ABZ encoder of the synchronous motor makes an abnormal mechanical jitter once for every revolution.	1. Unsmooth rotating structures exist in mechanical connections of the passive load. 2. The encoder has large radial run-out.	1. Make the motor run at a high speed in the FVC mode and then make the motor coast to stop. Use the oscilloscope to check whether the encoder feedback speed fluctuates. If there is a mechanical connection problem, periodic noise occurs. 2. Use a dial gauge to confirm the radial run-out of the encoder shaft. For scenarios with high speed accuracy requirements, the accuracy must be less than 0.1 microns (or 0.0001 mm).	1. Check the mechanical connection to ensure proper friction. 2. Check the radial run-out of the encoder. You can re-install the encoder and cut the length of the encoder output shaft.
		The load-carrying capacity of asynchronous motors in the FVC mode is weak.	1. The load is too heavy. 2. The pre-excitation is insufficient. 3. Large friction or large load inertia exists in the system. 4. Motor parameters are incorrect or are not tuned. 5. The directional angle is incorrect.	1. Verify the mechanical connection and system structure. Verify that the output torque has reached the set torque limit. 2. Run the motor without load. Verify whether the flux detection value U6-37 is below 80%. 3. Verify the output torque when the motor runs under no load or light load. If the value is high, the friction torque is present in the system. When the motor runs to a high speed and then coasts to stop, the load inertia is large if the slip stop time is long. 4. Check the motor nameplate parameters and confirm whether the F1 group parameters are updated. 5. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again.	1. Adjust the load. If the output torque reaches the limit, replace the motor with a higher power level. If the drive is overloaded, reconfirm the drive selection. 2. Perform static auto-tuning again and check whether the pre-excitation time (d0-18) changes. If not, extend the time appropriately. 3. Use the RFG feedforward torque coefficient to select d3-39 to increase the feedforward torque coefficient for inertia compensation. 4. Confirm the motor nameplate parameters, and perform no-load complete auto-tuning again. 5. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
6	Abnormality in the FVC control mode	Insufficient torque accuracy and torque linearity	1. Motor parameters are incorrect or not tuned. 2. The directional angle is incorrect. 3. The encoder feedback speed fluctuates. 4. The bearings in the system are worn or lubricated unevenly.	1. Check the motor nameplate parameters and confirm whether the F1 group parameters are updated. 2. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again. 3. Refer to the method for abnormal encoder feedback speed fluctuation. 4. Check the output torque when the motor is running without load. If the mechanical frequency fluctuates greatly, cause 4 is confirmed. Noise exists if the problem is caused by mechanical factors, which is easily detected.	1. Confirm the motor nameplate parameters, and perform no-load complete auto-tuning again. 2. Confirm the relevant encoder parameters, and perform no-load complete auto-tuning again. 3. Refer to the method for abnormal encoder feedback speed fluctuation. 4. Check mechanical installation and lubrication.
		Obvious speed fluctuation	1. The active load fluctuates. 2. Unsmooth rotating structures exist in mechanical connections of the passive load. 3. The encoder has large radial run-out. 4. The value of the loop gain is high.	1. Make the motor run at a high speed in the FVC mode and then make the motor coast to stop. Use the oscilloscope to check whether the encoder feedback speed fluctuates. 2. Make the motor run at a high speed in the FVC mode and then make the motor coast to stop. Use the oscilloscope to check whether the encoder feedback speed fluctuates. If there is a mechanical connection problem, periodic noise occurs. 3. Use a dial gauge to confirm the radial run-out of the encoder shaft. For scenarios with high speed accuracy requirements, the accuracy must be less than 0.1 microns (or 0.0001 mm). 4. If the fluctuation is not caused by the feedback signal or load, the value of the loop gain may be high. Decrease the value of F2-00 (FVC speed loop Kp) and increase the value of F2-01 (FVC speed loop Ti) to check whether the speed fluctuation decreases.	1. Increase the value of F2-00 (FVC speed loop Kp) and decrease the value of F2-01 (FVC speed loop Ti). Shorten the encoder speed detection filter time appropriately. Increase the value of the loop gain for active loads. 2. Check the mechanical connection to ensure proper friction. 3. Check the radial run-out of the encoder. You can re-install the encoder and cut the length of the encoder output shaft. 4. Decrease the value of F2-00 (FVC speed loop Kp) and increase the value of F2-01 (FVC speed loop Ti). Prolong the encoder speed detection filter time appropriately.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
6	Abnormality in the FVC control mode	Large speed overshoot	The main reason for running speed overshoot in the vector control mode is that the values of speed loop integral and speed loop proportion. This results in slow integral cancellation and output overshoot.	Increase the values of F2-00 (FVC speed loop Kp) and F2-01 (FVC speed loop Ti) to check whether the problem of overshoot is resolved.	1. Increase the values of F2-00 (FVC speed loop Kp) and F2-01 (FVC speed loop Ti). 2. Activate feedforward control. See the manual for details.
		The motor speed is unstable at low speed.	1. The bus voltage fluctuates. 2. The bearings in the system are worn or lubricated unevenly. 3. The load fluctuates. 4. The set speed fluctuates. 5. The encoder feedback signal fluctuates. 6. The speed loop parameter or current loop parameter is not proper.	1. Verify the fluctuation level of the DC bus voltage L3248 in the oscilloscope. If the peak fluctuation value is greater than 15 V, the front grid needs to be checked. 2. Check the output torque when the motor is running without load. If the mechanical frequency fluctuates greatly, cause 2 is confirmed. Noise exists if the problem is caused by mechanical factors, which is easily detected. 3. After the motor runs with load to a medium speed, the motor coasts to stop. Check whether fluctuation exists in the system through the oscilloscope. If yes, the problem is caused by the load. 4. Verify whether the final set speed of the motor (L3002) encounters fluctuation through the oscilloscope. 5. Check whether there is interference in the encoder feedback signal through the oscilloscope. 6. Check the fluctuation of the torque current L3222 and torque current feedback value L3226 through the oscilloscope. If the torque current fluctuates, the speed loop parameter needs to be adjusted. If the torque current does not fluctuate but the torque current feedback value fluctuates, the current loop parameter needs to be adjusted.	1. Check the causes of fluctuations in the front grid. 2. Check mechanical installation and lubrication. 3. Re-check the installation mode of the load. 4. Check the signal sent by the host controller. 5. Check whether the encoder shield cable is connected effectively. Eliminate interference sources. Increase the encoder speed detection filter time constant C0-05. 6. If the torque current fluctuates, decrease the value of F2-00 (FVC speed loop Kp) and increase the value of F2-01 (FVC speed loop Ti). If the torque current L3222 does not fluctuate but the torque current feedback value fluctuates L3226, decrease the value of d4-02 (current loop Q-axis Kp) and decrease the value of d4-03 (current loop Q-axis Ki).

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
6	Abnormality in the FVC control mode	The motor runs normally at a low speed. Speed loss and stall occur when the motor runs at a high speed.	1. The bus voltage is too low. 2. The voltage margin is small. 3. Motor parameters are incorrect. 4. The encoder feedback signal is subject to interference.	1. Check the value of the DC bus voltage L3248 through the oscilloscope. If the value is low, check the front grid. 2. Check whether the output voltage no longer increases after a certain speed is reached through the oscilloscope. 3. Confirm the motor nameplate parameters, and perform no-load complete auto-tuning again. 4. Confirm whether there is interference in the encoder feedback signal through the oscilloscope.	1. Check whether the encoder shield cable is connected effectively. Eliminate the interference source. 2. Calibrate the encoder installation. The encoder rotor mounting coupling segment should be kept within 0.03 mm. Reducing the length of the encoder mounting shaft can effectively reduce the speed fluctuation. If the problem persists, set d7-02 to 1. Switch to the SVC mode at a high speed. In this case, the performance in the SVC mode is close to that in the FVC mode.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
7	Encoder abnormalities	The ABZ encoder does not have speed feedback.	1. The encoder is not wired correctly. 2. The encoder is installed properly. 3. The encoder signal cable output is abnormal. 4. The encoder related parameters are set incorrectly. 5. The PG card is not working properly. 6. Other causes	1. Check the encoder wiring according to the manual and confirm that the signal, power and shield cables are not loose. 2. Verify that the encoder is securely mounted and the axis is aligned. Loose mounting or misalignment will not occur when the motor runs in the SVC mode. 3. Check whether the A, B, and Z signal cable output of the encoder is normal with the differential probe. 4. Check whether the encoder type (C0-00), encoder phase sequence (C0-03), and encoder PPR (C0-02) are set correctly. 5. Check whether the PG card is installed correctly. Check whether the PG card indicator is normal. 6. Contact the agent or Inovance for technical support.	1. Check the cable, especially the connection of the shielded cable. 2. Set the control mode to SVC, and operate the motor under the normal working conditions. Check whether the encoder is securely installed and whether there will be any misalignment. If the encoder is loose or misaligned, reinstall the encoder. 3. Use a differential probe to check whether the A and B signal cables of the encoder output differential signals, and whether the frequency output by the Z signal cable is consistent with the mechanical frequency of the motor. If the interference is too large, you need to eliminate the interference source. Check the shielded cable. 4. Check whether the encoder type (C0-00), encoder phase sequence (C0-03), and encoder PPR (C0-02) are set correctly. Perform complete auto-tuning. 5. Refer to the PG card manual for troubleshooting. 6. Contact the agent or Inovance for technical support.

No.	Abnormal Phenomenon		Possible Cause	Check Method	Solution
7	Encoder abnormalities	Encoder feedback speed fluctuation	1. The active load fluctuates. 2. Unsmooth rotating structures exist in mechanical connections of the passive load. 3. The encoder has large radial run-out. 4. The value of the loop gain is high.	1. Make the motor run at a high speed in the SVC mode and then make the motor coast to stop. Use the oscilloscope to check whether the encoder feedback speed fluctuates. 2. Make the motor run at a high speed in the SVC mode and then make the motor coast to stop. Use the oscilloscope to check whether the encoder feedback speed fluctuates. If there is a mechanical connection problem, periodic noise occurs. 3. Use a dial gauge to confirm the radial run-out of the encoder shaft. For scenarios with high speed accuracy requirements, the accuracy must be less than 0.1 microns (or 0.0001 mm). 4. If the fluctuation is not caused by the feedback signal or load, the value of the loop gain may be high. Decrease the value of FVC speed loop Kp and increase the value of FVC speed loop Ti. Check whether the speed fluctuation decreases.	1. Increase the value of F2-00 (FVC speed loop Kp) and decrease the value of F2-02 (FVC speed loop Ti). Decrease the encoder speed detection filter time constant (C0-05) appropriately. Increase the value of the loop gain for active loads. 2. Check the mechanical connection to ensure proper friction. 3. Check the radial run-out of the encoder. You can re-install the encoder and cut the length of the encoder output shaft. 4. Decrease the value of F2-00 (FVC speed loop Kp) and increase the value of F2-02 (FVC speed loop Ti). Increase the encoder speed detection filter time constant (C0-05).
7	Encoder abnormalities	Burrs occur in the encoder feedback speed.	There is interference during the transmission of encoder feedback signals.	1. Check whether the shielded cable is connected. 2. Check the original output of the encoder signal cable with the differential probe for burrs. You can prolong the encoder speed detection filter time (n5-17) to handle the problem of burrs.	1. Connect the shielded cable properly. 2. Increase the value of C0-05 (encoder speed detection filter time constant). This solution can reduce burrs in the feedback speed, but it will slow down the system dynamic response speed.

7.8 Solutions to Common EMC Problems

The AC drive pulls energy from the grid to obtain current *“7.8.1 Harmonic suppression solution” on page 1062*in a pulsating and intermittent manner. This principle causes the AC drive to have large harmonic emission. When the grid quality is required on site, rectify the current according to the measures in.

The AC drive is a strong interference device. If the cabinet wiring, grounding, and system configuration are faulty during use, This means that there will be electromagnetic noise interference such as cable coupling interference and common ground impedance interference in the whole system, resulting in loss of various functions or performance degradation of the system. For example, the residual current device acts improperly. Common I/O signal jump, high-speed pulse I/O count error, communication interruption, etc. When interference occurs with other devices, *“7.8.2*

*Residual Current Device Malfunction" on page 1062 "7.8.3.2 Common I/O Signal Interference" on page 1065 "7.8.4 RS485 Communication Interference" on page 1066 "7.8.5 EtherCAT, EtherNet IP, and PROFINET communication interference" on page 1066*Rectification can be performed by using the,, and methods.

7.8.1 Harmonic suppression solution

The AC drive pulls energy from the grid to obtain current in the pulsating and intermittent manner. This pulsating current and the grid's along-path impedance together form a pulsating voltage drop superimposed on the grid voltage, resulting in voltage distortion.

The harmonics generated by the AC drive can cause power loss and interference:

- Increase the mean root value of the total input current (up to 50%)
- Voltage distortion of the power supply (voltage harmonics)
- Power factor reduction
- Overload and noise of transformers, cables, and other electrical components Vibration...
- Interference to sensitive surrounding devices
- Resonance hazard: This causes parallel resonance and series resonance in the public power grid, which amplifies the harmonics

Therefore, harmonic suppression is required in the following cases:

- The relevant standards must be met
- The quality of the on-site power grid is required
- The power factor of the device is required

No.	Requirement	Remarks
1	The requirements of class A or table 4 in IEC 61800-3/IEC 61000-3-12 must be met	/
2	High harmonics requirements include IEEE519, GB/T14549, or customized harmonics < 10%	The passive harmonic filter is recommended

7.8.2 Residual Current Device Malfunction

To prevent the leakage current protection circuit breaker from acting improperly, we need to select a proper type of leakage current protection circuit breaker. During AC drive use, the high frequency leakage current caused by IGBT action will affect the action of the leakage circuit breaker. Therefore, select a leakage protection of not less than 100 mA for each AC drive.

When multiple AC drives connected in parallel share one RCD, the operating current of the RCD must be not lower than 300 mA.

It is recommended to use Chint or Schneider RCDs.

In case of on-site current leakage or tripping, see the following table for specific solutions.

Table 7–7 Measures against leakage current

Tripping	Possible cause	Step
Tripped upon power-on	The anti-interference performance of the RCD is poor.	1 .Use an ELCB of a recommended brand. 2 .Use an ELCB with a higher tripping current. 3 .Move the unbalanced load to the front end of the ELCB. 4 .Disconnect the EMC screw or the grounding terminal of the external EMC filter to reduce the ground capacity of the input end.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	The capacitance to the ground at the front end of the AC drive is large.	
Trip during operation	The anti-interference performance of the earth leakage circuit breaker is poor.	1 .Use a RCD from a recommended manufacturer. 2 .For an individual AC drive, tighten the EMC screw. For multiple AC drives, disconnect the optional EMC grounding screw, as shown in the following figures . 3 . 4 .Install a simple filter on the input side of the drive, and wind the LN/RST cables through a magnetic ring near the RCD, as shown in the following figure . 5 .Replace with an ELCB with a higher rated tripping current. 6 .Reduce the carrier frequency while ensuring performance. 7 .Use shorter motor cables.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	For motor cables and the motor, the distributed capacitance to ground is too high.	

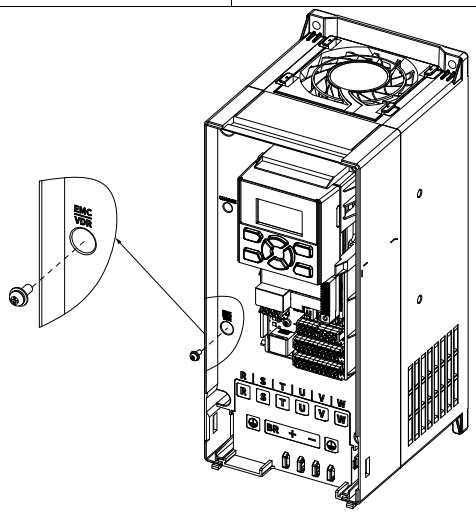


Figure 7-2 Disconnecting optional EMC grounding screw

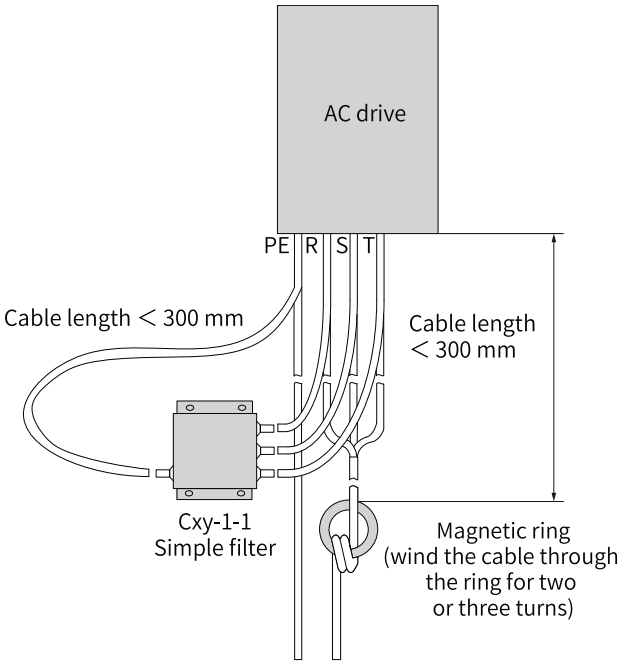


Figure 7-3 Installing a simple filter and magnetic ring on the input side

7.8.3 I/O Signal Interference

7.8.3.1 High-Speed Pulse Interference

Refer to the following table to rectify the high-speed pulse interference.

No.	Step
1	Use shielded twisted pair cables and ground *" Control Circuit Connection" on page 81*them at both ends (see for details).
2	The motor housing is connected to the PE end of the AC drive.
3	Connect the PE end of the AC drive to the PE end of the grid.
4	Add an equipotential grounding cable between the host controller and the AC drive (see for details) *"3.4.1 Cabinet design that meets EMC requirements" on page 64*.
5	Separate signal cables from power cables with a distance of at least 30 cm.
6	Add a magnetic buckle to the signal cable or 2-4 turns of magnetic wrap (see the diagram of magnetic ring installation).
7	Add a magnetic ring to the output UVW of the AC drive, and wind the drive around for two to four turns (see the magnetic ring installation diagram for details).
8	Use shielded power cables and ground the shield properly.

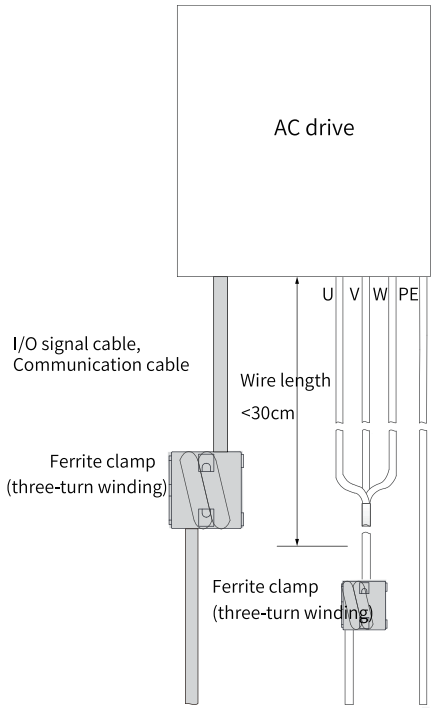


Figure 7-4 Magnetic ring installation

7.8.3.2 Common I/O Signal Interference

Refer to the following table for troubleshooting common I/O signal interference.

No.	Step
1	The I/O signal cable is shielded with the shield connected to the PE terminal (see for details *" Control Circuit Connection" on page 81*).
2	Connect the motor PE to the PE terminal of the AC drive that connects to the PE of the mains power supply.
3	Add an equipotential grounding cable between the host controller and the AC drive (see for details) *"3.4.1 Cabinet design that meets EMC requirements" on page 64*.
4	Add a magnetic ring to the output UVW of the AC drive, and wind it around for two to four turns (see the *"7.8.3.1 High-Speed Pulse Interference" on page 1064*installation of the magnetic ring diagram).
5	Increase the capacitor filter at low-speed DI, with a maximum recommended value of 0.1 μF (see the diagram of increasing the filter on the I/O signal cable for details).
6	Increase the capacitor filter between AI and GND to a maximum of 0.22 μF (for details, see the diagram of increasing the filter on the I/O signal cable).
7	Add a magnetic buckle or magnetic ring to *"7.8.3.1 High-Speed Pulse Interference" on page 1064*the signal cable, and turn 1-2 turns (see the installation of the magnetic ring).
8	Use shielded power cables and ground the shield properly.

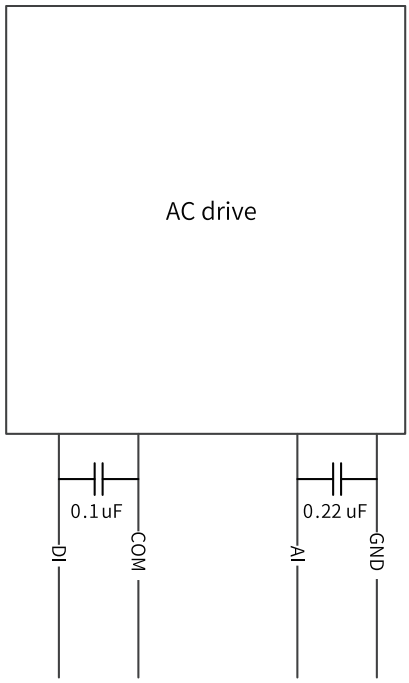


Figure 7-5 Diagram of adding filter on the I/O signal cable

7.8.4 RS485 Communication Interference

Refer to the following table to eliminate the common RS485 communication interference.

No.	Step
1	Install a 120 Ω termination resistor on each end of the bus.
2	Replace with multi-conductor shielded twisted pair cables and ground both ends of the shield.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt daisy chain mode for multi-node communication layout.
5	For multi-node communication, add an equipotential bonding grounding cable between nodes (see *"3.4.1 Cabinet design that meets EMC requirements" on page 64*).
6	Add a ferrite clamp at both ends of the communication cable or add a magnetic ring at both ends of the communication cable and wind the communication cable through the magnetic ring for one to two turns (see *"7.8.3.1 High-Speed Pulse Interference" on page 1064*).
7	Add a magnetic ring to the output UVW of the AC drive, and wind it around for two to four turns (see the *"7.8.3.1 High-Speed Pulse Interference" on page 1064*installation of the magnetic ring diagram).
8	Use shielded power cables and ground the shield properly.

7.8.5 EtherCAT, EtherNet IP, and PROFINET communication interference

Refer to the following table to correct the communication interference problems of EtherCAT, EtherNet/IP, and PROFINET.

No.	Step
1	Check that the communication network cables meet the specification requirements for shielded Cat 5e cables.
2	Check that the communication port is secure and in good contact.
3	Separate communication cables from power cables with a distance of at least 30 cm.

4	For multi-node communication, add an equipotential bonding grounding cable between nodes.
5	Ensure the length of the cable between two nodes does not exceed 100 m.
6	Add magnetic buckles on both sides of the communication cable and turn 1 to 2 turns (see the *"7.8.3.1 High-Speed Pulse Interference" on page 1064*installation of the magnetic ring).
7	Add a magnetic ring to the output UVW of the AC drive, and wind it around for two to four turns (see the *"7.8.3.1 High-Speed Pulse Interference" on page 1064*installation of the magnetic ring diagram).
8	Use shielded power cables and ground the shield properly.

7.9 Fault Code List

E002.1: Hardware overcurrent

Fault reason: The instantaneous output current exceeds 3.535 x rated drive current (A3-03).

Fault Cause	Confirmation	Solution
Output grounding.	Method 1： Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. (When the grid is an IT system, short circuit to ground cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the short circuit to ground part. Replace the UVW output cables or motor.
Interphase short circuit occurs on output phases.	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.	Check the short-circuited output phases. Replace the UVW output cables or motor.
Speed loop parameter setpoints too high (SVC)	/	1. Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start operating and observe whether the drive can run smoothly. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high parameter setpoints.

Fault Cause	Confirmation	Solution
Synchronous motor demagnetization (SVC)	1. Check whether the carrier frequency A5-01 is set to an excessively low value. 2. Check whether the speed control oscillates. Check whether the actual speed jitters excessively through the continuous oscilloscope function of the iFA drive commissioning software. 3. Check whether the motor back EMF harmonics and output current harmonics are excessively high. 4. Check whether the motor EMF is too low. Record the current back EMF (F1-12). Disconnect the motor coupling and perform dynamic auto-tuning of the synchronous motor again (F1-69 = 12). Compare whether the auto-tuned back EMF (F1-12) is lower than the original back EMF. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Low carrier frequency during high-speed operation	Check whether the carrier frequency (A5-01) set for the motor during high-speed operation is higher than the output frequency x 12. If not, overcurrent may occur due to dissipated control.	1. Increase the carrier frequency during high-speed motor control. 2. Calculate the derating rate based on the required carrier frequency (12 x output frequency) during model selection.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1), and then start the drive again.
Oscillation caused by overcurrent (asynchronous motors in V/f control mode)	Use the continuous oscilloscope function of the iFA software tool to check whether the actual excitation (L3224), torque current (L3226), and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the fluctuation range does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. 2. Change the motor control mode to SVC (F0-01 = 0) and perform parameter auto-tuning.
Overcurrent suppression parameters are improperly (asynchronous motor in V/f control mode).	Ensure that overcurrent suppression is enabled (d2-26 = 1). Check whether the overcurrent suppression point (d2-27) and overcurrent suppression Kp/Ki (d2-28/d2-29) are too large or small.	Decrease the overcurrent suppression setpoints Kp/Ki setting first. If the fault persists, increase the setpoint. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.) For details, see *"5.3.2.5 V/f Overcurrent Suppression" on page 504*.

Fault Cause	Confirmation	Solution
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, see *"5.3.2.3 V/f Overvoltage Suppression" on page 498* and *"5.3.2.4 V/f Undervoltage Suppression" on page 501*.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02 to A3-04) are consistent with those on the nameplate.	Set the drive model parameters (A3-02 to A3-04) according to the nameplate label of the drive.
Motor parameters are set improperly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.

Fault Cause	Confirmation	Solution
Braking resistor overcurrent	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. Remove the braking resistor and enable the AC drive to run again. Check whether overcurrent occurs again after the bus voltage increases. If not, the braking resistor is faulty. In this case, check the following: 1. Check whether the braking output is short circuit. 2. Check whether the braking resistor is wired correctly. 3. The resistance of the braking resistor is too small.	1. Re-connect the braking resistor. 2. Replace with a braking resistor of higher resistance.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, check whether violent feedback speed fluctuation, unusual motor noise, motor stall, or slightly continuous reverse rotation occurs. If yes, an exception occurs.	1. Avoid the long-term operation in SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*. 3. Enable IF control (set the tens of d0-85 to 1 for low-speed processing mode). For details, see *" Vector control" on page 430*.
Hardware exception	Ask for technical support.	Ask for technical support.

E002.2: Software overcurrent

Fault reason: The output instantaneous current exceeds the self-defined software overcurrent threshold (A3-54).

Fault Cause	Confirmation	Solution
Output grounding.	Method 1： Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system.	Check the short circuit to ground part. Replace the UVW output cables or motor.
Interphase short circuit occurs on output phases.	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.	Check the short-circuited output phases. Replace the UVW output cables or motor.

Fault Cause	Confirmation	Solution
Speed loop parameter setpoints too high (SVC)	/	1. Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start operating and observe whether the drive can run smoothly. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high parameter setpoints.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Low carrier frequency during high-speed operation	Check whether the carrier frequency set for the motor during high-speed operation is higher than the result of output frequency x 12. If no, control dissipation may result in overcurrent.	The carrier frequency of high-power machines is low by default. In this case, increase the carrier frequency during high-speed motor operation. Calculate derating according to the carrier frequency and select the model according to the derating coefficient.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Oscillation caused by overcurrent (asynchronous motors in V/f control mode)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC.
Overcurrent suppression parameters are improperly (asynchronous motor in V/f control mode).	Ensure that overcurrent suppression is enabled (d2-26 = 1). Check whether the overcurrent suppression point (d2-27) and overcurrent suppression Kp/Ki (d2-28/d2-29) are set to excessively high or low values.	Decrease the overcurrent suppression setpoints Kp/ Ki setting first. If the fault persists, increase the setpoint. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.) For details, see *"5.3.2.5 V/f Overcurrent Suppression" on page 504*.

Fault Cause	Confirmation	Solution
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-54) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, see *"5.3.2.3 V/f Overvoltage Suppression" on page 498* and *"5.3.2.4 V/f Undervoltage Suppression" on page 501*.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.

Fault Cause	Confirmation	Solution
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation of the SVC at speeds close to zero. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see the section "Vector control" in the function guide. For details, see " *Vector control" on page 430*.
The custom software overcurrent threshold (A4-29) is set to excessively low value.	Check whether the custom software overcurrent threshold is excessively low.	Increase the custom software overcurrent threshold.
Hardware fault	Ask for technical support.	Ask for technical support.

E002.3: Phase-W overcurrent

Fault reason: The instantaneous output current of phase W exceeds the overcurrent threshold.

Fault Cause	Confirmation	Solution
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Low carrier frequency during high-speed operation	Check whether the carrier frequency set for the motor during high-speed operation is higher than the result of output frequency x 12. If no, control dissipation may result in overcurrent.	The carrier frequency of high-power machines is low by default. In this case, increase the carrier frequency during high-speed motor operation. Calculate derating according to the carrier frequency and select the model according to the derating coefficient.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Oscillation caused by overcurrent (asynchronous motors in V/f control mode)	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/3226) and operating frequency (U0-00) of the motor are oscillating. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Fault Cause	Confirmation	Solution
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, see *"5.3.2.3 V/f Overvoltage Suppression" on page 498* and *"5.3.2.4 V/f Undervoltage Suppression" on page 501*.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.

Fault Cause	Confirmation	Solution
Braking resistor overcurrent	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. Remove the braking resistor and enable the drive to run again. Check whether overcurrent occurs again after the bus voltage increases. If not, check the following: 1. Whether the braking output is short-circuited. 2. Whether the braking resistor is wired correctly. 3. Whether the resistance of the braking resistor is too low.	1. Re-connect the braking resistor. 2. Select a braking resistor with large resistance.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, the feedback speed fluctuates greatly and abnormal noise, motor stall, or slightly continuous reverse rotation occurs.	1. Avoid the long-term operation of the SVC at speeds close to zero. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see the section "Vector control" in the function guide. For details, see *" Vector control" on page 430*.
Hardware fault	Ask for technical support.	Ask for technical support.

E002.4: Hardware vce fault

Fault reason: Monitored vce signal error

Fault Cause	Confirmation	Solution
Hardware fault	Ask for technical support.	Ask for technical support.

E005.1: Bus overvoltage

Fault reason: The bus voltage exceeds the effective overvoltage threshold (A3-58).

Fault Cause	Confirmation	Solution
Output grounding.	Method 1： Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.
In the power generation state, the braking recovery power is insufficient (synchronous motor/ asynchronous motor in SVC mode).	1. Check whether the motor is in the generating state. 2. Use a multimeter to check whether the braking resistor power is too low. 3. Check whether the braking resistor is connected securely.	1. Increase the deceleration time (F0-49) to reduce the generating power. 2. Replace with a braking resistor of higher power. 3. Re-connect the braking resistor. 4. Enable overvoltage suppression when the load allows (d1-54 = 0). Note： Active loads such as cranes does not support overvoltage suppression.
Sudden removal of the load causes speed overshoot and generation (synchronous motor/ asynchronous motor in SVC mode).	Check whether the actual motor speed increases significantly after the load is suddenly removed. If yes, an exception occurs.	1. Increase the speed loop Kp (F2-02). 2. Add the speed loop Ti (F2-03). The recommended value is 2s.
The value of the speed loop gain is too low, resulting in feedback power generation after feedback speed overshoot when the speed reference reaches the target value (synchronous motor/ asynchronous motor in SVC mode).	Observe whether overvoltage occurs after the speed reaches the target value during acceleration.	1. Increase the speed loop Kp (F2-02) and increase the speed loop Ti (F2-03) to 2s. 2. Enable S-curve (b7-00 = 1) to set the ramp acceleration end arc (F0-51).
Speed loop parameter setpoints too high (SVC)	Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start running and observe whether the drive can run smoothly. If the fault persists, reduce the Kp to half the current value several times. If the fault still occurs, the fault is not caused by the cause.	Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s.
The motor is started during rotation (synchronous/ asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Fault Cause	Confirmation	Solution
V/f oscillation caused by overvoltage (asynchronous motors in V/f control mode)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.
The deceleration time is too short.	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/ deceleration time is a value that must be set by the process. Otherwise, extend the acceleration/ deceleration time properly. 2. Enable overvoltage suppression (F2-39 = 1) for working conditions where requirements on speed following are low. For working conditions where requirements on speed following are high, install a braking resistor. 3. For applications where a braking resistor cannot be installed, increase the excitation current (d0-40 for SVC d0-41 for V/f). In the SVC mode, enable vector overexcitation (d0-39 = 1).
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The starting voltage of the braking unit is too high.	Check whether the effective action voltage of the braking unit (A4-01) reaches the overvoltage threshold (A3-57).	The effective action voltage of the braking unit varies with the voltage level of the machine. Manual modification is not required under normal conditions. In extreme cases, reduce the action voltage of the braking unit (A4-00).
The input voltage is too high.	Check whether the input voltage is within the normal range (380 V to 480 V).	1. Reduce the input voltage to a value within the normal range (380 V to 480 V). 2. Increase the overvoltage suppression action voltage (F2-40) and the braking unit action voltage (A4-00).

Fault Cause	Confirmation	Solution
The overvoltage suppression parameters are set improperly.	Enable overvoltage suppression (d1-39 = 1) and check whether the overvoltage suppression Kp/Ki (d1-57/d1-58) is set to excessively low or high values (based on actual operating conditions).	Decrease the setpoint of kp or ki first. If the fault persists, increase the setpoint again. In addition, for large inertia models, reduce the setpoint further. Adjust the overvoltage suppression Kp/Ki (d1-57/58). For details, see *"5.3.2.3 V/f Overvoltage Suppression" on page 498*.
The synchronous motor triggers a fault after overspeed or coasts to stop manually. Overspeed occurs on the synchronous motor. The synchronous motor coasts to stop manually or to coasts to stop upon fault.	Check whether the output voltage (F1-12 x U0-00 x 1.414) of the synchronous motor exceeds the overvoltage threshold A4-39. If yes, interruption of the operation may result in overvoltage, leading to explosion of the drive. Note: When the synchronous motor overspeed occurs, the output voltage (F1-12 x U0-00 x 1.414) can be much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time, leading to back EMF short circuit in the output diode during switch-on in the reverse direction.	1. Limit the speed upper limit by setting d1-03 (Digital setting of positive frequency upper limit) to a value lower than or equal to A4-39/(1.414 x F1-12). 2. Replace with a motor with a higher back EMF. Note: A motor with high back EMF can effectively reduce the output current. However, operating at a speed above the limit may result in damage caused by overvoltage.

E008.1: Frequent contactor action

Fault reason: When the AC drive is not powered off, soft start is triggered on the relay multiple times within a short period of time.

Fault Cause	Confirmation	Solution
The grid inlet contactor is faulty.	/	Replace the inlet contactor.
ON/OFF operations are performed frequently.	/	Ensure that the input voltage is within the normal range (380 V to 480 V) or wait until the input voltage stabilizes.
The pre-charge contactor of the drive is faulty.	/	Ask for technical support.

E009.1: Bus undervoltage

Fault reason: The bus voltage is lower than the unervoltage threshold (A3-56).

Fault Cause	Confirmation	Solution
Input phase loss exists.	Measure whether the line voltages between RS, ST, and RT are symmetrical at the mains input side.	Check whether the input switches, contactors, and wiring terminals are abnormal and re-connect them.
Power dip occurs and the grid voltage is unstable.	Check whether undervoltage occurs in other devices in the same cabinet at the same time. Note: Undervoltage is mostly caused by power dip.	In load scenarios such as wind turbines, water pumps, air compressors, and electric drums, enable undervoltage suppression (d1-63 = 1). Note: When undervoltage suppression is enabled (d1-63 = 1), a brief speed drop occurs during undervoltage suppression and the drive converts the motor kinetic energy into electrical energy to stabilize the bus voltage, preventing the undervoltage fault.

Fault Cause	Confirmation	Solution
The input voltage is too low.	1. Check whether the input voltage is within the normal range (380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the upstream circuit breaker or contactor is normal.
The undervoltage suppression parameters are set improperly.	1. Check whether undervoltage suppression (d1-63 = 1) is enabled and whether the undervoltage suppression Kp/Ki (d1-66/-67) are set to excessively high or low values. 2. During undervoltage suppression, undervoltage fault is triggered when the actual speed is lower than the minimum operating frequency (d1-72) of undervoltage suppression. In this case, the drive stops.	1. Adjust the undervoltage suppression Kp/Ki (d1-66/67). Decrease the setpoint first. If the fault persists, increase the setpoint again. 2. If you need to run with a low speed, modify the minimum operating frequency (d1-72) for undervoltage suppression. For details, see *"5.3.2.4 V/f Undervoltage Suppression" on page 501*.
Undervoltage occurs during motor oscillation	Check whether the output torque (U0-06) and bus voltage (U0-02) are subject to large oscillation (fluctuation above 10%) in the same frequency as that of bus fluctuation.	Rectify the motor oscillation fault.
The pre-charge contactor is abnormal and the pre-charge resistor cannot be disconnected properly.	Check whether the undervoltage fault occurs after power-on, whether the bus recovers after stop, and whether the undervoltage fault disappears after stop.	Contact technical support to replace the relay.
Hardware error (circuit board)	/	Ask for technical support.

E009.3: Pre-drive timeout

Fault reason: The bus voltage falls below the undervoltage threshold (A3-56) within the specified time after the start command is triggered.

Fault Cause	Confirmation	Solution
The input circuit is not connected properly.	Check whether cables are connected properly.	Reconnect the AC drive.
The input voltage is excessively low.	Check whether the input voltage is within the normal range (380 V to 480 V).	Increase the input voltage to a value within the normal range (380 V to 480 V).
Hardware error (circuit board)	If the input fault persists, the hardware may be damaged.	Ask for technical support.

E010.1: Servo drive overload

Fault reason: The cumulative overload coefficient (L3208) of the AC drive reaches 100%.

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC mode at speeds closed to 0. 2. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see "*Vector control* on page 430.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see "*4.6.1 Asynchronous Motor Parameter Auto-tuning* on page 133.

Fault Cause	Confirmation	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/ deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/ deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/ frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/ asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Fault Cause	Confirmation	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The drive power class is too small	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/(1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Derated operation applies due to long-term operation at low frequencies.	Check whether the current operating frequency is 0 Hz to 5 Hz at low frequency. If yes, the system is in the low-frequency derating range. (In this range, the power of the drive is lower than the rated power.) Note 1: During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. Note 2: When the frequency is in the low frequency range from 0 Hz to 5 Hz, the derating is reduced from 20% to 0%.	Replace with a drive of higher power.

Fault Cause	Confirmation	Solution
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Derating occurs due to excessive carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.

E010.2: PCB overload

Fault Cause	Confirmation	Solution
The cumulative PCB overload curve reaches 100%	/	1. The internal heat of the drive is too large. Stop for one minute and run. 2. The ambient temperature is higher. Lower the ambient temperature.

E011.1: Motor overload

Fault reason: The cumulative overload coefficient (L3210) of the motor reaches 100%.

Fault Cause	Confirmation	Solution
The load is too heavy.	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

Fault Cause	Confirmation	Solution
The input voltage is too low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the inlet switch is normal.
The motor overload protection coefficient (d1-46) is set to an excessively low value.	/	1. Increase the motor overload protection coefficient (d1-46). 2. If the fault persists after long-term operation, switch off the motor overload protection (d1-45 = 0).

E012.1/A012.1/L012.1/N012.1: Input phase loss

Fault reason: Input phase loss is detected in the hardware circuit.

Fault Cause	Confirmation	Solution
The input cables of the AC drive are connected improperly.	Check whether the input cables of the drive are connected properly.	Re-connect the AC drive according to *"3.2 Electrical Connection" on page 62*.
The input voltage is too low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the inlet switch is normal.
The diode of the AC drive is damaged.	/	Ask for technical support.

E013.1: U phase loss

Fault reason: The phase U current in the operating state is much lower than the other two phases.

Fault Cause	Confirmation	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit trips.	Close the output contactor or brake.
The motor is faulty.	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.2: V phase loss

Fault reason: The phase V current in the operating state is much lower than the other two phases.

Fault Cause	Confirmation	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit trips.	Close the output contactor or brake.
The motor is faulty.	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.3: W phase loss

Fault reason: The phase W current in the operating state is much lower than the other two phases.

Fault Cause	Confirmation	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit trips.	Close the output contactor or brake.
The motor is faulty.	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E014.1: Drive overtemperature

Fault reason: The power module temperature exceeds the overtemperature threshold (A3-51.)

Fault Cause	Confirmation	Solution
Over-high ambient temperature	Measure the ambient temperature to check whether it is higher than 50℃.	Lower the ambient temperature.
The air filter is blocked.	Check whether the air filter of the fan is blocked.	Clean the air filter.
The fan is damaged.	After cooling down, start the AC drive and observe whether the fan rotates.	Replace the fan.
The thermistor of the module is damaged.	Ask for technical support.	Ask for technical support.
The module is damaged.	The fault persists after the preceding measures are taken.	Ask for technical support.

E015.1/A015.1/L015.1/N015.1: External fault 1

Fault reason: The signal state that corresponds to external fault 1 (H2-00) is high level.

Fault Cause	Confirmation	Solution
The input signal is activated.	Check whether the state of the input signal corresponding to external fault 1 (H2-00) is high level (H2-00 = 1).	Restore the state of the external fault 1 (H2-00) input signal to low level (H02-00 = 0).

E015.2/A015.2/L015.2/N015.2: External fault 2

Fault reason:

Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level.

Fault Cause	Confirmation	Solution
The input signal is activated.	Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level (H2-00 = 0).	Restore the state of the external fault 2 (H2-01) input signal to high level (H2-00 = 1).

E018.1: Current detection circuit fault

Fault reason: The current zero drift detected in the stop state is excessively high.

Fault Cause	Confirmation	Solution
The current sampling hardware is abnormal.	Ask for technical support.	Ask for technical support.

E019.1: Motor auto-tuning timeout

Fault reason: The auto-tuning is not completed for a long time.

Fault Cause	Confirmation	Solution
Motor parameters are set incorrectly.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.2: Motor auto-tuning is interrupted.

Fault reason: Auto-tuning interruption

Fault Cause	Confirmation	Solution
The drive stops during parameter auto-tuning.	Check whether the drive stops during parameter auto-tuning.	Perform parameter auto-tuning again.
Voltage dip occurs during parameter auto-tuning.	Check whether transient power off occurs due to input voltage fluctuation.	Wait for the input voltage to stabilize before starting the drive. If power-on fails for a long time, check if the main contactor and grid are normal.

E019.4: Back EMF auto-tuning is abnormal.

Fault reason: The auto-tuned back EMF is not within the allowable range.

Fault Cause	Confirmation	Solution
The load is too heavy or the motor is stalled.	21. During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is large, the load is too heavy. 2. Check whether the brake releases normally.	1. Reduce the load. 2. Release the brake.
The motor does not rotate.	/	Remove the brake or device that prevents the motor from rotating.
Overcurrent occurs during auto-tuning of the magnetic pole position.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may result in overcurrent in magnetic pole position auto-tuning.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.5: The motor type is incorrect.

Fault reason: The motor auto-tuning mode (F1-69) does not match the motor type (F1-00).

Fault Cause	Confirmation	Solution
The motor type setting is incorrect.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.6: The current sampling phase-to-phase gain deviation auto-tuning error occurs.

Fault reason: This fault is reported when the current sampling gain deviation between UV/VW phases is higher than that set by the software.

Fault Cause	Confirmation	Solution
The current sampling phase-to-phase gain deviation auto-tuning error occurs.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may lead to abnormal auto-tuning of gain deviation between current sampling phases.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.7: Auto-tuned no-load current exceeds the limit.

Fault reason: This fault is triggered when the no-load current is not within the allowable range specified by the software.

Fault Cause	Confirmation	Solution
The auto-tuned no-load current result is abnormal.	Check the no-load current (C4-30) of the asynchronous motor. If the value is not within 20% to 50% of the rated motor current (C4-04), the auto-tuned values are abnormal.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E020.1 Encoder cable hardware disconnected

Fault Cause	Confirmation	Solution
The encoder is damaged.	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder power supply is faulty.	Check whether the power cable of the encoder is properly connected.	Ensure the encoder is powered properly.
The encoder connection is faulty.	1. Check whether the AB connection of the encoder is correct. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
The encoder disconnection detection setting is abnormal.	1. Check whether C0-01 bit3 hardware disconnection detection is set incorrectly. 2. Check whether d7-02/dF-02/y7-02/yF-02 is set incorrectly.	Set encoder disconnection hardware detection mode (C0-01) properly. 2. Set FVC switchover SVC mode to 2. The switch will be switched to SVC after the switch is disconnected. The encoder disconnection fault will be reported after stop.
The encoder does not support setting the baud rate	1. Modify different baud rates and click Reset to see whether the fault disappears. 2. Check whether the current set baud rate is supported through the encoder manual	1. Set the baud rate correctly. 2. Check the encoder manual to confirm that the encoder supports the current set baud rate.
Wrong number of single-turn/ multi-turn bits of communication-type encoder	Check whether the number of single-turn/multi-turn bits of the communication encoder is consistent with the encoder nameplate or manual.	Set single-turn bits (C0-51) and multi-turn bits (C0-52) of the communication encoder correctly.
The encoder cable is incorrect or too long	1. Modify the encoder baud rate to the minimum baud rate supported in the encoder manual. Click Reset to see whether the fault disappears. 2. Check whether the cable is longer than the cable length described in the encoder card manual. 3. Check whether the cable specifications are recommended in the encoder card manual.	1. Decrease the baud rate gradually and click Reset until the fault disappears. 2. Replace the cable with the recommended cable in the encoder card manual and not longer than the recommended length.
The encoder type is incorrectly set.	Check whether the encoder type is incorrectly set.	Set the encoder type C0-01 correctly
Other causes	Ask for technical support.	Ask for technical support.

E020.2: Encoder PPR error

Fault Cause	Confirmation	Solution
The encoder PPR is set incorrectly.	Check whether the encoder resolution C0-02 is set correctly.	Set the encoder resolution C0-02 correctly
Encoder abnormality	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder feedback speed differs from the actual motor speed.	Run the motor in SVC mode and check whether the actual motor frequency (U0-19) is equal to the feedback speed (U0-29).	The PPR of the ABZ encoder is wrong or the number of resolver pole pairs is wrong.
Other causes	Ask for technical support.	Ask for technical support.

E020.3: There is no feedback from the encoder.

Fault Cause	Confirmation	Solution
The encoder connection is faulty.	Check and ensure that the encoder wiring is secure.	Ensure that the encoder cable is connected properly.
The encoder PPR is set incorrectly.	Check whether the encoder resolution C0-02 is set correctly	Set the encoder resolution C0-02 correctly
Wrong number of single-turn and multi-turn bits of communication-type encoder	Check whether the number of single-turn/multi-turn bits of the communication encoder is consistent with the encoder nameplate or manual.	Set single-turn bits (C0-51) and multi-turn bits (C0-52) of the communication encoder correctly.
Other causes	Ask for technical support.	Ask for technical support.

E020.4: The encoder direction is wrong.

Fault Cause	Confirmation	Solution
The encoder phase sequence is wrong.	Check the phase sequence of encoder according to *"5.3.4.2.2 Input Phase Sequence of Encoder" on page 546*.	Set the phase sequence of the encoder (C0-03) correctly
Other causes	Ask for technical support	Ask for technical support

E020.5: Encoder software disconnected

Fault Cause	Confirmation	Solution
The encoder is damaged.	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder power supply is faulty.	Check whether the power cable of the encoder is properly connected.	Ensure the encoder is powered properly.
The encoder connection is faulty.	1. Check whether the AB connection of the encoder is correct. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
Other causes	Ask for technical support	Ask for technical support.

E020.6: Motor stall during zero position auto-tuning

Fault Cause	Confirmation	Solution
During zero position angle auto-tuning with load auto-tuning, the motor stalled.	1. Check whether the motor brake is not released. 2. Check whether the motor has a large load and cannot rotate.	Ensure that the motor rotates freely.
Set encoder PPR correctly.	Check whether the number of encoder PPR in the encoder manual or nameplate is consistent with the value of C0-02.	Set the encoder PPR (C0-02) correctly.
The encoder phase sequence is wrong.	Check the phase sequence of encoder according to *"5.3.4.2.2 Input Phase Sequence of Encoder" on page 546*.	Set the phase sequence of the encoder (C0-03) correctly
Other causes	Ask for technical support	Ask for technical support.

E020.7: Z signal interference

Fault Cause	Confirmation	Solution
1. The Z signal of the incremental encoder interferes. 2. The AB pulse of the incremental encoder interferes.	/	Note: This fault is reported only when ABZ encoder or sin/cos encoder is used by the synchronous motor in FVC mode. 1. Check whether the wiring is normal. 2. Check whether the encoder is normal. 3. Check whether the encoder shield is grounded at the AC drive. 4. Check whether the motor housing is grounded.

E020.8: The Z signal is lost.

Fault Cause	Confirmation	Solution
Z signal of the incremental encoder loss	/	1. Connect the three-phase power supply to the AC drive properly. 2. Connect the ground of the output motor properly to the AC drive. 3. Connect the shield of the encoder cable to the PE interface of the PG card

E020.9: Encoder pulse interference

Fault Cause	Confirmation	Solution
The encoder is not grounded properly	Check the encoder and motor grounding.	Ask for technical support
The encoder is not grounded properly.	Ask for technical support	This fault is reported only during self-check of the encoder.

E021.1: Uninterrupted operation on the EEPROM timeout

Fault reason: The continuous operation of the EEPROM exceeds 60 seconds.

Fault Cause	Confirmation	Solution
EEPROM read-write is abnormal.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for parameter writing is correct and whether the RAM address mapping for each group of parameters is correct. If the fault persists after the preceding two causes are ruled out, the EEPROM chip may be damaged.	1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.2: EEPROM read fault

Fault reason: EEPROM parameter read failure

Fault Cause	Confirmation	Solution
EEPROM read-write is abnormal.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for parameter writing is correct and whether the RAM address mapping for each group of parameters is correct. If the fault persists after the preceding two causes are ruled out, the EEPROM chip may be damaged.	1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.3: EEPROM write fault

Fault reason: EEPROM parameter write failure

Fault Cause	Confirmation	Solution
EEPROM read-write is abnormal.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for parameter writing is correct and whether the RAM address mapping for each group of parameters is correct. If the fault persists after the preceding two causes are ruled out, the EEPROM chip may be damaged.	1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.4: The number of write-read operations on the EEPROM exceeds the setpoint within 1s.

Fault reason: The number of read/write operations in 1s exceeds the value of P0-62.

Fault Cause	Confirmation	Solution
EEPROM read-write is abnormal.	Check through the host controller whether the memory operation on the user side within 1s is frequent.	Reduce the number of write/read operations within 1s.

E021.5: The internal buffer of the EEPROM exceeds the limit.

Fault reason: The number of EEPROM operations exceeds the number of EEPROM operation queues.

Fault Cause	Confirmation	Solution
The internal buffer of the EEPROM exceeds the limit.	In the case of parameter writing through communication, check through the host controller whether the write operation is too frequent.	Reduce the number of write operations within 1s.

E022.1: Encoder card not activated

Fault Cause	Confirmation	Solution
The PG card is not activated during operating in the FVC mode.	/	/

E022.4: Resolver encoder card overtemperature

Fault Cause	Confirmation	Solution
The resolver encoder temperature is too high.	Scan the encoder card chip temperature through thermograph.	1. Reduce the temperature of the encoder card. 2. Contact the manufacturer for technical support.

E022.5: Orientation deviation

Fault Cause	Confirmation	Solution
1. The encoder mounting angle is not auto-tuned (C0-04). 2. The encoder slides with the motor shaft. 3. The angle of magnetic pole position auto-tuning is incorrect. 4. The Z signal may be disturbed.	/	1. Perform auto-tuning again. 2. Check whether the encoder is installed loosely. 3. Increase the magnetic pole position auto-tuning current (d0-75). Select auto-adaption for magnetic pole position auto-tuning method (d0-71). High-frequency injection is recommended for the cam motor. 4. Ask the manufacturer for service

A022.6: The Z signal is lost.

Fault Cause	Confirmation	Solution
Z signal of the incremental encoder loss	/	Note: This fault is reported only when ABZ encoder or sin/cos encoder is used by the synchronous motor in FVC mode. 1. Check for correct wiring. 2. Ensure a normally functioning encoder.

E022.7: Encoder card communication abnormal

Fault Cause	Confirmation	Solution
1. The encoder card is not installed. 2. The communication between the control board and the encoder card is abnormal.	/	1. Check whether the encoder card is installed. 2. Check whether the encoder card is installed securely. 3. Replace the encoder card with a new one. 4 Contact the manufacturer for service

E022.8: The encoder communication is abnormal.

Fault Cause	Confirmation	Solution
The communication between the encoder card and the encoder is abnormal	/	1. Check whether the encoder is disconnected. 2. Check the encoder software version. 3. Replace the encoder card with a new one. 4. Ask for manufacturer service

E023.1: Drive output short-circuited to ground

Fault reason: Check the current exists between the output phase and ground.

Fault Cause	Confirmation	Solution
Output grounding.	Method 1： Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.

E026.1/A026.1/L026.1/N026.1: Running time reached

Fault reason: The accumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).

Fault Cause	Confirmation	Solution
The cumulative operating time reaches the set value.	Check that the cumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).	Set parameter initialization (A0-00) to 2 to clear the accumulative running time.

E027.1/A027.1/L027.1/N027.1: User-defined fault 1

Fault reason: Custom fault 1 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 1 source is valid (H2-02 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 1 to "Inactive" (H2-02 = 0) and disable the fault.

E027.2/A027.2/L027.2/N027.2: User-defined fault 2

Fault reason: Custom fault 2 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 2 source is valid (H2-03 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 2 to "Inactive" (H2-03 = 0) and disable the fault.

E027.3/A027.3/L027.3/N027.3: User-defined fault 3

Fault reason: Custom fault 3 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 3 source is valid (H2-04 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 3 to "Inactive" (H2-04 = 0) and disable the fault.

E027.4/A027.4/L027.4/N027.4: User-defined fault 4

Fault reason: Custom fault 4 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 4 source is valid (H2-05 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 4 to "Inactive" (H2-05 = 0) and disable the fault.

E027.5/A027.5/L027.5/N027.5: User-defined fault 5

Fault reason: Custom fault 5 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 5 source is valid (H2-06 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 5 to "Inactive" (H2-06 = 0) and disable the fault.

E027.6/A027.6/L027.6/N027.6: User-defined fault 6

Fault reason:

Custom fault 6 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 6 source is valid (H2-07 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 6 to "Inactive" (H2-07 = 0) and disable the fault.

E027.7/A027.7/L027.7/N027.7: User-defined fault 7

Fault reason: Custom fault 7 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 7 source is valid (H2-08 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 7 to "Inactive" (H2-08 = 0) and disable the fault.

E027.8/A027.8/L027.8/N027.8: User-defined fault 8

Fault reason: Custom fault 8 triggered

Fault Cause	Confirmation	Solution
The signal of custom fault is inputted through the concatenator.	Check whether the custom fault 8 source is valid (H2-09 = 1). This fault is reported when the fault source is active.	Set the source of custom fault 8 to "Inactive" (H2-09 = 0) and disable the fault.

E028.1/A028.1/L028.1/N028.1: User-defined alarm 1

Fault reason: Custom alarm 1 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 1 is valid (H2-10 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 1 to "invalid" (H2-10 = 0).

E028.2/A028.2/L028.2/N028.2: User-defined alarm 2

Fault reason: Custom alarm 2 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 2 is valid (H2-11 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 2 to "invalid" (H2-11 = 0).

E028.3/A028.3/L028.3/N028.3: User-defined alarm 3

Fault reason: Custom alarm 3 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 3 is valid (H2-12 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 3 to "invalid" (H2-12 = 0).

E028.4/A028.4/L028.4/N028.4: User-defined alarm 4

Fault reason: Custom alarm 4 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 4 is valid (H2-13 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 4 to "invalid" (H2-13 = 0).

E028.5/A028.5/L028.5/N028.5: User-defined alarm 5

Fault reason: Custom alarm 5 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 5 is valid (H2-14 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 5 to "invalid" (H2-14 = 0).

E028.6/A028.6/L028.6/N028.6: User-defined alarm 6

Fault reason: Custom alarm 6 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 6 is valid (H2-15 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 6 to "invalid" (H2-15 = 0).

E028.7/A028.7/L028.7/N028.7: User-defined alarm 7

Fault reason: Custom alarm 7 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 7 is valid (H2-16 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 7 to "invalid" (H2-16 = 0).

E028.8/A028.8/L028.8/N028.8: User-defined alarm 8

Fault reason: Custom alarm 8 triggered

Fault Cause	Confirmation	Solution
The user-defined alarm is input through the connector.	Check whether the source of custom alarm 8 is valid (H2-17 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 8 to "invalid" (H2-17 = 0).

E029.1/A029.1/L029.1/N029.1: Accumulative power-on time reached

Fault reason: Check whether the cumulative power-on time (Ad-02 and Ad-03) has reached the set power-on time threshold (P0-16 and P0-18).

Fault Cause	Confirmation	Solution
The cumulative power-on time reaches the set value.	Defines whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set power-on time (P0-16 and P0-18).	Set parameter initialization (A0-00) to 2 to clear the cumulative power-on time.

E030.1/A030.1/L030.1/N030.1: Output three-phase loss

Fault reason: When the three-phase loss protection is enabled, this fault is triggered when the three-phase output current keeps lower than the three-phase output phase loss detection threshold (d1-84) for the time defined by d1-85 (Three-phase output phase loss detection time).

Fault Cause	Confirmation	Solution
The AC drive runs without the motor.	Check whether the output cables of the drive are connected properly.	Reconnect the AC drive.

E031.1/A031.1/L031.1/N031.1: PID feedback lost

Fault Cause	Confirmation	Solution
PID feedback is not within the loss detection range.	Check the input value of the corresponding PID feedback source according to the setpoint of PID feedback source selection (P2-04). For example, when the PID feedback source is set to "0: AI1", the input value of the PID feedback source is AI1. Determine whether the PID feedback value is higher than the upper limit of PID detection (P2-30) or lower than the lower limit of PID detection (P2-31).	Adjust the input value of the PID feedback source or set the PID feedback parameter (P2-30\P2-31) properly to ensure that the PID feedback value is within the upper and lower limits of PID detection. Increase the upper limit of PID detection (P2-30) by 10% in sequence, or decrease the lower limit of PID detection (P2-31) by 10% in sequence.

E032.1/A032.1/L032.1/N032.1: Parameter reset fault

Fault reason: When parameter reset is performed through parameter initialization (A0-00), the execution fails.

Fault Cause	Confirmation	Solution
Parameter reset improperly	When parameter reset is performed through parameter initialization (A0-00), the execution fails.	Perform parameter initialization (A0-00) again.

E032.2/A032.2/L032.2/N032.2: Parameter backup fault

Fault reason: Parameter backup by setting the user backup (A0-39) parameter fails.

Fault Cause	Confirmation	Solution
Parameter backup error	Parameter backup by setting the user backup (A0-39) parameter fails.	Perform parameter backup again.

E032.4/A032.4/L032.4/N032.4: Parameter setting incorrect

Fault reason: Improper parameter setting

Fault Cause	Confirmation	Solution
Parameter setting error	1. If the value of U2-98 (Prompt for parameter setting error) is 1, the parameter setting is incorrect. 2. Check the user load curve of group P0 is correct. In group P0, check whether the x-coordinate increases in sequence. If not, a fault occurs. In group P0, check whether the lower limit exceeds the upper limit in the x-coordinate. If yes, a fault occurs.	Ensure that the user load curve in group P0 is set correctly. The x-coordinate must be increased by 1/2/3 in sequence, and the upper limit must be greater than the lower limit.

E032.6/A032.6/L032.6/N032.6: Parameter power-on check error

Fault reason: Attributes of parameters read through EEPROM upon power-on are incorrect. For example, the parameter value read is not within the upper and lower limits.

Fault Cause	Confirmation	Solution
Parameter check error upon power-on	When the parameter check at power-on is abnormal and the 16-bit parameter error type (U2-95) is not 0, it indicates a parameter check exception occurs.	Ask for technical support

E032.7/A032.7/L032.7/N032.7: Parameter backup invalid

Fault reason: Parameter backup failed

Fault Cause	Confirmation	Solution
The number of backup parameters exceeds the upper limit.	When the value of U2-99 is 1, it indicates that the number of backup parameters exceeds the upper limit (A0-39).	After clearing the parameter backup record, perform parameter backup again.

E032.8/A032.8/L032.8/N032.8: Parameter power-on initialization error

Fault reason: Parameter power-on initialization fails.

Fault Cause	Confirmation	Solution
Error occurs on parameter initialization upon power-on	When the value of the power-on initialization completion flag (U2-91) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E032.9/A032.9/L032.9/N032.9: Parameter attribute change error

Fault reason: The parameter setpoint exceeds the upper and lower limits.

Fault Cause	Confirmation	Solution
Parameter attribute change error	When the value of the power-on initialization completion flag (U2-92) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E040.1: Pulse-by-pulse current limiting fault

Fault reason: This fault is reported when the output current exceeds the pulse-by-pulse limit and the duration of the pulse-by-pulse limit reaches the threshold in the V/f control mode of asynchronous motor.

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The power rating of the AC drive is too low.	The rated current of motor (F1-04) is higher than that of the drive (A3-03).	Reduce the load or replace with a drive of higher power rating.

Fault Cause	Confirmation	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/ deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/ deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Output grounding.	Method 1： Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see *"5.3.3.5 Self-test" on page 518*.	Check the short circuit to ground part. Replace the UVW output cables or motor.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Interphase short circuit occurs on output phases.	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.	Check the inter-phase short circuit part and replace the motor or cable.
V/f oscillation (asynchronous motor V/f)	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/3226) and operating frequency (U0-00) of the motor are oscillating. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether oscillation gets weaker. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, use the SVC mode.
Output phase loss occurs.	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. Method 2: Enable manual self-test (C2-04 = 1) and run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.

Fault Cause	Confirmation	Solution
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	1. Check whether the manual torque boost value (d2-14) is set to an excessively high value. 2. When the torque boost mode is "automatic" or "manual+automatic", check whether the stator resistance (F1-20) is auto-tuned.	1. Reduce the manual torque boost value and enable the drive to run again. 2. Perform static partial auto-tuning of the asynchronous motor (F1-69 = 1) and enable the drive to run again.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

E042.1/A042.1/L042.1/N042.1: Excessive speed deviation

Fault reason: The deviation between the actual motor speed and the set speed is higher than the threshold (d1-40), and such status keeps after the time defined by d1-39 elapses.

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation of the SVC at speeds close to zero. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see “*Vector control” on page 430*.

Fault Cause	Confirmation	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 2), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).

Fault Cause	Confirmation	Solution
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches the generating/motoring power limit (d1-13 to d1-17).	Increase the power limit (d1-13/d1-14) properly.

E042.2/A042.2/L042.2/N042.2: The actual speed is the opposite of the set speed

Fault reason: The actual speed is in opposite direction to the set speed.

Fault Cause	Confirmation	Solution
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation of the SVC at speeds close to zero. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the tens of the low-speed processing mode d0-85) to 1. For details, see " *Vector control" on page 430*.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Fault Cause	Confirmation	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

E043.1/A043.1/L043.1/N043.1: Motor overspeed

Fault reason: This fault is reported when the actual motor speed exceeds the overspeed protection threshold (d1-37) and such status lasts after the time defined by d1-36 elapses.

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

Fault Cause	Confirmation	Solution
The power rating of the AC drive is too low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The motor overspeed detection parameter is set improperly.	Check whether the motor overspeed detection parameters (d1-36/d1-37) meet the requirements of the current operating conditions. If the detection parameters can override the actual motor speed change range, the parameters comply.	Set the detection parameters (d1-36 and d1-37) properly as needed so that the motor overspeed detection parameters can cover the actual speed change range of the motor.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-02) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches the generating/motoring power limit (d1-13 to d1-17).	Increase the power limit (d1-13/d1-14) properly.
The startup torque is too large during torque control.	Check whether the motor control mode is torque control (F0-02 = 1) and whether a large torque reference is set.	Do not start in the torque control mode with a large torque reference at no load.

E043.2/A043.2/L043.2/N043.2: SVC stall of asynchronous motor

Fault reason: This fault is triggered when the actual motor speed exceeds the asynchronous motor SVC runaway protection threshold (d1-92) and lasts for the time defined by d1-91.

Fault Cause	Confirmation	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

E045.1/A045.1/L045.1/N045.1: Motor overtemperature

Fault reason: The read-out temperature of the expansion card is higher than the motor overtemperature protection threshold (E2-76).

Fault Cause	Confirmation	Solution
The cable of the temperature sensor becomes loose.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor overtemperature occurs.	Check whether the motor temperature is higher than the motor overtemperature protection threshold (E2-76).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor overtemperature protection threshold is set to an excessively low value.	Check whether the motor overtemperature protection threshold (E2-76) is set to an excessively low value.	Increase the motor overtemperature protection threshold (90℃ to 100℃ for normal motors).

E045.2/A045.2/L045.2/N045.2: Motor pre-overheat

Fault reason: The read-out temperature of the expansion card is higher than the motor pre-overtemperature alarm threshold (E2-75).

Fault Cause	Confirmation	Solution
The cable of the temperature sensor becomes loose.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor overtemperature occurs.	Check whether the motor temperature is higher than the motor overtemperature protection threshold (E2-75).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor pre-overtemperature alarm threshold is too low.	Check whether the motor pre-overtemperature alarm threshold (E2-75) is set to an excessively low value.	Increase the motor overtemperature protection threshold (90℃ to 100℃ for normal motors).

E046.1: Load monitoring overload fault

Fault reason: Load monitoring overload action (P0-68) is selected as fault. The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 for the time defined by P0-85 (Permissible overload time).

Fault Cause	Confirmation	Solution
Load monitoring parameters are set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.2: Load monitoring overload alarm

Fault reason: Load monitoring overload action (P0-68) is selected as a alarm. The load monitoring signal keeps exceeding the lower limit of the load set by P0-75 to P0-79 after the time defined by P0-85 (Permissible overload time) elapses.

Fault Cause	Confirmation	Solution
Load monitoring parameters are set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E046.3 Load monitoring load loss fault

Fault reason: Load monitoring load loss action (P0-69) is selected as fault. The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 after the time defined by P0-86 (Permissible load loss time) elapses.

Fault Cause	Confirmation	Solution
Load monitoring parameters are set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.4: Load monitoring load loss alarm

Fault reason: Load monitoring load loss action (P0-69) is selected as a alarm. The load monitoring signal keeps exceeding the lower limit defined by P0-80 to P0-84 after the time defined by P0-86 (Permissible load loss time) elapses.

Fault Cause	Confirmation	Solution
Load monitoring parameters are set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E047.1: STO1 disconnection

Fault reason: The 24 V input detection of STO1 fails.

Fault Cause	Confirmation	Solution
The STO1 signal is disconnected.	Check whether the 24 V power supply of STO1 is normal.	Ensure that the STO1 is connected properly.

E047.2: STO2 disconnection

Fault reason: The 24 V input detection of STO2 fails.

Fault Cause	Confirmation	Solution
The STO2 signal is disconnected.	Check whether the 24 V power supply of STO2 is normal.	Ensure that the STO2 is connected properly.

E047.3: STO circuit power supply fault

Fault reason: The power supply of some components of the STO circuit is abnormal.

Fault Cause	Confirmation	Solution
Undervoltage or overvoltage occurs on the STO circuit.	Check whether the control board power supply is normal.	Check whether the control board is normal. If the control board is abnormal, replace the control board.

E047.4: The STO circuit input subsystem fault

Fault Cause	Confirmation	Solution
The STO circuit input subsystem is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Ask for technical support

E047.5: STO BUFFER chip fault

Fault Cause	Confirmation	Solution
The STO buffer chip is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Ask for technical support

E047.7: STO FLASH check error

Fault Cause	Confirmation	Solution
The STO FLASH check fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Ask for technical support

E047.8: STO RAM check error

Fault Cause	Confirmation	Solution
The STO RAM check fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Ask for technical support

E047.9: STO check configuration failure

Fault Cause	Confirmation	Solution
Configuration of the STO function safety library fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Ask for technical support

E051.1: Magnetic pole position auto-tuning abnormal

Fault reason: The magnetic pole position auto-tuning is interrupted due to an exception.

Fault Cause	Confirmation	Solution
A pole position auto-tuning error occurs.	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. Method 2: Enable manual self-test (C2-04 = 1) and run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.

E056.1: Self-test interruption

Fault reason: A stop command is sent during system auto-inspection, leading to unusual interruption.

Fault Cause	Confirmation	Solution
The self-test process is interrupted.	Check whether the AC drive stops during the self-test.	Perform the self-test again and ensure that no stop command is entered during the self-test.
A fault occurs during the self-test	Check whether any other fault is reported.	Rectify the fault reported.

E056.2: Phase U upper bridge IGBT is short-circuited.

Fault reason: IGBT-monitored VCE signal error

Fault Cause	Confirmation	Solution
VCE signal exception of phase U upper bridge IGBT	Ask for technical support	Ask for technical support

E056.3: Phase U lower bridge IGBT is short-circuited.

Fault reason: IGBT-monitored VCE signal error

Fault Cause	Confirmation	Solution
VCE signal exception of phase U lower bridge IGBT	Ask for technical support	Ask for technical support

E056.4: Phase V upper bridge IGBT is short circuited.

Fault reason: IGBT-monitored VCE signal error

Fault Cause	Confirmation	Solution
The VCE signal of phase V upper bridge IGBT is detected to be abnormal.	Ask for technical support	Ask for technical support

E056.5: Phase V lower bridge IGBT is short-circuited.

Fault reason: IGBT-monitored VCE signal error

Fault Cause	Confirmation	Solution
The VCE signal of phase V lower bridge IGBT is abnormal.	Ask for technical support	Ask for technical support

E056.9: Output phase loss during self-test

Fault reason: Phase loss occurs on the cable connecting the drive and motor.

Fault Cause	Confirmation	Solution
Output phase loss is detected during self-test of the drive.	Perform manual self-test (C2-04 = 1) and start the drive to check whether output phase loss exists.	Re-connect the output circuit of the drive.

E057.1: Phase U upper bridge or phase V lower bridge IGBT cannot be switched on

Fault reason: U+V- IGBT open circuit is detected

Fault Cause	Confirmation	Solution
The phase U upper bridge or phase V lower bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.2: U phase lower bridge or V phase upper bridge IGBT continuity failure

Fault reason: U+V- IGBT open circuit is detected

Fault Cause	Confirmation	Solution
The phase U lower bridge or phase V upper bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.3: V phase upper bridge or W phase lower bridge IGBT continuity failure

Fault reason: V+W-IGBT open circuit is detected.

Fault Cause	Confirmation	Solution
The phase V upper bridge or phase W lower bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.4: V phase lower bridge or W phase upper bridge IGBT continuity failure

Fault reason: V+W-IGBT open circuit is detected.

Fault Cause	Confirmation	Solution
The phase V lower bridge or phase W upper bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.5: W phase upper bridge or U phase lower bridge IGBT continuity failure

Fault reason: Open circuit of W+U-IGBT is detected.

Fault Cause	Confirmation	Solution
The phase W upper bridge or phase U lower bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.6: W phase lower bridge or U phase upper bridge IGBT continuity failure

Fault reason: Open circuit of W+U-IGBT is detected.

Fault Cause	Confirmation	Solution
The phase W lower bridge or phase U upper bridge IGBT is faulty.	Ask for technical support	Ask for technical support

E057.7: Phase-to-phase short circuit occurs on phase UV.

Fault reason: Output phase-to-phase short circuit occurs on U/V end.

Fault Cause	Confirmation	Solution
Output inter-phase short circuit occurs in phase UV.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase UV output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E057.8: Phase-to-phase short circuit occurs on phase VW.

Fault reason: Inter-phase output short circuit is detected on the VW end.

Fault Cause	Confirmation	Solution
Output inter-phase short circuit occurs in phase VW.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase VW output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E057.9: Phase-to-phase short circuit occurs on phase WU.

Fault reason: Inter-phase output short circuit is detected on the WU end.

Fault Cause	Confirmation	Solution
Output inter-phase short circuit occurs in phase WU.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase WU output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E058.1: The U phase current sensor is inversely installed.

Fault reason: Phase U current is reversed.

Fault Cause	Confirmation	Solution
The U phase sensor is inversely installed.	Ask for technical support	Ask for technical support

E058.2: The V phase current sensor is inversely installed.

Fault reason: Phase V current is reversed.

Fault Cause	Confirmation	Solution
The V phase sensor is inversely installed.	Ask for technical support	Ask for technical support

E058.3: The W phase current sensor is inversely installed.

Fault reason: Phase W current is reversed.

Fault Cause	Confirmation	Solution
The W phase sensor is inversely installed.	Ask for technical support	Ask for technical support

E058.4: Phase U and phase V current sensors misplaced.

Fault reason: The phase UV current sampling is abnormal.

Fault Cause	Confirmation	Solution
Phase U and phase V current sensors misplaced.	Ask for technical support	Ask for technical support

E058.5: Phase V/ W current sensors misaligned

Fault reason: The phase VW current sampling is abnormal.

Fault Cause	Confirmation	Solution
Phase V/ W current sensors misaligned	Ask for technical support	Ask for technical support

E058.6: Phase W/U current sensors are misaligned.

Fault reason: The phase WU current sampling is abnormal.

Fault Cause	Confirmation	Solution
Phase W/U current sensors are misaligned.	Ask for technical support	Ask for technical support

E059.1/A059.1/L059.1/N059.1: VW phase is unbalanced

Fault reason: The UV phase output is unbalanced with the other phase.

Fault Cause	Confirmation	Solution
The load at the output side is unbalanced.	Check whether the phase V/W current on the load side is balanced.	Adjust the output current on the load side to ensure that the V/W phase current does not differ greatly.
The accuracy of the current sensor is insufficient.	Ask for technical support	Ask for technical support

E059.2/A059.2/L059.2/N059.2: UW phase is unbalanced

Fault reason: The VW phase output is unbalanced with the other phase.

Fault Cause	Confirmation	Solution
The load at the output side is unbalanced.	Check whether the phase V/W current on the load side is balanced.	Adjust the output current on the load side to ensure that the V/W phase current does not differ greatly.
The accuracy of the current sensor is insufficient.	Ask for technical support	Ask for technical support

E059.3/A059.3/L059.3/N059.3: UV phase is unbalanced

Fault reason: The WU phase output is unbalanced with the other phase.

Fault Cause	Confirmation	Solution
The load at the output side is unbalanced.	Check whether the phase V/W current on the load side is balanced.	Adjust the output current on the load side to ensure that the V/W phase current does not differ greatly.
The accuracy of the current sensor is insufficient.	Ask for technical support	Ask for technical support

E060.1: Capacitor leakage occurs.

Fault reason: The bus voltage fluctuation range exceeds the threshold for a certain period.

Fault Cause	Confirmation	Solution
Capacitor leakage occurs.	Check whether leakage occurs on the bus capacitor.	Replace the bus capacitor.

E080.1/A080.1/L080.1/N080.1: The fan speed feedback is abnormal

Fault reason: The fan operates improperly.

Fault Cause	Confirmation	Solution
The fan is blocked.	Check whether the fan is blocked and whether the air duct is blocked.	Ensure that the air duct is not blocked.
The fan is not connected.	Check whether the fan is connected improperly.	Re-connect the fan properly.

E080.2/A080.2/L080.2/N080.2: Fan initialization failure

Fault reason: The fan chip is damaged or communication between the MCB and the fan chip is faulty.

Fault Cause	Confirmation	Solution
The fan chip is damaged.	Check whether the power supply of the fan is normal.	1. Ensure that the fan chip is normal. 2. If the fault persists, contact the technical support.
The fan does not exists.	Check whether the auto-cooling model is wrong. The non-self-cooling model is selected.	1. Ensure that the self-cooling model is correct. 2. If the fault persists, contact the technical support.

E084.1: Brake apply failure

Fault reason: The brake release command is generated but there is no feedback signal within the specified time.

Fault Cause	Confirmation	Solution
The brake apply feedback signal is abnormal.	Check the positive and negative logic of the brake feedback source (P4-04).	Check signal feedback point or feedback source wiring, or positive and negative logic.
Brake release time is improper.	Check the brake release action time (P4-02).	Check whether the set action time is proper.

E084.2: Brake closing failure

Fault reason: The brake close command is generated but there is no feedback signal.

Fault Cause	Confirmation	Solution
The brake apply feedback signal is abnormal.	Check the brake feedback point source (P4-04).	Check signal feedback point or feedback source wiring, or positive and negative logic.
The brake close action time is set improperly.	Check the brake close action time (P4-03).	Check whether the set action time is proper.

E084.3: Brake torque verification failure

Fault reason: During brake verification, the torque is outputted. After reaching the set time, the feedback torque is detected to be less than 50% of the set torque.

Fault Cause	Confirmation	Solution
During brake verification, the torque cannot reach 50% of the set value.	1. Check that the brake can close normally and whether the motor is equipped with a brake. 2. Check that the motor parameters are set correctly and cables are connected properly. 3. Check the brake for excessive abrasion. 4. Disable brake verification (P4-40=0) in the V/f control mode.	1. Replace the brake if it is worn out. 2. Ensure that the motor is connected correctly.

E084.4: Brake speed verification failure

Fault reason: During brake verification, the encoder generates displacement.

Fault Cause	Confirmation	Solution
During brake verification, the encoder generates displacement.	1. Check that the brake can be closed properly. 2. Check that the motor parameters are set correctly and cables are connected properly. 3. Check the brake for excessive abrasion. 4. Disable brake verification (P4-40=0) in the V/F control mode.	1. Replace the brake if it is worn out. 2. Ensure that the motor is connected correctly.

E084.6: The brake is not allowed to be released during auto-tuning.

Fault reason: After the brake function is enabled, the software assumes that the motor actually has a brake. For safety reasons, brake release is not allowed when it is required to run during auto-tuning.

Fault Cause	Confirmation	Solution
Brake release is required during auto-tuning. For safety reasons, brake release is prohibited.	1. Check whether the motor has a brake. 2. Check whether the brake function (P4-00) is enabled.	1. When the motor is not equipped with a brake, disable the brake function (P4-00 = 0) and restart auto-tuning. 2. When the motor is equipped with a brake and the value of P4-00 is not 0, switch off the brake function (P4-00 = 0) and restart auto-tuning again. 3. When the motor is equipped with a brake and the value of P4-00 is not 0, set bit3 of P4-07 to 1 [Brake release allowed]. Then select the source of RO1 output as the brake command output (E1-00 = L0211), and then restart auto-tuning.

E085.1/A085.1/L085.1/N085.1: Sequence fault 1

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.2/A085.2/L085.2/N085.2: Sequence fault 2

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.3/A085.3/L085.3/N085.3: Sequence fault 3

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.4/A085.4/L085.4/N085.4: Sequence fault 4

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.5/A085.5/L085.5/N085.5: Sequence fault 5

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.6/A085.6/L085.6/N085.6: Sequence fault 6

Fault Cause	Confirmation	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E093.1/A093.1/L093.1/N093.1: Motor stall fault

Fault reason: When the motor reaches the torque limit and the motor operating frequency keeps lower than the stall fault detection frequency (d1-81) within the time defined by d1-80, a motor stall fault can be reported.

Fault Cause	Confirmation	Solution
A motor stall fault is reported when the torque is limited in the speed control mode.	Check whether the torque is limited in the speed control mode.	Disable motor stall detection (d1-79 = 0).
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control, and set the tens of the low-speed processing mode (d0-85) to 1. For details, see " Vector control" on page 430.

Fault Cause	Confirmation	Solution
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see "4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches the generating/motoring power limit (d1-13 to d1-17). For details, see "5.3.1.7 Power Limit" on page 476.	Increase the power limit (d1-13/d1-14) properly.

E093.2/A093.2/L093.2/N093.2: Motor step loss fault

Fault reason: After motor step loss detection is enabled, when the deviation between the magnetic flux setpoint and the feedback value keeps exceeding the step loss fault detection threshold (d1 -86) within the time defined by d1-85, this fault can be reported. It is active only for asynchronous motors.

Fault Cause	Confirmation	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Output phase loss occurs.	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and enable the drive to run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.

E093.3/A093.3/L093.3/N093.3: Current control abnormal

Fault reason: After current control error detection is enabled, when the deviation between the set current and feedback current keeps exceeding the current control error detection threshold (d1-88) within the time defined by (d1-87), this fault can be reported.

Fault Cause	Confirmation	Solution
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
Output phase loss occurs.	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and enable the drive to run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.
The droop coefficient is set to an excessively high value (synchronous motor/ asynchronous motor SVC).	Check whether the droop function (d3-27 = 1) is enabled, ensure that the droop coefficient (d3-29) does not exceed the rated slip of the motor, and check whether the set frequency (U0-01) shows obvious oscillation every time.	The droop coefficient (d3-29) is lower than the rated slip of the motor.

E094.1/A094.1/L094.1/N094.1: The calculated value of the pole pairs does not match the set value

Fault reason: The set number of motor pole pairs (F1-14) is different from the auto-tuned number of motor pole pairs.

Fault Cause	Confirmation	Solution
The set number of motor pole pairs is inconsistent with the actual number.	Check whether the number of active pole pairs (F1-15) of the motor is consistent with the parameters provided by the motor manufacturer.	Set the number of motor pole pairs correctly (F1-14).

E094.2/A094.2/L094.2/N094.2: The rated power, voltage, and current of the motor do not match.

Fault reason: The set motor power factor is not within the allowable range.

Fault Cause	Confirmation	Solution
The set rated power, voltage, and current of the motor do not match each other.	Check whether the rated motor power P (F1-01), rated voltage U (F1-03), rated current I (F1-04), and power factor (C4-09) are set outside the normal range.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

E094.3/A094.3/L094.3/N094.3: No-load current parameter range error

Fault reason: The auto-tuned no-load current value is outside the allowable range.

Fault Cause	Confirmation	Solution
The rated motor parameters are set incorrectly. Therefore, the auto-tuned no-load current is outside the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.4/A094.4/L094.4/N094.4: Mutual inductance and no-load current inconsistent with the rated voltage

Fault reason: The deviation between the rated flux and the flux calculated based on the rated voltage and frequency exceeds the allowable range.

Fault Cause	Confirmation	Solution
The auto-tuned mutual inductance and no-load current are inconsistent with the rated voltage and rated frequency.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.5/A094.5/L094.5/N094.5: The rotor resistance parameter range is abnormal

Fault reason: The auto-tuned rotor resistance is not within the allowable range.

Fault Cause	Confirmation	Solution
The auto-tuned rotor resistance is not within the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E110.1/A110.1/L110.1/N110.1: Pre-overload of the drive

Fault reason: The cumulative value of drive overload is reached (100% - AC drive pre-overload threshold (A4-28)).

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Enable IF control, and set the tens of the low-speed processing mode (d0 -85) to 1. For details, see " *Vector control" on page 430*.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.

Fault Cause	Confirmation	Solution
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, extend the acceleration/deceleration time properly 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking for stop to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).

Fault Cause	Confirmation	Solution
The motor is started during rotation (synchronous/ asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see *"5.3.2.6 V/F Oscillation Suppression" on page 506*. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC.
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the AC drive is too low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/(1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.

Fault Cause	Confirmation	Solution
Derated operation applies due to long-term operation at low frequencies.	During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. The derating ratio increases from 0% to 20% when frequency changes from 5 Hz to 0 Hz.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Derating occurs due to excessive carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.

E110.2: PCB pre-overload

Fault Cause	Confirmation	Solution
The cumulative PCB overload curve reaches 100%	/	1. The internal heat of the drive is too large. It is recommended to reduce the output current or carrier frequency. 2. The ambient temperature is higher. Lower the ambient temperature.

E111.1/A111.1/L111.1/N111.1: Motor pre-overload

Fault reason:

When pre-overload protection is enabled, the cumulative overload of the motor exceeds the motor overload alarm coefficient (d1-47).

Fault Cause	Confirmation	Solution
The load is too heavy, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
Synchronous motor demagnetization (SVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The input voltage is too low.	1. Check whether the input voltage meets the design requirements (380 V models： 380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the inlet switch is normal.
The motor pre-overload alarm coefficient (d1-47) is set improperly.	The default motor overload data of the drive does not match the actual motor. The actual motor temperature rise is not high.	Increase the motor pre-overload alarm coefficient (d1-47) to extend the time for the motor to report an overload. If the motor continues to report a fault during long-term operation, you can directly turn off the motor overload protection.

E114.1/A114.1/L114.1/N114.1: Module pre-overheat

Fault Cause	Confirmation	Solution
Over-high ambient temperature	Measure the ambient temperature to check whether it is higher than 50°C.	Lower the ambient temperature.
The air filter is blocked.	Check whether the air filter of the fan is blocked.	Clean the air filter.
The fan is damaged.	After cooling down, start the AC drive and observe whether the fan rotates.	Replace the fan.

Fault Cause	Confirmation	Solution
The thermistor of the module is damaged.	Test the thermistor of the drive.	Ask for technical support
The module is damaged.	The fault persists after the preceding measures are taken.	Ask for technical support

E132.3: Parameter power-off error

Fault reason: Parameter storage failure upon power-off

Fault Cause	Confirmation	Solution
Parameter power-off error	Parameters are not saved upon power-off.	Ask for technical support

E151.1/A151.1/L151.1/N151.1: Cable drum vertical application parameter setting error

Fault Cause	Confirmation	Solution
The max. tension, min. tension, max. torque setpoint, or min. torque setpoint are set improperly during cable drum vertical application.	Obtain the [Toque max. value of vertical cable drum application] through [PD-02 Max. tension] x [PC-11 Min. reel diameter]/[PC-03 Mechanical transmission ratio]/[Rated motor torque]. Obtain the [Torque min. of vertical cable drum application] through [PC-51 Min. tension setpoint of vertical cable drum application] x [PC-10 Max. reel diameter]/[PC-03 Mechanical transmission ratio]/[Rated motor torque]. If the [Torque min. value of vertical cable drum application] is higher than [Torque max. value of vertical cable drum application] after preceding calculation, Err150.01 is reported, indicating vertical application parameters are set improperly.	Reset parameters properly.

E153.1/A153.1/L153.1/N153.1: Material breaking fault

Fault Cause	Confirmation	Solution
Material run-out is detected under tension process run-out detection.	The material run-out fault occurs when the reel diameter change keeps exceeding the material run-out detection error after continuous material run-out detection time elapses.	Check the material condition and re-load the material.

E154.1/A154.1/L154.1/N154.1: HDI disconnected

No HDI input signal is detected or the input frequency signal is lower than the specification.

Fault Cause	Confirmation	Solution
Pulse signal disconnected	Check whether the HDI input circuit is intact.	Perform wiring again.
The set pulse signal is incorrect.	Check the pulse input signal. If the pulse signal is not continuous or the pulse input signal is lower than half of the minimum input, the pulse signal input is abnormal.	Ensure that the HDI input signal and wiring are correct.

E154.3/A154.3/L154.3/N154.3: AI1 input abnormal

Fault reason: AI1 input voltage (current) is not within the range of E2-14 (AI1 input protection upper limit) and E2-15 (AI1 input protection lower limit).

Fault Cause	Confirmation	Solution
AI1 input signal disconnected	Check whether the AI input circuit is intact.	Perform wiring again.
The AI input signal voltage or current is abnormal.	Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (E2-14 or E2-15).	Ensure that the input voltage (current) does not exceed the upper and lower limits of protection (E2-14/E2-15). If the upper and lower limits are exceeded, do as follows: Mode 1: Change the setting of E2-14/E2-15 to avoid false alarms caused by signal interference. Mode 2: Change H1-14 to select a proper fault response level or shield the fault.

E154.4/A154.4/L154.4/N154.4: AI2 input abnormal

Fault reason: AI2 input voltage (current) is not within the range of E2-23 (AI2 input protection upper limit) and E2-24 (AI2 input protection lower limit).

Fault Cause	Confirmation	Solution
AI2 input signal disconnected	Check whether the AI input circuit is intact.	Perform wiring again.
The AI2 input signal voltage or current is abnormal.	Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (E2-23 or E2-24).	Ensure that the input voltage (current) does not exceed the upper and lower limits of protection (E2-23/E2-24). If the upper and lower limits are exceeded, proceed as follows: Mode 1: Change the setting of E2-23 and E2-24 to avoid false alarms caused by signal interference. Mode 2: Change H1-14 to select a proper fault response level or shield the fault.

E154.8/A154.8/L154.8/N154.8: I/O expansion card 1-AI input abnormal

Fault reason:

1. Check whether the AI input circuit is intact.
2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (EA-43 /44).

Fault Cause	Confirmation	Solution
1. Check whether AI1 input signal is disconnected. 2. Check whether AI1 input signal voltage or current is normal.	1. Check whether the AI input cable is intact. 2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (EA-43 or E2-44).	1. Perform wiring again. 2. Ensure the upper limit and lower limit for input voltage (current) protection are not exceeded. 3. Change the setting of EA-43/44 to avoid false alarms caused by signal interference. 4. Change H1-14 to select a proper fault response level or shield the fault

E154.9/A154.9/L154.9/N154.9: I/O expansion card 2-AI input abnormal

Fault reason:

1. Check whether the AI input circuit is intact.

2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (Eb-43 /44).

Fault Cause	Confirmation	Solution
1. Check whether AI1 input signal is disconnected. 2. Check whether AI1 input signal voltage or current is normal.	1. Check whether the AI input cable is intact. 2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (EB-43 or EB-44).	1. Perform wiring again. 2. Ensure the upper limit and lower limit for input voltage (current) protection are not exceeded. 3. Change the setting of Eb-43/44 to avoid false alarms caused by signal interference. 4. Change H1-14 to select a proper fault response level or shield the fault

E155.1/A155.1/L155.1/N155.1: The communication of I/O expansion card 1 timeout

Fault reason: The I/O expansion card 1 wiring is loose, or communication with the MD630 is abnormal

Fault Cause	Confirmation	Solution
1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the MD630 is normal.	1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the MD630 is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E155.2/A155.2/L155.2/N155.2: The communication of I/O expansion card 2 timeout

Fault reason: The I/O expansion card 2 wiring is loose, or communication with the MD631 is abnormal

Fault Cause	Confirmation	Solution
1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the MD630 is normal.	1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the MD630 is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E159.1: Fault auto reset failure

Fault reason: The fault reset function is configured and the fault cause is eliminated, but the fault is not automatically reset.

Fault Cause	Confirmation	Solution
Auto reset is disabled.	Check whether faults that cannot be reset are set in H3-13...H3-22.	If H3-13 to H3-22 are set with faults that cannot be reset, check whether to remove the fault that cannot be reset according to actual requirements. If H3-13 to H3-22 are not set with faults that cannot be reset, power off and on again. If the fault still persists, contact the technical support.

E160.1/A160.1/L160.1/N160.1: Modbus-RTU communication timeout

Fault reason: Modbus timeout (not 0) is configured and no data is received after the timeout period elapses.

Fault Cause	Confirmation	Solution
Ambient interference exists.	Check whether the RS485 communication cable is connected properly.	Connect the RS485 communication cable.
The baud rate and data format of the master and slave are inconsistent.	Check whether communication parameters such as station number (n2-02), communication baud rate (n2-00), and data format (n2-01) are set correctly. The baud rate and data format set by the host controller and the AC drive must be consistent. The station number must be unique. Otherwise, communication can fail.	Ensure that the baud rate, data format, and station number set by the host controller and those set in the AC drive are consistent.
The master does not send request data to the slave within the timeout period.	1. Check whether the master configures data request commands for the slave that reports errors. 2. Check whether the values of the Modbus communication timeout (n2-04) and the PLC communication cycle are proper. The Modbus communication timeout (n2-04) must be greater than the PLC communication cycle.	1. Ensure that the master configures data request command for the slave that reports errors. 2. Ensure that the value of the Modbus communication timeout (n2-04) is higher than the PLC communication cycle.

E161.1/A161.1/L161.1/N161.1: CANopen heartbeat timeout

Fault reason:

1. The heartbeat consumption time (1016) of the CANopen object dictionary is configured and the device does not receive the heartbeat of the target node after the heartbeat consumption time.
2. The heartbeat protection factor (100C) and the protection period (100D) are configured. The product of the two factors is the lifetime. After this lifetime, the remote request frame of the node is received.

Fault Cause	Confirmation	Solution
Ambient interference affects the CAN signal.	1. Check whether the CAN communication cable is correctly connected. 2. If the cable is connected properly, check parameters n3-10 to n3-12. If n3-12 is not 0, the values of n3-10 and n3-11 change, it indicates that strong interference exists.	1. Connect the CAN communication cable according to " *Communication*" *on page 842*. 2. Install the termination resistor, magnetic ring, and filter.
The master heartbeat production cycle is larger than the slave heartbeat consumption cycle.	Check whether the heartbeat cycle set by the master and the heartbeat consumption time set by the slave are proper. It is recommended that the heartbeat consumption time be set to at least 2.5 x heartbeat cycle of the master.	Ensure that the heartbeat consumption period is larger than the heartbeat production cycle of the master.

E161.2/A161.2/L161.2/N161.2: CANopenPDO length error

Fault reason: The received PDO length is inconsistent with the configured PDO mapping length.

Fault Cause	Confirmation	Solution
The length of the PDO sent by the master is incorrect.	Check whether the PDO mapping length configured by the master is consistent with the length of the PDO data sent (using the packet capture tool).	If the length of the PDO data sent is inconsistent with the configuration, the master may be faulty. In this case, contact the master manufacturer. To eliminate this fault, stop and restart or reset the slave.

E161.4/A161.4/L161.4/N161.4: CANopen state switchover error

Fault reason: The device receives a reset command from the master during normal operation.

Fault Cause	Confirmation	Solution
The master sends a reset node command to reset the communication command.	Check whether the master sends reset node commands and reset communication commands (with the aid of the packet capture tool) when the device is operating normally.	If you confirm that the master sends a reset node command or resets the communication command, it indicates that the master is faulty. In this case, contact the manufacturer of the master. To eliminate this fault, stop and restart. If the fault persists, contact technical support.

E162.1/A162.1/L162.1/N162.1: CANlink heartbeat timeout

Fault reason: The CANlink timeout (not 0) is configured and the device does not receive any requested data after the time that greater than 2.5 x timeout time elapses.

Fault Cause	Confirmation	Solution
Ambient interference affects the CAN signal.	1. Check whether the CAN communication cable is correctly connected. 2. If the cable is connected properly, check parameters n3-10 to n3-12. If n3-12 is not 0, the values of n3-10 and n3-11 change, it indicates that strong interference exists.	1. Connect the CAN communication cable according to " *Communication" on page 842*. 2. Install the termination resistor, magnetic ring, and filter.
The master heartbeat production cycle is larger than the slave heartbeat consumption cycle.	Check whether the heartbeat cycle set by the master and the slave are proper. The heartbeat cycle of the master must be lower than 2.5 x heartbeat cycle of the slave.	Ensure that the slave heartbeat cycle is larger than the master heartbeat production cycle.

E162.2/A162.2/L162.2/N162.2: CANlink station number conflict

Fault reason: The same station number exists in the same CAN network.

Fault Cause	Confirmation	Solution
In the same CANlink network, n3-07 of two or more devices is set to the same value.	Check whether n3-07 of other devices in the CANlink network is the same as n3-07 of the device reporting the fault.	Modify n3-07 of the device that reports the fault to ensure that this parameter is different from other devices in the CANLink network.

E165.1/A165.1/L165.1/N165.1: EtherNet/IP Ethernet communication timeout

Fault reason: The device cannot receive the data packets sent by the controller within the set communication cycle or the data packets received are incorrect.

Fault Cause	Confirmation	Solution
The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. 3. If the voltage is still unstable after preceding measures are taken, replace the power supply.
A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.

E165.2/A165.2/L165.2/N165.2: EtherNet/IP Ethernet hardware error

Fault reason: The Ethernet chip cannot be configured.

Fault Cause	Confirmation	Solution
The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

E165.3/A165.3/L165.3/N165.3: No MAC address programming for EtherNet/IP

Fault reason: No MAC address or illegal MAC address is detected after power-on.

Fault Cause	Confirmation	Solution
MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support personnel.

E165.4/A165.4/L165.4/N165.4: IP conflict for EtherNet/IP

Fault reason: Two identical IP addresses are detected in the communication network.

Fault Cause	Confirmation	Solution
IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

E166.1/A166.1/L166.1/N166.1: PROFINET communication timeout

Fault reason: After normal communication with the master is established, the connection is interrupted.

Fault Cause	Confirmation	Solution
The master or slave is disconnected during communication.	The operating panel displays the fault code.	Check the communication lines between the master and slave.

E166.2/A166.2/L166.2/N166.2: PROFINET not programming the MAC address

Fault reason: No MAC address or illegal MAC address is detected after power-on.

Fault Cause	Confirmation	Solution
The MAC address is lost or not programmed.	The keypad displays the fault code.	Ask for technical support

E166.3/A166.3/L166.3/N166.3: PROFINET mapping address error

Fault reason: The slave receives the PZD mapping configured by the master, but some or all of the mapped addresses are illegal, such as no parameter available, read-only parameters are being written, write-only parameters are being read.

Fault Cause	Confirmation	Solution
The mapping configured during configuration is illegal.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the illegal mapping address.

E167.1/A167.1/L167.1/N167.1: EtherCAT Sync lost

Fault reason: In OP state, the synchronization signal is lost.

Fault Cause	Confirmation	Solution
The slave hardware (for example, the ESC register) causes the synchronization signal to be lost and the drive runs improperly.	Observe whether the indicator (difference between SYNC and IRQ phases) is larger than the synchronization cycle set by the master through the continuous oscilloscope function of Inovance software, If yes, it indicates an error.	Replace the AC drive or contact technical support.

E167.2/A167.2/L167.2/N167.2: EtherCAT Link lost

Fault reason: When the device is not powered on again, the value of the link loss register increases, indicating that process data is lost.

Fault Cause	Confirmation	Solution
The physical connection of the data link is unstable or the process data is lost due to plug-in/plug-out of the network cable.	When the device is not powered on again, view the value of the link loss register through the software tool of the master. If it is not zero or the value increases continuously, the process data is lost.	Check whether the network cable of the drive is connected reliably. Check whether the network cable is loose due to strong vibration in the field. Ensure that the network cable is connected securely.

E167.3/A167.3/L167.3/N167.3: EtherCAT read-only memory loading error

Fault reason: During program start, EEPROM read failure is detected.

Fault Cause	Confirmation	Solution
The information saved in EEPROM is incorrect.	The version number defined by n4-33 is not 0, but E167.3 is still reported.	Program the XML file again.
The XML file is not programmed in Flash.	The version defined by n4-33 is 655.35.	Program the XML file again.

E167.4/A167.4/L167.4/N167.4: EtherCAT initialization error

Fault reason: EtherCAT peripheral initialization failed after power-on.

Fault Cause	Confirmation	Solution
Hardware fault (such as ESC chip fault)	EtherCAT cannot communicate properly. The master cannot scan and identify the slave device.	Replace the AC drive or contact technical support.

E167.6/A167.6/L167.6/N167.6: DC not enabled by EtherCAT

Fault reason: The host controller requests the EtherCAT slave to switch to OP state, but the DC mode is not enabled.

Fault Cause	Confirmation	Solution
The master is faulty or the master is operating improperly.	Check whether the master is configured correctly or analyze whether the master is faulty by capturing the packet.	Configure the master properly or ask for technical support.

E167.7/A167.7/L167.7/N167.7: The number or length of EtherCAT PDO mapping exceeds the limit

Fault reason: The number of PDOs or configured bytes of the TXPDO or RXPDO exceeds the limit. The MD630N specifies that a maximum of 16 PDOs can be configured for each group, and a maximum of 32 bytes can be configured for each group of PDOs.

Fault Cause	Confirmation	Solution
The master configuration information is incorrect.	Check whether the PDO is configured correctly.	Configure the number of mapped PDOs and bytes correctly. You can configure a maximum of 16 PDOs per group, and a maximum of 32 bytes per group of PDOs.

E167.8/A167.8/L167.8/N167.8: EtherCAT process data reception timeout

Fault reason: Check whether the IRQ is lost through SYNC interrupt. The error count is incremented by 1 each time the IRQ is lost. The error count is cleared every time the IRQ is lost. The error count exceeds the set value, and there is no data frame error exception protection fault, data frame transfer error exception protection fault, or link loss exception protection fault.

Fault Cause	Confirmation	Solution
The data frame is lost at the upstream station and the upstream station is faulty.	If master communication is not recovered, view the synchronous loss counter value (n4-30) of the drive. When a fault occurs, the value is not 0.	Check whether link loss occurs on the upstream station. Check that the wiring is correct.
The performance of the master is poor, the jitter of the IRQ exceeds the set value x communication cycle.	Observe the SYNC and Irq phases through the online oscilloscope function in the software tool of the drive. When a fault occurs, the phase is greater than or equal to the synchronization loss threshold x communication cycle.	Check whether the CPU operation load of the master is too large. You can optimize load reduction of the master by reducing the communication time and setting a high synchronization loss threshold.

E167.9/A167.9/L167.9/N167.9: EtherCAT ESC port 0 reception error

Fault reason: Check whether Rx_ERR occurs in Port0 and the link does not change upon occurrence of the fault.

Fault Cause	Confirmation	Solution
The data is lost due to EMC interference, poor quality of the network cable or improper connection.	View the error counter values of port 0 and port 1 in the master software tool, or view the corresponding port parameter of the drive. The values of port 0 (n4-25) and port 1 (n4-26) are not 0.	Check whether proper grounding is performed and rectify EMC measures. Check whether the network cable used is provided by Inovance and whether the network cable is reliable.

E168.1/A168.1/L168.1/N168.1: EtherCAT ESC port forwarding and EPU processing error

Fault reason: Check whether a processing unit error occurs due to transfer error or invalid frames upon occurrence of the fault, and check whether no counting is performed in RX-ERR of Port0.

Fault Cause	Confirmation	Solution
The data frame is damaged due to an upstream station fault or a link fault.	The values of the transfer error counter (n4-27) and the processing unit error counter (n4-28) change.	The upstream station may be disturbed, the link layer may be faulty, and the hardware is faulty. Replace the upstream station or contact technical support if necessary.

E168.2/A168.2/L168.2/N168.2: EtherCAT MailBox setting exception protection

Fault reason:

The following error occurs during EtherCAT communication startup configuration check:

1. SM channel is not enabled.
2. The read/write direction is configured incorrectly.
3. The mailbox mode does not apply (single buffer mode).
4. The length of the data received is not within the set range.
5. The address of the data received is not within the set range.
6. The memory of the read/write mailbox overlaps.

Fault Cause	Confirmation	Solution
The master imports the wrong XML file.	Check whether the correct XML file is imported and the XML file shall meet the following conditions: 1. The SM channel is enabled. 2. The read/write direction is configured correctly. 3. The mailbox mode applies (single buffer mode). 4. The length of the data received is within the setting range. 5. The address of the data received is within the setting range. 6. The memory of the read/write mailbox does not overlap.	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.3/A168.3/L168.3/N168.3: EtherCAT SM2 configuration error

Fault reason:

The following error occurs during EtherCAT communication startup configuration check:

1. The SM length and RxPDO length are not 0 when SM2 is not enabled.
2. SM2 channel is not write direction.
3. The memory of SM2 overlaps with adjacent SM1 or SM3.
4. The length of the RxPDO does not match.
5. In the preop state, the address of RxPDO is not in the set address field (maximum and minimum addresses), or in a non-preop state, the address of SM2 is equal to the starting address of RxPDO.
6. PDO mapping object dictionary index exceeds the set maximum (0x1600-0x170A).

Fault Cause	Confirmation	Solution
The master imports the wrong XML file.	1. Check whether the master imported the correct XML file. Check the following configuration: Check whether the SM2 channel is configured incorrectly. The following conditions must be met: 1) The length of SM2 and the length of RxPDO are equal to 0 without enabling. 2) SM2 channel is in the write direction. 3) SM2 does not overlap with adjacent SM1 or SM3 memory. Check whether the index of the RxPDO mapping object dictionary is out of bounds (the maximum index is 0x0A). 1) The length of RxPDO is matching. 2) In the preop state, the address of RxPDO is in the set address field (maximum and minimum address) or not in the preop state, the address of SM2 is not equal to the start address of RxPDO. 3) The PDO mapping object dictionary index does not exceed the set maximum value (0x1600-0x170A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.4/A168.4/L168.4/N168.4: EtherCAT SM3 configuration error

Fault reason:

The following error occurs during EtherCAT communication startup configuration check:

1. The SM length and TxPDO length are not 0 when SM3 is not enabled.
2. SM3 channel is not read direction.
3. Buffer overruns. The memory of SM2 overlaps SM3 and SM0 or SM1).
4. The length of the TxPDO does not match.
5. In the preop state, the address of TxPDO is not in the set address field (maximum and minimum addresses), or in a non-preop state, the address of SM3 is equal to the starting address of TxPDO.
6. PDO mapping object dictionary index exceeds the set maximum (0x1A00-0x1B0A).

Fault Cause	Confirmation	Solution
The master imports the wrong XML file.	1. Check whether the master imported the correct XML file. Check the following configuration: Check whether the SM3 channel is configured incorrectly. The following conditions must be met: 1) The length of SM3 and the length of TxPDO are equal to 0 without enabling. 2) SM3 channel is in the read direction. 3) SM2 does not overlap with SM3 and SM0 or SM1 memory. Check whether the index of the RxPDO mapping object dictionary is out of bounds (the maximum index is 0x1A). 1) The length of TxPDO is matching. 2) In the preop state, the address of TxPDO is in the set address field (maximum and minimum address) or not in the preop state, the address of SM3 is not equal to the start address of TxPDO. 3) The PDO mapping object dictionary index does not exceed the set maximum value (0x1A00-0x1B0A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.5/A168.5/L168.5/N168.5: EtherCAT PDO watchdog setting error

Fault reason:

1. The watchdog is enabled but the count is 0.
2. The watchdog is not enabled but the count is non-zero.

Fault Cause	Confirmation	Solution
The master is configured incorrectly or the attempt to configure the master failed.	The value of ESC state register 0x0134 read through the master software tool is 0x001F.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.

E168.6/A168.6/L168.6/N168.6: EtherCAT has no sync signal

Fault reason:

1. The start time of 0x990 register DC and 0x981 register DC activation time are smaller than the local system time of the slave.
2. The start time of 0x990 register DC and 0x981 register DC activation time are too large for the master station to exceed 17.2s of the slave local system time.
3. 0x982: The sync signal has a pulse width of 0 and no pulse signal.

Fault Cause	Confirmation	Solution
DC is enabled during slave station switchover from SAFEOP to OP, but the DC is not running for the following reasons: 1. The DC start time and DC activation time are set incorrectly . 2. There is no pulse signal input.	The value of ESC state register 0x0134 read through the master software tool is 0x002D.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.

E168.7/A168.7/L168.7/N168.7: EtherCAT Phy initialization configuration error

Fault reason: The phy ID register is read incorrectly during initialization.

Fault Cause	Confirmation	Solution
1. The ESC is not working properly before reading the phy ID 2. The phy chip is damaged. 3. The data is disturbed. 4. The model configured is different from the actual model of the phy.	Check the hardware to see whether the PHY chip is working properly.	Replace the AC drive and contact technical support,

E168.8/A168.8/L168.8/N168.8: The pulse length of the synchronous data signal configured in the EtherCAT read-only memory is abnormal.

Fault reason: During the sync signal pulse width check of the configuration data of the eeprom, the sync pulse width length in the eeprom does not match the sync pulse width length in the XML file.

Fault Cause	Confirmation	Solution
1. The master writes the eeprom configuration data incorrectly. 2. There is a difference between the XML file imported by the master and the information in the slave.	Check whether there is any difference between the XML file information saved in the slave device (which can be read through the master software tool) and the XML file information imported to the software tool.	Reset the ESI file by setting n4-41 to 1 or re-program the XML file. If the fault persists, contact technical support.

E169.1/A169.1/L169.1/N169.1: ModbusTCP Ethernet communication timeout

Fault reason: The device cannot receive the data packets sent by the controller within the set communication cycle or the data packets received are incorrect.

Fault Cause	Confirmation	Solution
The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. 3. If the voltage is still unstable after preceding measures are taken, replace the power supply.
A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.

E169.2/A169.2/L169.2/N169.2: ModbusTCP Ethernet hardware error

Fault reason: The Ethernet chip cannot be configured.

Fault Cause	Confirmation	Solution
The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

E169.3/A169.3/L169.3/N169.3: Modbus TCP not programming the MAC address

Fault reason: No MAC address or illegal MAC address is detected after power-on.

Fault Cause	Confirmation	Solution
MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support personnel.

E169.4/A169.4/L169.4/N169.4: ModbusTCP IP conflict

Fault reason: Two identical IP addresses are detected in the communication network.

Fault Cause	Confirmation	Solution
IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

E170.1/A170.1/L170.1/N170.1: Internal communication is being disturbed or the module operation stops.

Fault reason: The internal bus data is being disturbed, resulting in check failure.

Fault Cause	Confirmation	Solution
The power supply is unstable.	Check whether the main power supply of the equipment is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the MCB or replace it with a new one.

E170.2/A170.2/L170.2/N170.2: The internal communication synchronization frame on the MCB side is lost.

Fault reason: The synchronous frame cannot be received or the received synchronous frame data is abnormal.

Fault Cause	Confirmation	Solution
The power supply is unstable.	Check whether the main power supply of the equipment is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the MCB or replace it with a new one.

A176.1: The external 24 V power supply of the control board is abnormal.

Fault Cause	Confirmation	Solution
The external 24 power supply voltage of the control board is lower than the limit threshold.	Measure whether the external 24 V voltage is too low.	Increase the external 24 V power supply voltage.

E177.1: Model hardware identification error

Fault Cause	Confirmation	Solution
The hardware sampling voltage is not within the range of the active model.	This fault on the panel indicates that the control board is abnormal.	Replace the control board.

E177.2: The hardware type of the model does not match the software type.

Fault Cause	Confirmation	Solution
The hardware identification model and software type do not match.	The software does not match the model.	Contact technical support to re-program the software.

E179.1/A179.1/L179.1/N179.1: Capacitor life alarm of the main circuit

Fault reason: The residual life of the capacitor in the main circuit is lower than the alarm threshold.

Fault Cause	Confirmation	Solution
The main circuit capacitor is used for a long time and enters the lifetime alarm phase.	The predicted lifetime margin of the main circuit capacitor (AD-45) is lower than the capacitor lifetime alarm threshold defined by Ad-49.	Contact technical support to maintain the main capacitor.

E179.3/A179.3/L179.3/N179.3: IGBT life warning

Fault reason: The remaining lifetime margin of the IGBT is below the alarm threshold.

Fault Cause	Confirmation	Solution
The IGBT is used for a long time and enters the lifetime alarm phase.	The estimated lifetime margin of the IGBT (Ad-59) is lower than the threshold defined by Ad-61.	Contact technical support to maintain the IGBT.

E179.4/A179.4/L179.4/N179.4: Cooling fan life alarm

Fault reason: The remaining lifetime margin of the fan is below the alarm threshold.

Fault Cause	Confirmation	Solution
The cooling fan is used for a long time and enters the lifetime alarm phase.	The estimated life margin of the fan (Ad-65) is lower than the alarm threshold defined by Ad-67.	Contact technical support to maintain the cooling fan.

E186.1: Model parameter read-write failure

Fault reason: Model parameters are not written or read successfully.

Fault Cause	Confirmation	Solution
Power unit EEPROM read/write timeout	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact the technical support.

E186.2: Parameter unit parameter error

Fault reason: There is not storage-type parameters in the power unit.

Fault Cause	Confirmation	Solution
The power body is replaced with a new one.	Check whether the power unit is new.	Set A3-19 to 1 and reset after downloading the model parameters.

E186.3: The preset model parameters of the MCB do not match the power board.

Fault reason: The model parameters in the main control board are not completely consistent with those in the power unit.

Fault Cause	Confirmation	Solution
The power unit is replaced and the parameters of the power unit are inconsistent with those of the MCB.	Check whether the power unit has been replaced.	Reset the operation.
The control board is replaced and the parameters of the control board are inconsistent with the power unit.	Check whether the control board has been replaced.	Reset the operation.

E187.2/A187.2/L187.2/N187.2: Power unit junction temperature parameter file check failed

Fault reason: The junction temperature parameter format in the power unit read by the control board is inconsistent or CRC fails.

Fault Cause	Confirmation	Solution
1. The junction temperature parameter format saved by the power unit is inconsistent with the junction temperature parameter format specified by the control board. 2. The CRC on the junction temperature parameter file fails.	1. Check whether the power unit matches the current product. 2. Check whether there is significant interference on site.	Contact the technical support personnel.

E187.3/A187.3/L187.3/N187.3: Junction temperature parameter read/write failure in the EEPROM of the power unit

Fault reason: The junction temperature parameter is not written or read successfully.

Fault Cause	Confirmation	Solution
The control board and the power unit cannot communicate properly.	Check the communication line between the control board and the power unit.	Contact the technical support personnel.

E187.4/A187.4/L187.4/N187.4: The attempt to read EEPROM junction temperature parameter of the power unit times out upon power-on.

Fault reason: The junction temperature parameter read during power-on initialization is stuck in an exception state.

Fault Cause	Confirmation	Solution
Power-on exception	Check whether the value of A3-00 is consistent with Ub-95.	If the fault persists after restart, contact the technical support.

E187.6/A187.6/L187.6/N187.6: The model code of the EEPROM junction temperature parameter of the power unit is inconsistent with the model code set by the control board

Fault reason: The model of the junction temperature parameter downloaded to the EEPROM of the power unit is inconsistent with the current set model

Fault Cause	Confirmation	Solution
The model code A3-00 does not match Ub-95.	Check whether the A3-00 model code does not match the Ub-95 model code.	Set A3-00 and Ub-95 to be consistent.

E188.2/A188.2/L188.2/N188.2: Power-down area of the EEPROM of the power unit read failure

Fault reason: Parameters in the power-down area of the EEPROM of the power unit is not read or written successfully.

Fault Cause	Confirmation	Solution
The control board and the power unit cannot communicate properly.	Check the communication line between the control board and the power unit.	Power on and off again to check whether the fault disappears. If the fault persists, contact technical support.

E188.3/A188.3/L188.3/N188.3: Attempt to read data in the EEPROM power-down area of the power unit timed out

Fault reason: The data process read in the power-down area during power-on initialization is stuck in an exception state.

Fault Cause	Confirmation	Solution
Power-on exception	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact the technical support.

E189.1/A189.1/L189.1/N189.1: IDS communication timeout

Fault reason: Communication between the commissioning software and the AC drive failed

Fault Cause	Confirmation	Solution
The IDS communication fault is triggered when the software tool is disconnected from the drive after obtaining control permissions and controlling the motor operation.	Check whether SOP-20 is connected to the PC properly. Check whether SOP-20 is connected to the AC drive properly. Check whether cables are routed properly.	Ensure that the SOP-20 is connected to the PC properly. Ensure that the SOP-20 is connected to the drive properly. Ensure that the wiring is properly routed. You can install a magnetic ring to suppress interference.

E190.1: Application macro parameter write error

Fault Cause	Confirmation	Solution
After setting A0-48 interface macro or A0-50 industry macro, the parameter writing process is interrupted due to an exception.	After setting A0-48 or A0-50, check whether the drive is powered off due to an exception.	Set A0-48 interface macro or A0-50 industry macro again when the power supply of the drive is proper.

E191.1: Junction temperature too high

Fault Cause	Confirmation	Solution
High IGBT junction overtemperature	/	1. Check whether the device is in locked rotation, running at high carrier frequency, running under heavy load, or running with poor cooling of. 2. The device temperature is too high. Runs after stopping for a certain period of time.

E192.1: Speed tracking timeout

Fault reason: The speed tracking time exceeds the threshold.

Fault Cause	Confirmation	Solution
The speed of the synchronous motor exceeds the traceable range.	Check whether the synchronous motor speed is too high (U0-00).	After the speed of the synchronous motor is reduced (F0-30), the speed tracking starts (d0-02 = 1).
Asynchronous motor parameters are incorrect.	Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, see *"4.6.1 Asynchronous Motor Parameter Auto-tuning" on page 133*.

E193.1: Undervoltage suppression reaches the limit

Fault reason: The speed reaches the minimum operating frequency (d1-72) or the maximum operating time (d1-68) during undervoltage suppression in the vector control mode.

Fault Cause	Confirmation	Solution
In the vector control mode, the undervoltage suppression decelerates to the frequency lower limit (d1-72), and the bus voltage cannot be maintained.	1. Check whether the operating frequency (U0-00) at fault is lower than the minimum operating frequency in undervoltage suppression (d1-72). If yes, an exception occurs. 2. Start the drive after the bus voltage is stabilized. Check whether the main contactor/grid is normal if power-on is not possible for a long time.	Replace the main contactor. Ensure that the power grid is normal.
Check that the undervoltage suppression operating time limit function is enabled (bit2 of d1-76 = 1) and that the undervoltage suppression operating time reaches the maximum operating time (d1-68). Check that the undervoltage suppression operating time limit function is enabled (bit2 of d1-76 = 1) and that the undervoltage suppression operating time reaches the maximum operating time (d1-68).		If you do not need to limit the undervoltage suppression operating time, turn off the undervoltage suppression operating time limit.

N194.1: STO1 and STO2 are disconnected.

Fault reason: The 24 V inputs of STO1 and STO2 are abnormal.

Fault Cause	Confirmation	Solution
Both STO1 and STO2 are disconnected.	Check whether the 24 V power supply of the STO is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E195.1: Parameter downloading interrupted

Fault reason: The attempt to download parameters through the commissioning software fails.

Fault Cause	Confirmation	Solution
The drive powers off during parameter downloading.	Check whether the operating panel or commissioning software has a corresponding fault code.	Perform any of the following steps to restore the parameters, and then reset the fault. 1. Perform parameter initialization. 2. Perform parameter download.

A196.1: External flash data read/write fault of black box fault

Fault reason: The data read-write operation on the external flash of black box failed.

Fault Cause	Confirmation	Solution
The data read-write operation on the external flash of black box failed.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact technical support to maintain the external flash used for data saved in the black box.

N197.1: The fire mode is activated

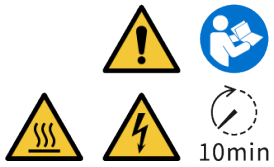
Fault reason: The fire mode is activated

Fault Cause	Confirmation	Solution
The fire mode is activated	The fire mode is activated	If you exit the fire mode, it will not be reported again

8 Maintenance and Repair

8.1 Safety Instructions for Maintenance and Repair

- Maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not service the equipment after power-on. Failure to comply will result in an electric shock.
- Cut off all power supplies to the equipment, and wait for the time specified on the warning label before maintenance.



- Before maintenance, you must measure the voltage between the positive and negative bus terminals of the main circuit. Operations are allowed only when the voltage is below 36 V.
- Mechanical protective measures must be taken to protect personal safety during maintenance. Wear necessary protective equipment (such as anti-smashing shoes and protective gloves) to prevent damage to the product and personal injury caused by falling of heavy objects.

8.2 Routine Maintenance

8.2.1 Daily Maintenance Items

8.2.1.1 Routine Checklist

Table 8–1 Daily inspection checklist

No.	Item	Checked
1	Ensure that no abnormal noise exists when the motor is running.	☐
2	Ensure that no abnormal vibration exists when the motor is running.	☐
3	Ensure normal cooling fan of the motor.	☐
4	The AC drive cooling fan runs normally.	☐
5	The electrical cabinet runs properly.	☐
6	Check whether the cabinet cable ducts are normal.	☐
7	Check whether the operating current of the AC drive exceeds the rated current of the AC drive.	☐
8	Check whether the operating current of the AC drive exceeds the rated current of the motor.	☐
9	The main circuit power supply voltage is normal.	☐
10	The power supply voltage of the control circuit is normal.	☐

8.2.1.2 Routine Cleaning Items

Table 8–2 Routine cleaning list

No.	Item	Checked
1	Remove dust on the equipment, especially metal dust, to prevent it from entering the equipment.	☐
2	Remove the liquid and oil from the surface of the equipment to prevent contaminants from corroding the equipment.	☐

Caution

- Keep the equipment clean.
- Disconnect the HV fast breaker on the battery side before cleaning. Clean the equipment with a blower gun or dry cleaning cloth.

8.2.2 Regular Checklist

Table 8–3 Regular checklist

No.	Item	Checked
1	Ensure that there are no wastes, dirt, or dust on the surface.	☐
2	Ensure that no power cables or connections discolor.	☐
3	Ensure that the cable insulation layer does not age or crack.	☐
4	Check whether the product peripheral contactor closes tightly or generates unexpected noise during operation.	☐
5	Ensure that no short circuit, water stain, expansion or cracking occurs on any peripheral device.	☐
6	Ensure that the air duct and heatsink are not clogged.	☐
7	Ensure that the fan is not damaged.	☐
8	Ensure that no control components are in poor contact.	☐
9	Ensure the product control circuit terminal screw is not loose.	☐
10	Ensure the insulation of the control cable is not cracked.	☐

8.2.3 Main circuit detection method

Ready

Before maintenance, do the following:

1. Switch off the input power switch of the AC drive.

Caution

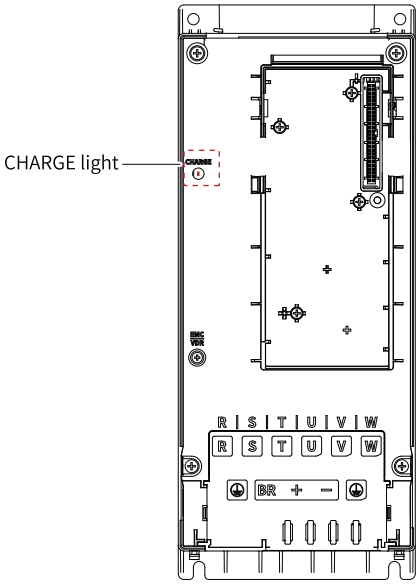
When the input power supply is cut off, the internal bus capacitor of the AC drive is still in the high voltage state. Wait for the time specified on the product warning label before proceeding to the next step.

2. Remove the upper cover of the AC drive.

Caution

Do not disassemble the AC drive without professional personnel. Contact the service personnel of the manufacturer.

3. Observe the charge light on the inside housing of the machine and wait for the light to turn off (T4 is shown as an example).



4. Remove the cable cover and measure the voltage between the positive and negative bus terminals of the main circuit with a multimeter. Make sure that the voltage is below 36 V.
5. Remove the power cables (R/S/T) and motor cables (U/V/W) connected to the AC drive and other main power cables (BR, +, -) that may be connected to the AC drive.

Main circuit power device detection

By measuring the diode voltage drop of the AC drive rectifier bridge, inverter bridge, and brake pipe, you can initially determine whether the power module is normal. You can use the diode range of the multimeter to test on the main circuit terminal of the AC drive, as shown in the following figure and table.

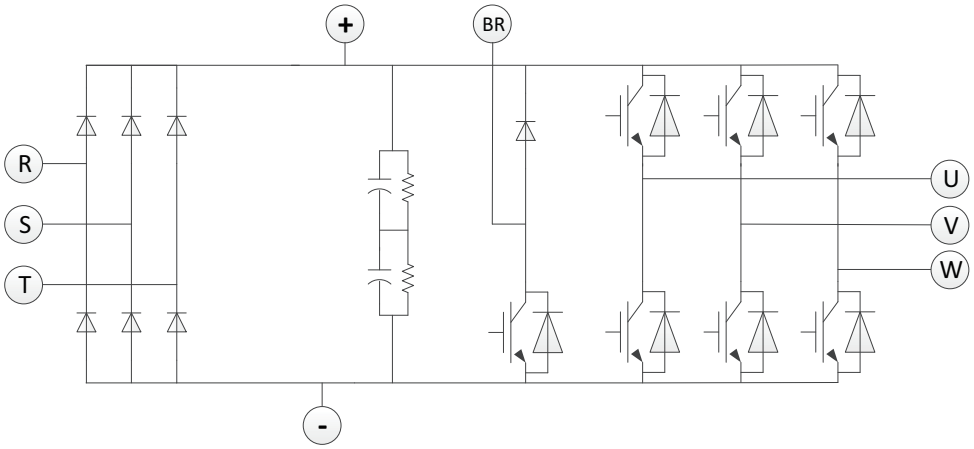


Figure 8-1 Main circuit topology

Test Item	The component under test	Test Voltage Applied between/at:		Standard of measured value
		Black lead of the multimeter	Red lead of the multimeter	
Voltage drop of the rectifier bridge tube	R upper bridge	+	R	The typical value is about 0.4 V. (The range is 0.25 V to 0.6 V, and R/S/T needs to be basically consistent with an error within 0.1 V)
	S upper bridge	+	S	
	T upper bridge	+	T	
	R lower bridge	R	/	
	S lower bridge	S	/	
	T lower bridge	T	/	
Inverter bridge pipe voltage drop	U upper bridge	+	U	The typical value is about 0.4 V. (The range is 0.25 V to 0.6 V, and the U/V/W must be basically consistent, with an error within 0.1 V)
	V upper bridge	+	V	
	W upper bridge	+	W	
	U lower bridge	U	/	
	V lower bridge	V	/	
	W lower bridge	W	/	
Brake pipe voltage drop	Braking diode	+	BR	The typical value is about 0.4 V. (Range: 0.25 V to 0.6 V)
	Braking IGBT	BR	/	
Bus short circuit detection	Bus	+	-	The typical value is about 0.8 V. (Range: 0.5 V to 1.2 V)

Main circuit voltage detection

The main circuit voltage can be detected only after the AC drive is powered on. Use a multimeter to measure the voltage on the input side, DC side, and output side of the AC drive. The voltage test can help confirm whether the AC drive is normal.

1. Input voltage detection:

   Measure the effective value of the line voltage (Vrs, Vrt, and Vrt) between R, S, and T in the AC range of a multimeter. Vst). It is normal to meet the following two conditions: 1. The three-phase ratio is within ±5% of the error between the three phases; 2. The error corresponds to the typical grid voltage. The difference between the capacitance capacity and the load size below the grid may vary from time to time. Compared with the typical grid voltage, the fluctuation range is usually -15% to +10%.

2. Bus voltage detection:

   The DC bus voltage after the AC drive is rectified can be viewed through the displayed value on the keypad or measured using a multimeter. A rough method of assessing the bus voltage value is that when the AC drive is in standby mode, the bus voltage is about 1.414 times the effective value

of the AC input voltage, and the bus voltage is about 1.35 times the effective value of the AC input voltage when the AC drive is full-load.

3. Output voltage detection:
   During stable running, the output voltage of the AC drive can be viewed through the display on the keypad or measured in AC mode using a multimeter. The three-phase output voltage is balanced under normal conditions, and the error between the three phases is generally within ±5%. Error within ±10% is normal.

Main circuit current detection (input, output)

The main circuit current can be detected only after the AC drive and the motor are in normal and stable operation. You can measure the current on the input and output sides of the AC drive using a hand-held current clamp or oscilloscope. The current detection can help confirm whether the AC drive is normal.

1. Input current detection:
   The input current value is related to the motor load and grid capacity. The heavier the load and the larger the grid capacity, the higher the current.

   The three-phase input current of R, S, and T (Irs, Irt, Ist), the three-phase input current is balanced under normal conditions, and the error between the three phases is about ±5%. However, due to the amplitude and phase imbalance of the three-phase grid voltage, and the difference in line impedance, the error is sometimes larger, reaching ±10%. Error within ±10% is normal.

2. Output current detection:
   The output current is related to the motor load. The heavier the load, the greater the current.

   During stable running of the AC drive, the output current of the AC drive can be viewed through the displayed value on the keypad or measured using a hand-held current clamp or oscilloscope. Normally, the three-phase output current is balanced, and the error between the three phases is about ±5%. However, the error may be larger due to the influence of the motor. The error within ±10% is normal.

Note

The current detection instrument to be used depends on actual requirements.

- If you only analyze the general problem, measure the three-phase input current and output current directly with the hand-held current clamp. You can determine whether the AC drive is abnormal through routine inspection.
- If you need to locate complex problems, such as motor jitter, torque fluctuation, and overload fault, For overcurrent faults, more detailed detection and analysis is required. In this case, an oscilloscope and corresponding current and voltage detection probes may be required.

8.2.4 Heat dissipation detection method

After the main power module inside the AC drive is heated, the heat is generally cooled onto the heatsink and then routed through the cooling fan. If the AC drive reports an overtemperature problem occasionally, the cooling of the AC drive needs to be detected. Generally, the heat dissipation detection is in four dimensions:

1. External ambient temperature detection

Check whether the ambient temperature of the AC drive is normal. If the operating temperature is too high, exceeding the AC drive specifications, and the load is heavy, an overheat fault may be reported. To solve this problem, reduce the ambient temperature, for example, add air conditioning to the machine room.

2. Cooling detection of the cabinet

a. Check whether the air inlet and outlet of the cabinet are blocked by dust or flocky objects.
b. Check whether the cooling design of the cabinet is reasonable: Whether the air inlet and outlet area of the cabinet are small and whether the air flow of the cabinet exhaust fan is small.
c. Check whether the internal layout of the cabinet is proper. 1. Due to the layout, no special heat deflection measures are taken inside the cabinet. As a result, the hot air from the air outlet of the AC drive does not exit the cabinet close to the door. Instead, it returns to the air inlet of the AC drive. The air inlet temperature of the AC drive increases significantly. 2. Multiple AC drives are arranged up and down the cabinet. The air outlet of the lower AC drive directly faces the air inlet of the upper AC drive. The air inlet temperature of the upper AC drive rises significantly due to the lack of a special guiding design. 3. The air inlet temperature of the upper AC drive does not comply with the requirements of the product manual. Allow sufficient space between the top and bottom of the AC drive, resulting in poor ventilation of the main cooling duct inside the AC drive.

3. AC drive fan detection

The fan is damaged most easily, resulting in poor cooling effect. Generally, you can check the fan speed and fan noise to determine whether the fan is normal. Observe whether the fan is damaged in one of the following conditions. If yes, replace the fan. 2. The speed is significantly low. 3. The speed is unstable (fast/slow or rotor eccentric). 4. The fan makes abnormal noise. 5. The appearance is abnormal (leaf defect, etc.).

4. AC drive heatsink detection

Check whether the main heatsink of the AC drive is blocked (such as oil, moisture, dust, and flocky). If the heatsink is severely blocked, Maintenance and cleaning are required. For this high-pollution application, to extend the service life of the AC drive, it is recommended that the customer clean the AC drive regularly to ensure proper protection.

8.3 Replace the AC drive.

8.3.1 Replace the AC drive (when data backup is available)

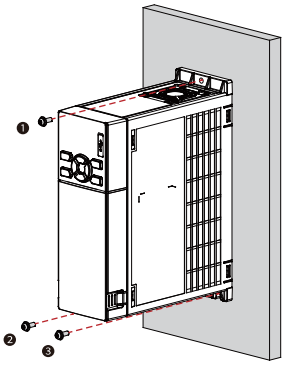
Prerequisite:

After replacing the AC drive, the data on the original device will be lost. Before replacing the AC drive, please back up the data. Save the parameter file to the local computer. After the replacement is completed, load the parameter file to the new device, and complete the quick parameter recovery. For details, see *“8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)” on page 1158*.

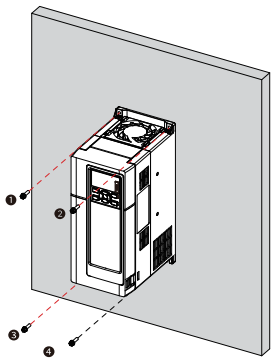
Operation steps:

1. Disconnect the main power supply to the AC drive. When the digital output of the AC drive uses an external 24 V power supply, the external 24 V power supply must also be disconnected.
2. Remove the connection cable from the AC drive.
3. Remove the AC drive to be replaced.

- Disassembling backplate-mounted AC drives (T1 to T5):



T1 to T2 models

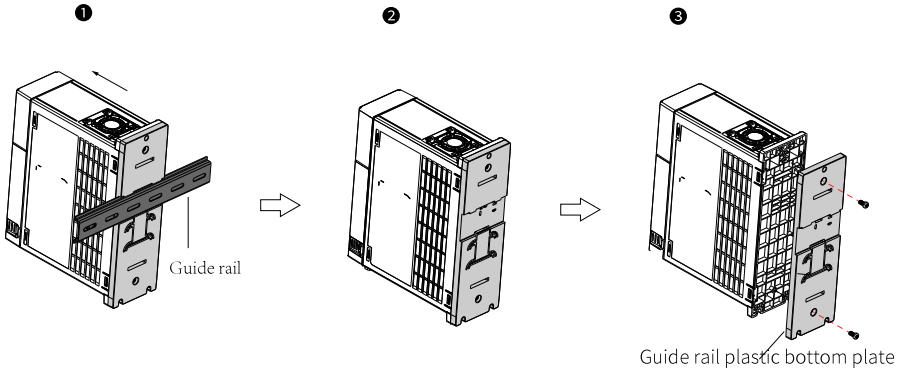


T3 to T5 models

- Remove the rail-mounted AC drives (T1 to T2):

  a. Tap the bottom of the AC drive in the direction of the arrow and pull the guide rail out, as shown in the following figure (1) and (2).

  b. Use a Phillips screwdriver to remove the two PA4 × 12 self-tapping screws from the plastic base plate of the guide rail, and remove the plastic base plate of the guide rail. You can complete the AC drive removal, as shown in the following figure.



- Disassemble the through-hole mounted AC drive (T4 to T5 models):

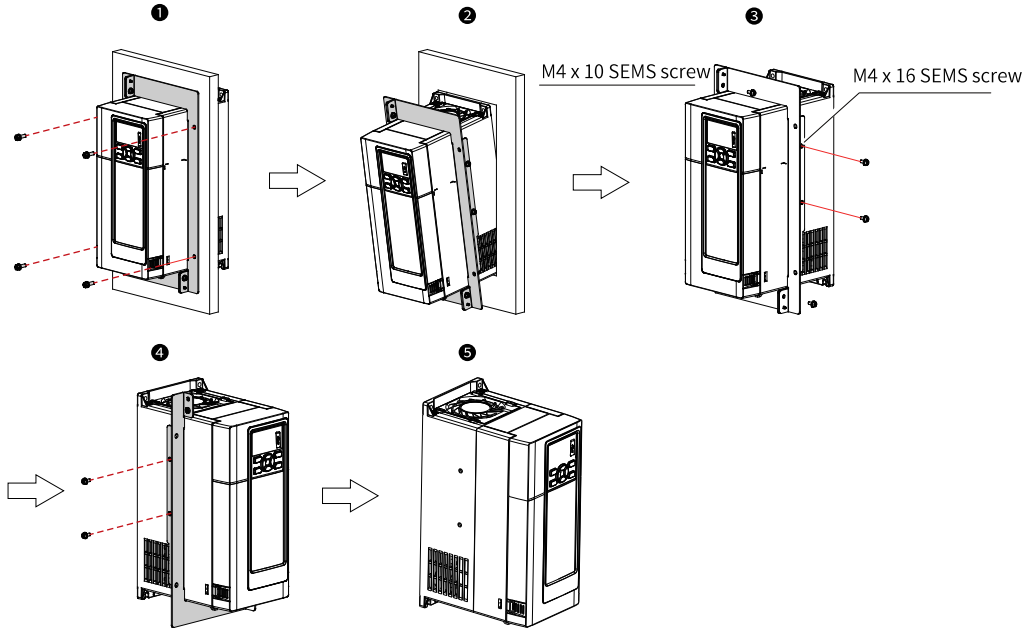
  a. Remove the four M5×20 cross recessed hexagon head SEMS screws around the bracket with a Phillips screwdriver, as shown in figure (1).

  b. Remove the AC drive from the fixed hole of the control cabinet, as shown in the figure (2).

  c. Remove the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for the T5 model) on the left side with a Phillips screwdriver. Remove the left and right brackets with two M4×10 cross recessed pan head SEMS screws. See Figure (3).

  d. Remove the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for T5 model) on the left side of the machine with a Phillips screwdriver, as shown in Figure (4).

e. The AC drive removed is shown in the figure (5).



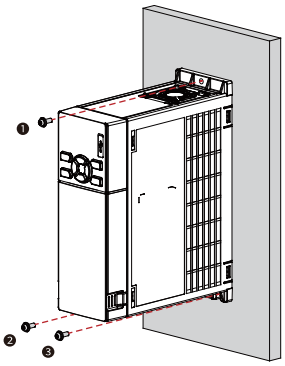
4. Reverse the steps above to install a new AC drive.
5. Connect all cables to the AC drive.
6. Reconnect the main power supply to the AC drive.
7. Load parameters to the device to enable quick parameter recovery; for details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*section.
8. Perform the acceptance test.
9. Check the rotation direction of the motor, make sure that the wiring is correct, and check that the function is normal.

8.3.2 Replace the AC Drive (when no data backup is available)

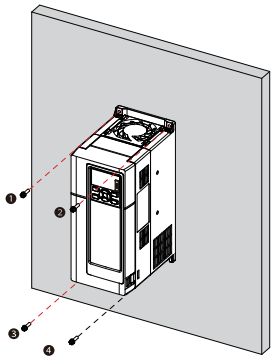
Operation steps:

1. Disconnect the main power supply to the AC drive. When the digital output of the AC drive uses an external 24 V power supply, the external 24 V power supply must also be disconnected.
2. Remove the connection cable from the AC drive.
3. Remove the AC drive to be replaced.

- Disassembling backplate-mounted AC drives (T1 to T5):



T1 to T2 models

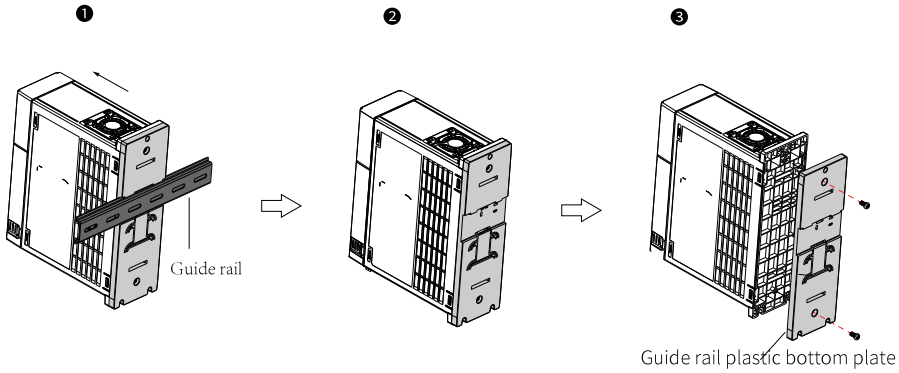


T3 to T5 models

- Remove the rail-mounted AC drives (T1 to T2):

  a. Tap the bottom of the AC drive in the direction of the arrow and pull the guide rail out, as shown in the following figure (1) and (2).

  b. Use a Phillips screwdriver to remove the two PA4 × 12 self-tapping screws from the plastic base plate of the guide rail, and remove the plastic base plate of the guide rail. You can complete the AC drive removal, as shown in the following figure.



- Disassemble the through-hole mounted AC drive (T4 to T5 models):

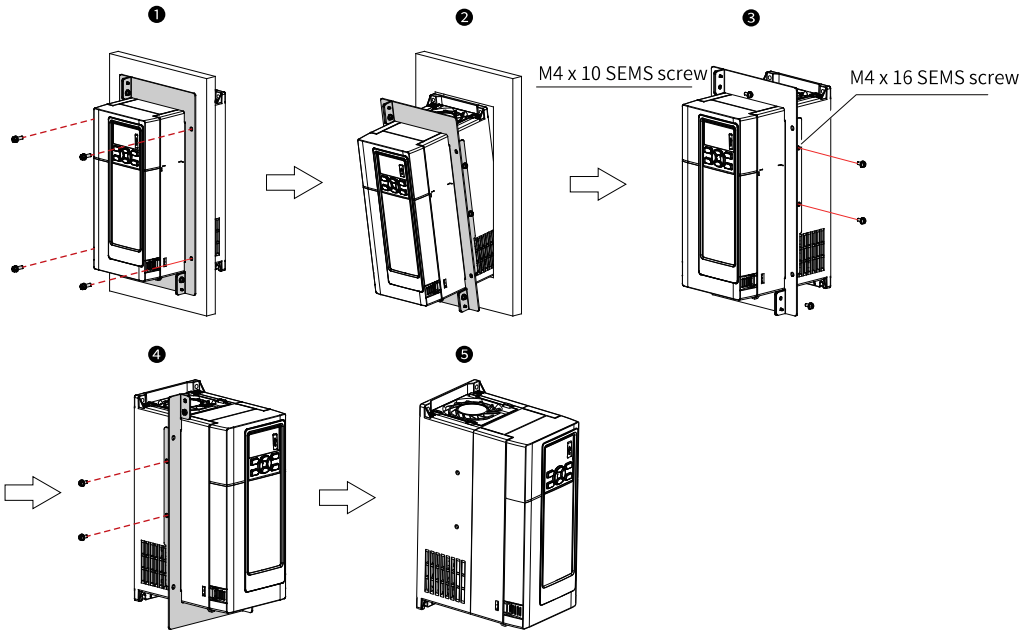
  a. Remove the four M5×20 cross recessed hexagon head SEMS screws around the bracket with a Phillips screwdriver, as shown in figure (1).

  b. Remove the AC drive from the fixed hole of the control cabinet, as shown in the figure (2).

  c. Remove the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for the T5 model) on the left side with a Phillips screwdriver. Remove the left and right brackets with two M4×10 cross recessed pan head SEMS screws. See Figure (3).

  d. Remove the two M4×16 cross recessed pan head SEMS screws (M5×20 cross outer hexagon screws for T5 model) on the left side of the machine with a Phillips screwdriver, as shown in Figure (4).

  e. The AC drive removed is shown in the figure (5).



4. Reverse the steps above to install a new AC drive.
5. Connect all cables to the AC drive.
6. Reconnect the main power supply to the AC drive.
7. Re-commissioning the AC drive.

8.4 Components Replacement

8.4.1 Serviceable Components

Component name	Reference life	Maintenance work	Measures to extend component life
Fan	5 years	Replace the fan, see *"8.4.3 Replace the Fan" on page 1153*.	Enhance the protection of the controller to reduce the entry of fibrous materials and dust into the machine's air ducts. Clean the air ducts regularly based on actual conditions.
Control board	-	Replace the control board, see *"8.4.4 Replace the control board." on page 1155*.	Do not operate with power on when connecting the control cable, and take anti-static measures.

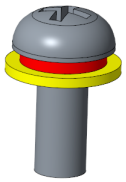
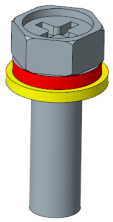
Component name	Reference life	Maintenance work	Measures to extend component life
Bus capacitor	5 years	Contact the manufacturer for technical support to replace the electrolytic capacitor.	If the cabinet ambient temperature is too high, reduce the drive ambient temperature, for example, by adding air conditioning to the drive control room. If there is a large imbalance in the grid or other capacitive load switchover devices exist on the grid side, it is recommended to add an AC reactor on the input side. Replace with a higher power drive and increase the derating.
Buffer relay	100,000 cycles	Contact the manufacturer for technical support to replace the buffer relay.	If you need to start and stop the drive frequently, use the keyboard or I/O terminals to control the drive. It is recommended to add vibration damping measures for high vibration applications.

Note

- The reference life shown in the preceding table is an estimated life. It is based on the following conditions. It is not a guarantee value because the actual service life of the device may be shortened due to the harsh installation environment and use conditions.
  - Ambient: Temperature: 40℃; Humidity: Less than 95% RH, non-condensing.
  - Load rate: 100% rated for heavy load.
  - Running rate: 24 hours a day, 365 days a year.

  Harsh application conditions may shorten product life.
- The harsh installation environment and usage conditions include the following:
  - Conductive dust, oil, salt spray, and halogen corrosive gases; dust or flocculent causes air ducts to clog.
  - The input three-phase voltage is unbalanced.
  - When the AC drive is connected to a high-capacity power transformer, or when other devices on the input side are used for capacitive load switchover, the AC drive input side generates too large peak current, which also affects the life of the components to a certain extent. To reduce this effect, it is recommended to add an input AC reactor on the input side.

8.4.2 Maintenance Tools

Tool	Applied material	Diagram	Applied position	Quantity of materials	Recommended torque (N·m)
Electric screwdriver (Select bits according to bolt head types)	M4 cross recessed pan head SEMS screw		Installation feet for fixing of MD630-INT T1 to T2 models	3	1.2
	M4 cross recessed pan head SEMS screw		Installation feet for fixing of MD630-INT T3 models	4	
	M5 cross recessed hexagon head SEMS screw		Installation feet for fixing of MD630-INT T4 to T5 models	4	2.8
	Self-taping screw (M3 x 12)		Control board mounting hole for all MD630-INT models	3	0.55
			Operating panel mounting hole for all MD630-INT models	1	0.55
			Expansion card mounting hole for all MD630-INT models	2	

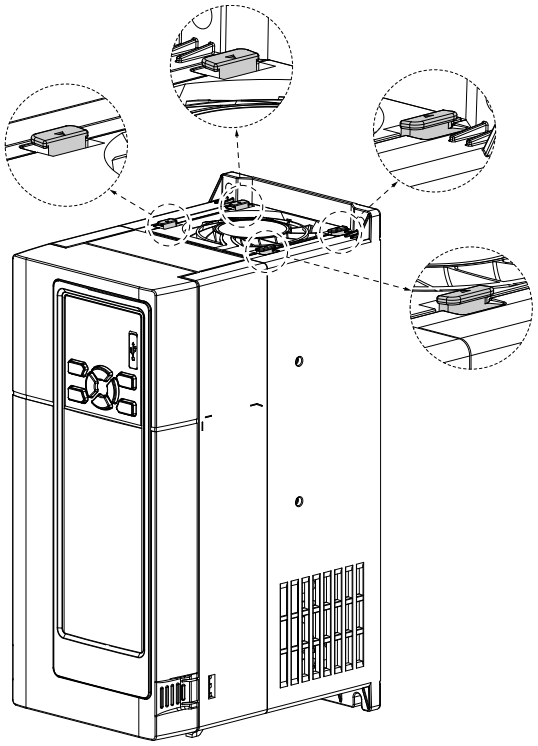
Note

- The tools shown are for reference only. You need to purchase these tools from a third party.
- Use qualified and calibrated tools.
- Unit conversion: 1 N·m ≈ 10 kgf.cm

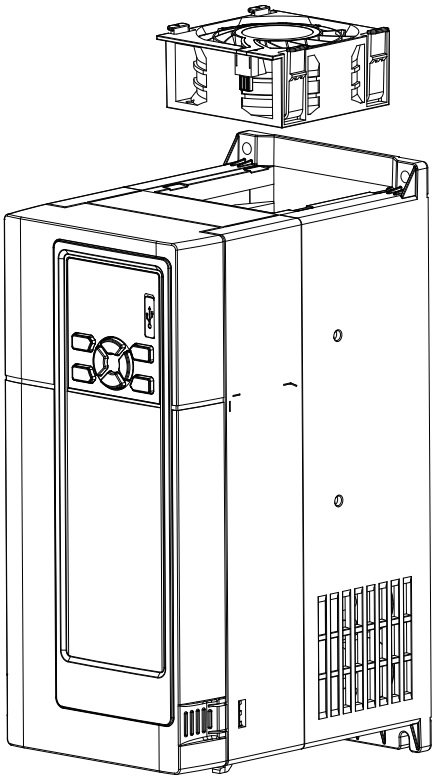
8.4.3 Replace the Fan

Replacement procedure (the following figure takes T4 as an example):

1. Press down the four snap-fit positions of the top fan simultaneously.



2. Lift the fan up to remove the fan.



3. Install the new fan in reverse order. When the fan is installed, you hear a click of the fan latch. This indicates that the snap hook is installed properly.
4. Power on the product to ensure that the fan runs normally.

Note

Contact Inovance for details on the fan purchase process.

8.4.4 Replace the control board.

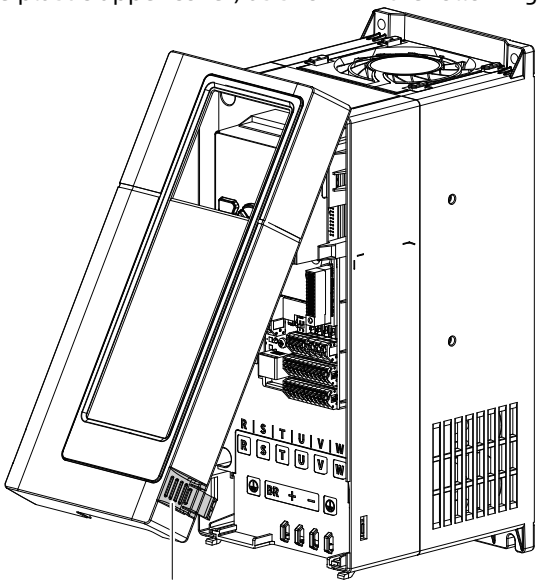
Preparation

Ensure that the replacement control board matches the device model.

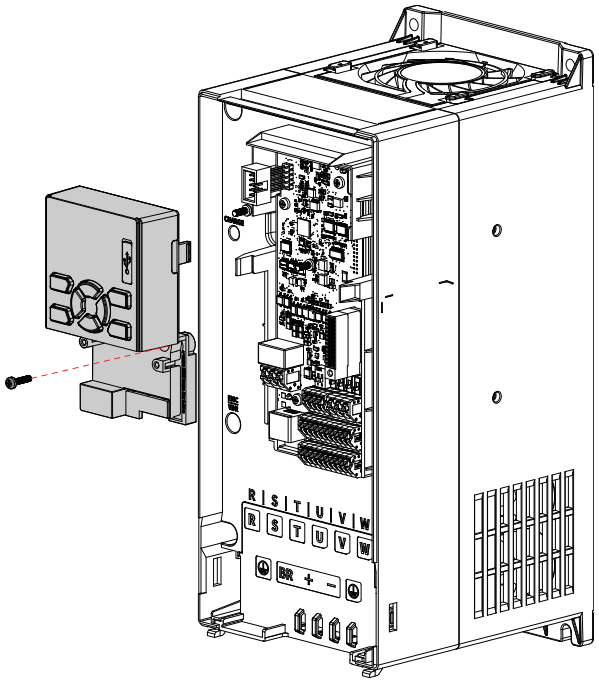
After replacing the control board, the data carried on the old control board will be lost. Before replacing the control board, perform a data backup. Save the parameter file to the local computer. After the replacement is completed, load the parameter file to the new control board to restore the parameters quickly. For details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*.

Replacement procedure (T4 is shown as an example):

1. Press the snap-fit buttons on the lower sides of the plastic upper cover of the product, and turn them upwards to open the plastic upper cover, as shown in the following figure.

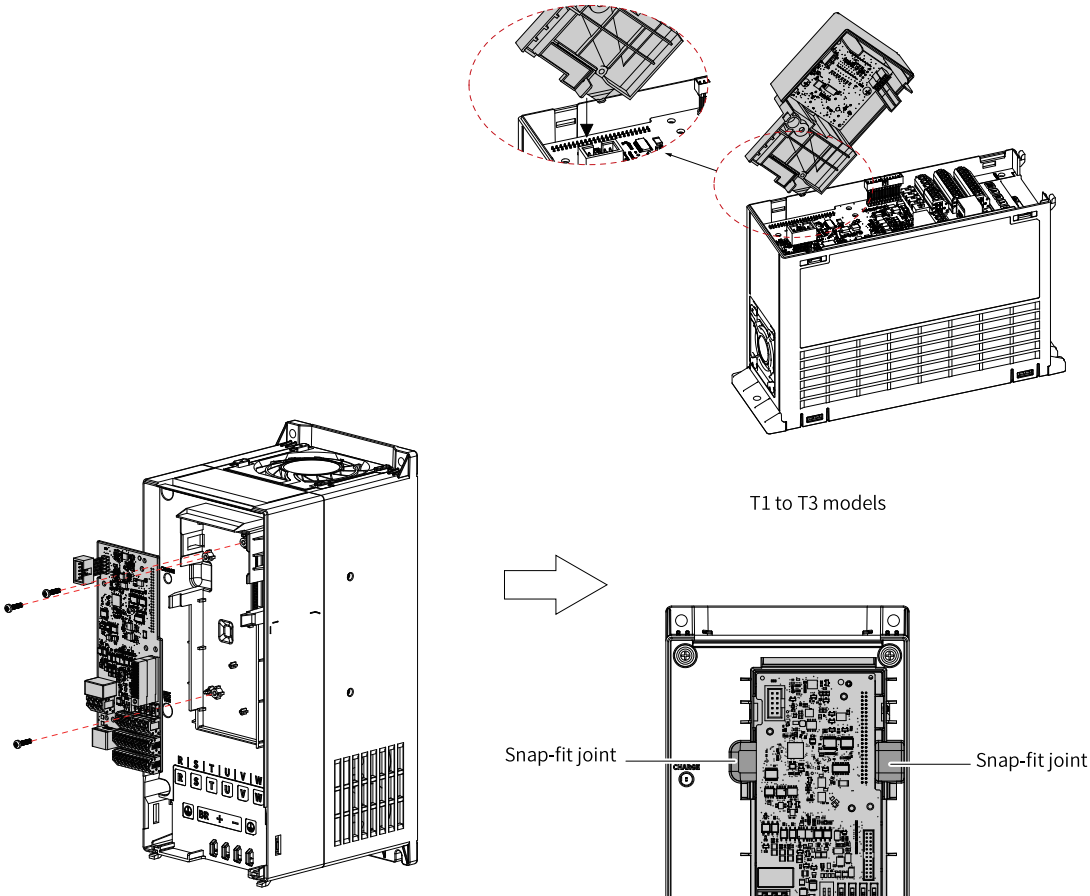


2. Use a Phillips screwdriver to remove the ST2.9 self-tapping screw on the operating panel assembly, press the clasp on both sides of the operating panel assembly, and remove the operating panel assembly, as shown in the following figure.



3. Use a Phillips screwdriver to remove the three M3 self-tapping screws on the control board, as shown in the following figure.

- For T1 to T3 models, insert the hook on the operating panel box into the position shown in the figure and lift the control board with the hook to release the drive control terminal, as shown in the following figure.
- T4 to T5 models move the control board by using the hand position on both sides of the control board, as shown in the following figure.



4. Install the new control board in reverse order.
5. Connect all cables to the AC drive.
6. Reconnect the main power supply of the AC drive.
7. Load parameters to the device to enable quick parameter recovery. For details, see *"8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)" on page 1158*.
8. Perform acceptance test.

Check the rotation direction of the motor and ensure that the wiring is correct. Check whether the function is normal.

Note

Do not connect or disconnect the terminals in the control board during maintenance or disassembly, causing the pin to skew/break. Due to the large number of pins, the AC drive cannot be used due to faults.

Contact Inovance for details on the purchase process of the control board.

8.5 Parameter Upload and Download (Based on iFA Drive Commissioning Software)

Scenario

Before replacing the AC drive or control board, save the parameter file to the local computer. After the replacement is completed, import the parameter file from the local computer to the device for quick parameter recovery.

Function description

Parameter upload: Save the parameters of the drive to the local computer.

Parameter download: Download the parameter file from the local computer to the drive.

Prerequisite

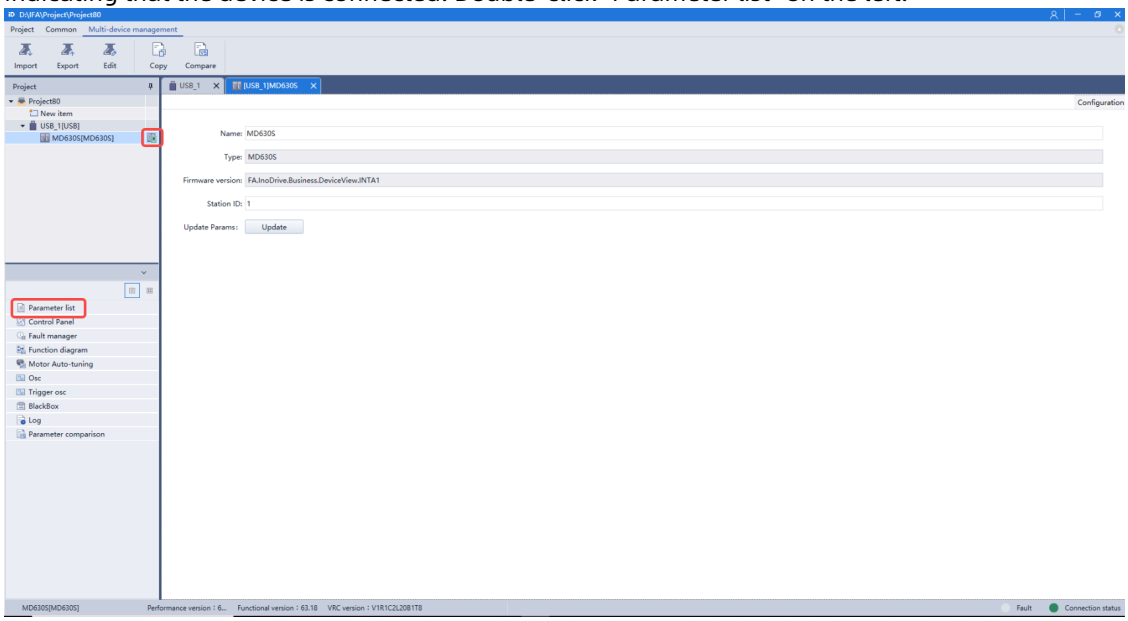
You have created a new project on the iFA commissioning software and completed the connection of the iFA to the drive. For details, see *"4.2.2.2 Quick Start Guide" on page 115*.

Operation steps

First, back up the parameter file.

Back up the parameter file of the drive to the local computer. The steps are as follows:

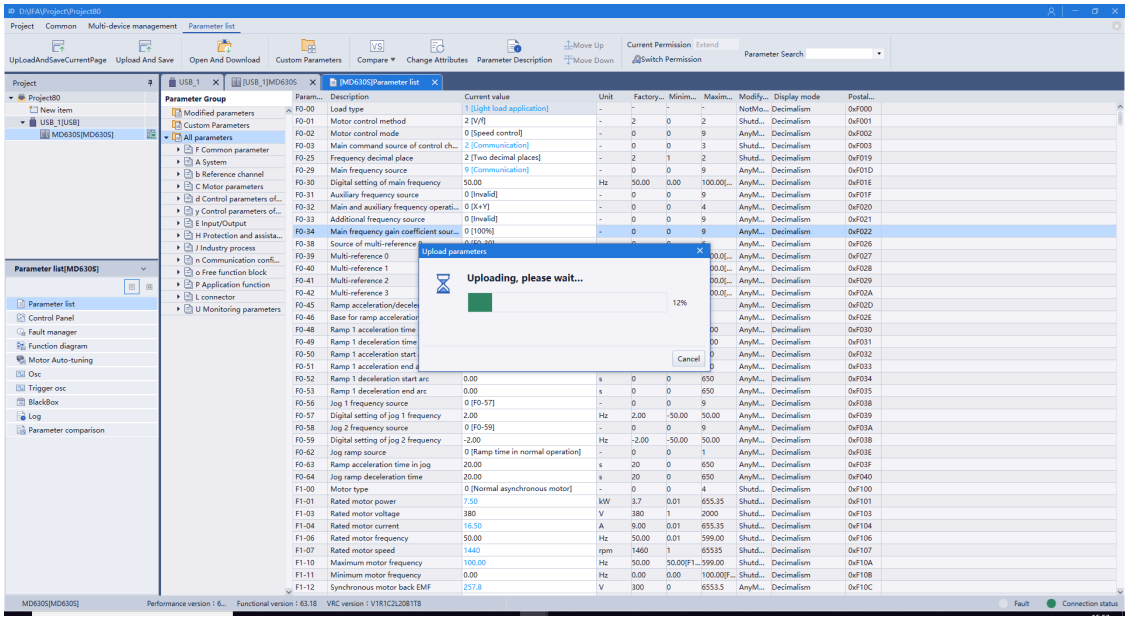
1. The device name (MD630S-INT) in the project tree on the left displays a green flag to the right, indicating that the device is connected. Double-click "Parameter list" on the left.



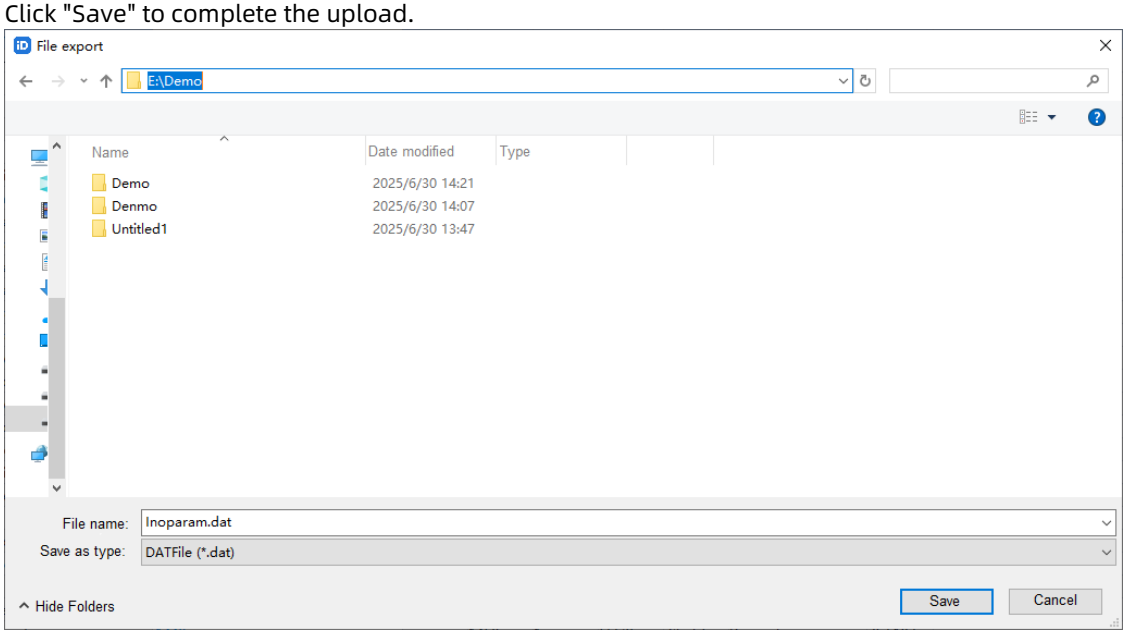
2. The interface displays a list of parameters of this device. Click the "Upload and Save" button and the "UpLoadAndSaveCurrentPage" in the upper left corner to back up the parameter file locally.

   - Upload and Save: When you back up parameters, all parameters are backed up.
   - UpLoadAndSaveCurrentPage: When you back up parameters, only the parameters of the current page are backed up.

As shown in the following figure, the system starts uploading parameters. Do not operate during parameter upload.



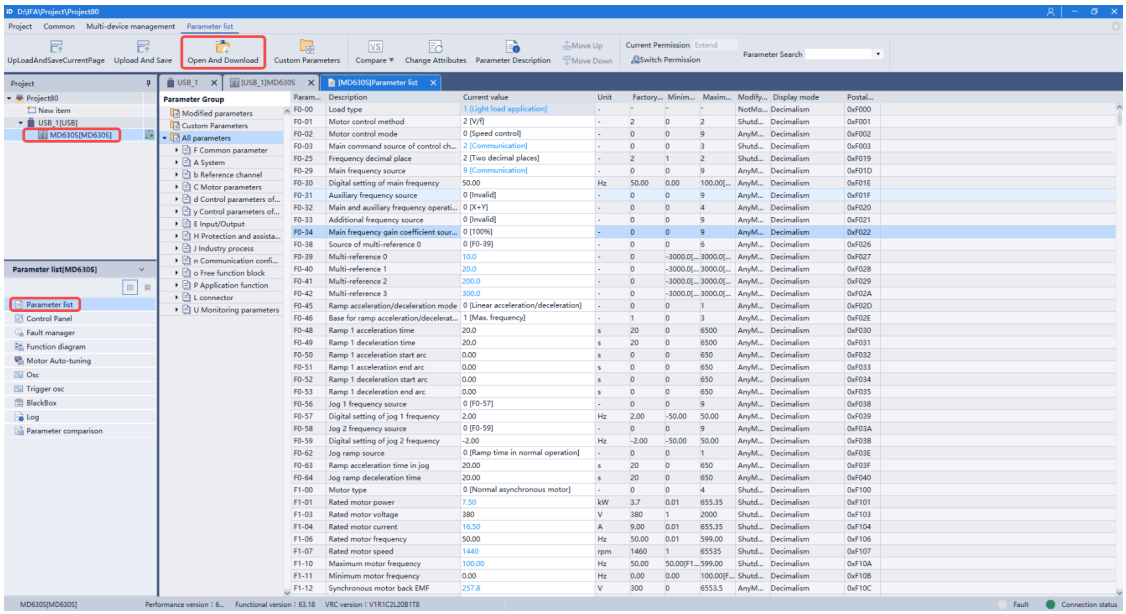
3. After the upload is completed, set the location and file name of the parameter file to be saved. Click "Save" to complete the upload.



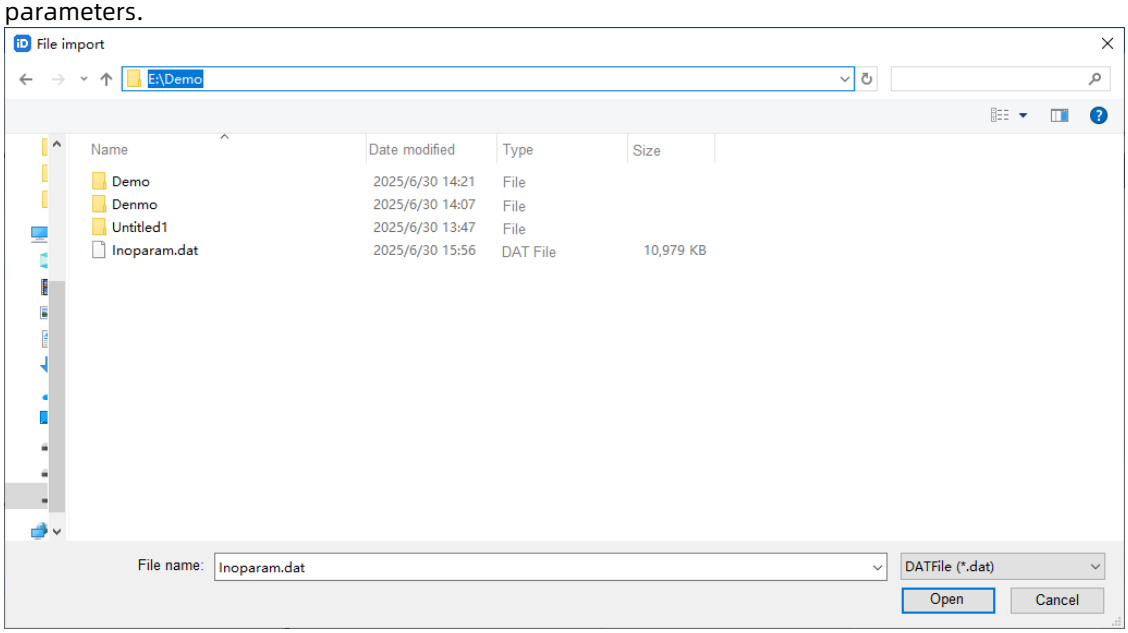
Second, load the parameter file.

Load the parameter file that is backed up to the local computer to the drive or other device for quickly copying the parameters. The steps are as follows:

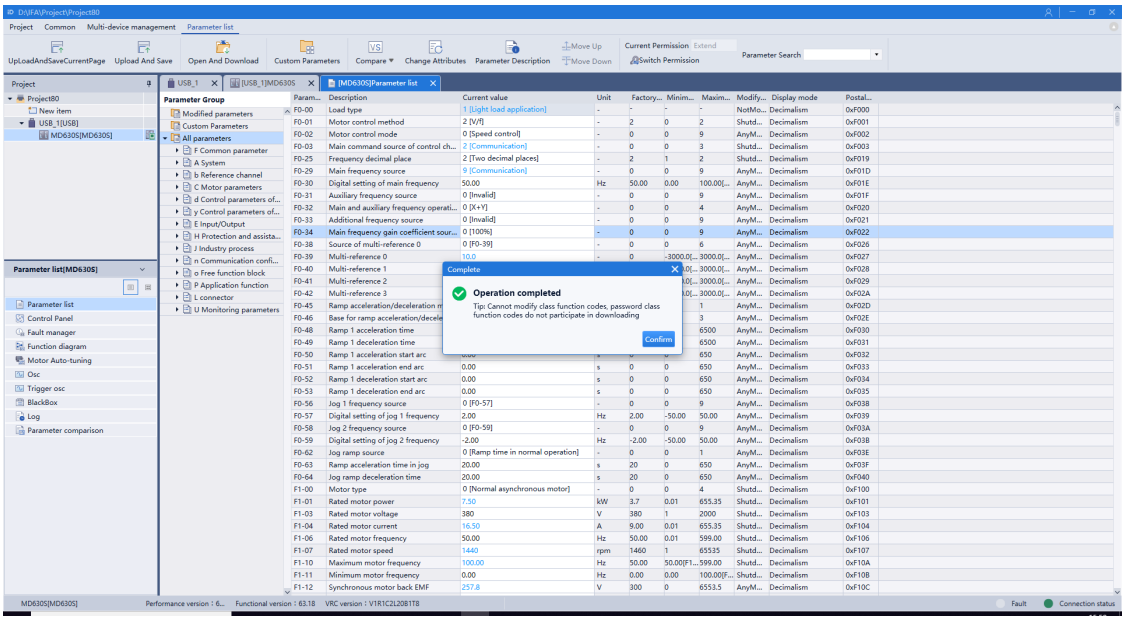
1. On the "Parameter list" page, select the corresponding project (for example, MD630S-INT) in the project tree on the left. Double-click "Parameter list" to open the parameter file of the device. Click the "Open And Download" button.



2. Select the parameter file to be imported in the pop-up box, and click "Open" to import the saved parameters.



3. As shown in the following figure, the system starts downloading parameters. Do not operate during the parameter download process.
4. After the download is complete, the message "Operation completed" is displayed.


Project
Common
Multi-device management
Parameter list
UpLoadAndSaveCurrentPage
Upload And Save
Open And Download
Custom Parameters
Compare
Change Attributes
Parameter Description
Move Up
Move Down
Current Permission
Switch Permission
Parameter Search
Project80
New item
USB_1[USB]
MD630S[MD630S]
Parameter list[MD630S]
Parameter list
Control Panel
Fault manager
Function diagram
Motor Auto-tuning
Osc
Trigger osc
BlackBox
Log
Parameter comparison
USB_1
[USB_1]MD630S
[MD630S]Parameter list
Parameter Group
Modified parameters
Custom Parameters
All parameters
F Common parameter
A System
b Reference channel
C Motor parameters
d Control parameters of...
y Control parameters of...
E Input/Output
H Protection and assista...
J Industry process
n Communication confi...
o Free function block
P Application function
L connector
U Monitoring parameters
Complete
Operation completed
Tip: Cannot modify class function codes, password class function codes do not participate in downloading
Confirm
MD630S[MD630S]
Performance version : 6...
Functional version : 63.18
VRC version : V1R1C2L20B1T8
Fault
Connection status

9 Technical Specifications

9.1 Electrical Specifications

Note

In the following tables, the rated power of the AC drive is measured under the following conditions:

For three-phase 380 V to 480 V models, the rated power is measured at the input voltage of 400 VAC.

Three-phase 380 V to 480 V

Table 9–1 Electrical specifications for T1 to T2 models (three-phase 380 V to 480 V)

Items		Specifications					
Model: MD630S/N-4Txxxxx-INT		1R5BS	2R1BS	3R8BS	5R1BS	7R2BS	9R0BS
Drive structure		T1			T2		
Applicable motor capacity (kW)	G-type model	0.37	0.75	1.5	2.2	3	4
	P-type model	0.75	1.5	2.2	3	4	5.5
Input	Rated input current (A) of G-type model	1.7	2.4	4.6	6.3	8.9	11.4
	Rated input current (A) of P-type model	2.4	4.6	6.4	9	11.4	17
	G type Rated DC bus input current (A) (at DC input)	2.1	2.9	5.6	7.7	10.9	14
	P-type model Rated DC bus input current (A) (at DC input)	2.9	5.6	7.8	11	14	20.8
	Rated voltage/Rated frequency	AC: Three-phase 380 V to 480 V, 50/60 Hz					
	Allowable voltage fluctuation range	-15% to +10%, or 323 VAC to 528 VAC					
	Allowable frequency fluctuation range	±5%, or 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA) of G-type model (400 V)	1.3	1.8	3.5	4.8	6.8	8.7
	Rated power supply capacity (kVA) of G-type model (480 V)	1.4	2	3.6	5	7	9
	Rated power supply capacity (kVA) of P-type model (400 V)	1.9	3.5	4.9	6.9	8.7	13
	Rated power supply capacity (kVA) of P-type model (480 V)	2	3.6	5.1	7.1	9	13.3

Items		Specifications					
Model: MD630S/N-4Txxxxx-INT		1R5BS	2R1BS	3R8BS	5R1BS	7R2BS	9R0BS
Output	Rated output current (A) of G-type model	1.5	2.1	3.8	5.1	7.2	9
	Rated output current (A) of P-type model	2.1	3.8	5.1	7.2	9	13
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz (edited by parameter)					
	Carrier frequency	0.8 kHz to 16.0 kHz (automatically adjusted according to the load features)					
	Braking transistor	Built-in standard configuration					
	Overload capacity	G-type model: 60s at 150% of the rated current P-type model: 60s at 110% of the rated current					
Heat dissipation design	Heat output (W) of G-type model	29	34	58	74	100	114
	Heat output (W) of P-type model	35	54	76	103	129	174
	Air exhaust volume (CFM)	/	/	12.6	23	17	17
	Cooling mode	Natural ventilation	Natural ventilation	Air cooling	Air cooling	Air cooling	Air cooling
Overvoltage class	OVC III						
Pollution degree	PD2						
Protection class	Class I						
IP rating	IP40 (Except for power supply distribution wiring and capacitor vent)						
IEC61800-9-2 energy efficiency rating	IE2						

Note

G-type: Heavy-load models that support 1.5 times the rated load.

P-type: Light-load models, supporting 1.1 times the rated load.

Table 9–2 Electrical specifications for T3 to T5 models (three-phase 380 V to 480 V)

Items		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Drive structure		T3 models		T4		T5	
Applicable motor capacity (kW)	G type	5.5	7.5	11	15	18.5	22
	P-type model	7.5	11	15	18.5	22	30

Items		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Input	Rated input current (A) of G-type model	16.8	22.0	32.4	41.6	48.7	58.5
	Rated input current (A) of P-type model	22.7	33.4	42.1	49.1	60.1	71.6
	G type Rated DC bus input current (A) (at DC input)	20.6	26.9	39.7	50.9	59.6	71.6
	P-type model Rated DC bus input current (A) (at DC input)	27.8	40.9	51.6	60.1	73.6	87.7
	Rated voltage/Rated frequency	AC: Three-phase 380 V to 480 V, 50/60 Hz					
	Allowable voltage fluctuation range	-15% to +10%, or 323 VAC to 528 VAC					
	Allowable frequency fluctuation range	±5%, or 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA) of G-type model (400 V)	12.8	16.8	24.7	31.7	37.1	44.6
	Rated power supply capacity (kVA) of G-type model (480 V)	13.2	17.3	25.4	32.5	38	45.8
	Rated power supply capacity (kVA) of P-type model (400 V)	17.3	25.5	32.1	37.4	45.8	54.6
	Rated power supply capacity (kVA) of P-type model (480 V)	17.6	25.9	32.8	38.2	46.7	56.1
Output	Rated output current (A) of G-type model	13.0	17.0	25.0	32.0	37.0	45.0
	Rated output current (A) of P-type model	17.0	25.0	32.0	37.0	45.0	60.0
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz (edited by parameter)					
	Carrier frequency	0.8 kHz to 16.0 kHz (automatically adjusted according to the load features)					
	Braking transistor	Built-in standard configuration					
	Overload capacity	G-type model: 60s at 150% of the rated current P-type model: 60s at 110% of the rated current					
Heat dissipation design	Heat output (W) of G-type model	174	210	349	391	513	571
	Heat output (W) of P-type model	242	344	491	482	674	856
	Cooling mode	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling
	Air exhaust volume (CFM)	31	31	55.7	57.5	91.8	85
Overvoltage class	OVC III						
Pollution degree	PD2						

Items		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Protection class	Class I						
IP rating	IP40 (Except for power supply distribution wiring and capacitor vent)						
IEC61800-9-2 energy efficiency rating	IE2						

Note

G-type: Heavy-load models that support 1.5 times the rated load.

P-type: Light-load models, supporting 1.1 times the rated load.

9.2 General Specifications

Item			Technical Specification
Motor control performance	Motor type		Asynchronous induction motors (IM), permanent magnet synchronous motors (PMSM), and synchronous reluctance motors (SynRM)
	Control mode		Sensorless vector control (SVC), feedback vector control (FVC), and voltage/frequency (V/f) control
	Asynchronous motor (V/f)	Supported functions	Energy saving control, overvoltage suppression, overcurrent suppression, undervoltage suppression (voltage dip suppression), oscillation suppression, torque boost, slip compensation, different V/f curve selection, V/f separation, DC braking, random PWM, overexcitation fast deceleration, and droop control
	Synchronous reluctance motor V/f	Supported functions	Speed tracking, electronic motor stator shorting, MTPA control, overvoltage suppression, undervoltage suppression (voltage dip suppression), DC braking, zero-speed holding, IF running control
	Asynchronous motor (SVC)	Supported functions	Energy saving control, inertia auto-tuning, acceleration feedforward, adaptive speed loop parameters, droop control, free programming and self-adaption of speed loop parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), overexcitation fast deceleration, automatic voltage adjustment, flying start, and DC braking
		Speed regulation range	1:500
		Startup torque	200%
		Torque step response	Within 2ms
		Torque control accuracy	±3% at the frequency above 5 Hz
		Speed stability accuracy	Within 10% of the rated slip value
		Flux weakening magnification	6
	Asynchronous motor (FVC)	Supported functions	Energy saving control, inertia auto-tuning, acceleration feedforward, adaptive speed loop parameters, droop control, free programming and self-adaption of speed parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), overexcitation fast deceleration, automatic voltage adjustment, flying start, DC braking, continuous operation after smooth switchover to SVC upon encoder abnormality, and FVC-to-SVC switchover at designated frequency (This can avoid abnormal operation caused by high-speed jitter of the encoder.)
		Supported encoder	ABZ encoder (differential, collector, push-pull), 23-bit communication encoder, resolver encoder, SSI encoder, sin-cos encoder, EnDat encoder, and BISS encoder
		Startup torque	200%
		Torque step response	Within 2ms
		Torque control accuracy	±2%
		Speed fluctuation	0.05% when the motor and encoder are free from faults
		Speed stability accuracy	0.02% when the motor and encoder are free from faults
		Flux weakening magnification	5

Item			Technical Specification
Motor control performance	Permanent magnet synchronous motor and synchronous reluctance motor (SVC)	Supported functions	Flying start, electronic motor stator shorting, overexcitation fast deceleration, MTPA control, maximum ratio of torque to current, inertia auto-tuning, acceleration feedforward, droop control, free programming and self-adaption of speed loop parameters, overvoltage suppression, undervoltage suppression, DC braking, and IF control in SVC mode
		Speed regulation range	1:200
		Startup torque	200%
		Torque step response	Within 2ms
		Speed stability accuracy	0.05% when the motor is free from faults
		Torque control accuracy	±3% at the frequency above 5 Hz

Item			Technical Specification
Basic function	Input frequency resolution		Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%.
	Operation	Operation command	Supports independent dual channels that can be switched freely Supports different start/stop sources (such as terminal, panel, communication, customization, and connector) Supports standard control words
		Frequency reference	Supports independent dual channels that can be switched freely Supports various sources (such as communication, panel, analog, and connector) Supports main frequency, auxiliary frequency, and various operations (ADD, SUBTRACT, MULTIPLY, MAX, MIN) Supports additional frequency Supports multi-level frequency limit
		Auxiliary frequency reference	Supports various auxiliary frequency references, enabling fine tuning of the auxiliary frequency and main & auxiliary calculation
		Standard command word	Normal start/stop (OFF1) Emergency stop (OFF2) Quick stop, stop at maximum capability (OFF3) Operation enable, operation pause
		Torque reference	Supports various torque references, including digital setting, analog voltage, analog current, pulse setting, multi-reference, PID reference, simple PLC, and communication (switchable through multiple methods)
		Start/Stop Mode	Supports dual channels that can be switched freely Supports six start/stop modes, including single-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2
		Acceleration/ deceleration time	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration Supports four groups of acceleration/deceleration time Supports independent configuration for the 7-segment S curve Supports automatic acceleration/deceleration switchover
		Multi-motor parameters	Supports four groups of motor parameters independent of each other
	Multi-speed		Supports up to 16 segments Supports different unit settings,including Hz, rpm, rated value (%), and maximum speed (%) Supports free per-unit conversion Supports custom limit
	Ramp function		When speed references are sent periodically through communication, automatic interpolation is supported, which prevents reference discontinuity caused by communication intervals and ensures operation stability.
	Output limit		Supports torque limit, power limit, current limit, maximum/minimum torque limit, speed limit, and jump frequency

Item			Technical Specification
Commissioning and configuration (HMI)	Control terminal	Analog input (AI)	Two channels of analog inputs: • AI1: -10 V to +10 V/0 mA to 20 mA • AI2: -10 V to +10 V/0 mA to 20 mA/PT100/PT1000/KTY/PTC Voltage current: Correction accuracy 0.3%, response time less than 2ms • PT100 (-25℃ to +200℃, ±0.5℃) • PT1000 (-25℃ to +200℃, ±0.5℃) • KTY84-130 (-40℃ to 260℃, ±0.5℃) • PTC (20℃ to 180℃, ensuring a range from 110℃ to 150℃, ±5℃)
		Analog output (AO)	Standard MD630S-INT: One channel of analog output (AO1: 0 V to 10 V/0 mA to 20 mA), correction accuracy of 100 mV, resolution of 12 bits, correction accuracy of 0.5% Bus-type MD630N-INT: No analog output
		Digital input (DI)	Standard MD630S-INT: Six channels of regular inputs and one channel of high-speed input, NPN/PNP input wiring, DI7 as high-speed pulse input, frequency of 20 kHz Bus-type MD630N-INT: Two channels of regular inputs, NPN/PNP input wiring
		Digital output (DO)	Relay output: Two contacts, 3 A/250 VAC, 3 A/30 VDC, NO/NC function supported • Standard MD630S-INT: One channel of regular digital input, frequency of 100 Hz, output voltage range of 0 V to 24 V, output current range of 0 mA to 50 mA; one channel of high-speed digital output, frequency of 100 kHz, output voltage range of 0 V to 24 V, output current range of 0 mA to 50 mA • Bus-type MD630N-INT: One channel of regular digital output, frequency of 100 Hz, output voltage range of 0 V to 24 V, output current range of 0 mA to 50 mA
	External 24 V power supply input		Standard MD630S-INT: Not configured Bus-type MD630N-INT: Configured (with an input range of 21.6 VDC to 26.4 VDC and a load current of 1 A)
	Display and operating panel	LED operating panel	It can display parameters and AC drive status (forward running, reverse running, stop, operating panel/terminal/communication control, speed/torque control, STO state) and can be used to modify parameters.
		Locking and function selection of keys	Keys on the operating panel can be locked partially or all keys can be locked. In addition, functions with limited availability range can be assigned to some keys. This can prevent accidental operation.
	Commissioning software		The commissioning software iFA Drive allows users to upload and download AC drive parameters, and provides a virtual oscilloscope display that shows system status for fault diagnosis. The function logic is presented in data flow diagram which transforms the commissioning mode from parameter + manual combination to manual-free commissioning. Reduces product learning costs and commissioning time
	Parameter protection function		Supports parameter-write protection to prevent incorrect modification of parameters
	User password (parameter lock)		Supports user-defined passwords to prevent inappropriate parameter access
	Parameter access permission classification		Standard: Common functions enabled by default Expansion: Expansion of non-common functions Expert: Professional user setting that supports password protection

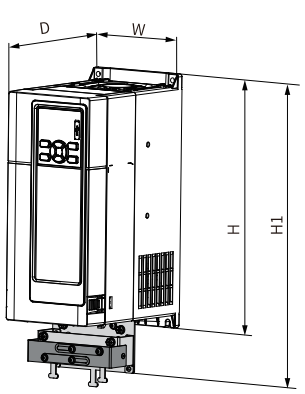
Item			Technical Specification
Advanced functions	Applicability and usability	Application macro	Interface macro: Predefines interface solution of typical start/stop and speed reference, which simplifies the configuration process Industry macro: Enables quick parameter configuration based on industry-specific applications (such as water pump and ceramic)
		Custom user parameter group	Allows users to create new parameter groups 1) Enables quick query or setting of parameters as needed 2) Enables quick access to communication instructions
		Auxiliary function	Timing reached, operating time reached, dead zone time in forward/reverse run, set frequency reached, set current reached, and load speed conversion
		Configurable startup protection	Supports flexible configuration of startup protection reference sources
		Automatic carrier frequency adjustment	Improves overload capacity; carrier frequency automatically adjusted according to output frequency change
	Standard process	Process PID	Supports two groups of PID parameters which can be switched automatically Supports PID initial value, PID pause, limit, PID reference filter time, dead zone, integral saturation, PID forced, and PID feedback loss detection
		Free function block	Meets custom requirements through different free function blocks Supports function blocks including arithmetic and logic operations, control function, time control, switch selection function, multi-point curve, and data conversion
		Simple PLC	Supports 16 work instructions Supports custom acceleration/deceleration time, speed, and operation time Supports custom cyclic mode Supports retention upon power failure Supports pause and reset
		Droop control	Applicable to scenarios where multiple motors drive the same motor
		Jump frequency	Enables the drive to avoid mechanical resonance points of the load Supports up to four jump frequencies
		Motorized potentiometer	Supports virtual potentiometer output implemented by software
	Industry process	Wobble control	The output frequency of the drive increases/decreases based on the set frequency. This function is applicable to industries such as textile and chemical fibers, as well as applications requiring reciprocating motion and winding/unwinding.
		Fire mode	In this mode, the AC drive ignores certain non-critical faults and continue operation to ensure safe personnel evacuation and timely firefighting in buildings, elevators, and tunnels.
	Energy efficiency	Energy conservation statistics	Supports visualized energy conservation. The effects can be converted into data to be read by host controller, including kWh, carbon dioxide emission, and amount saved.
		Hibernation and wakeup	The drive mode goes into standby or hibernation mode when continuous operation is not required. If necessary, the drive will restart.
	STO		STO rating: SIL3 (IEC 61508), PL e, Cat.3 (EN ISO 13849) Interface terminal specifications: 24 VDC (±15%) for STO1 and STO2 dual-circuit input

Item		Technical Specification
Communication	Four-in-one industrial Ethernet bus	Standard MD630S-INT: Modbus (Modbus-RTU) Bus-type MD630N-INT: Integrated with dual Ethernet interfaces; supports four industrial Ethernet communication protocols (PROFINET, EtherCAT, EtherNet/IP, and Modbus TCP), reducing inventory costs and shortening delivery time
	Communication command word	Single-word control mode (compatible with previous series) Position control mode Free-running mode
	Communication disconnection hold	Sets the action mode after communication disconnection: keep running, alarm, or stop upon fault
Fault and protection	Black box function	The black box record is triggered automatically upon fault. The iFA software can be used to obtain the device operation state, facilitating fault analysis. Supports custom trigger conditions for the black box to monitor device operation
	Custom fault	Supports custom faults, alarms, and notifications
	Historical fault records	Supports up to six historical fault records The records include fault code, fault subcode, operation data, and time upon fault occurrence.
	Load monitoring	Supports user-defined range for drive normal operation based on load and speed conditions; supports user-defined faults and alarms once the value is beyond the set range.
	Automatic reset upon fault	Supports automatic reset upon fault. When the number of automatic fault resets is exhausted, the fault cannot be reset. Supports custom configuration of the white list and black list
	Automatic restart upon fault	Supports automatic reset and restart upon fault. When the number of automatic fault resets is exhausted, the fault cannot be reset. Supports custom configuration of the white list and black list
	Fault protection	Supports protection for short circuit to ground upon power-on, drive overcurrent/overload/overvoltage/undervoltage/overheat, motor overload/overspeed/overheat/stall/load loss/step loss, input/output phase loss, communication fault, current detection fault, braking overcurrent protection, current loop exception, excessive speed deviation, demagnetization protection, overspeed protection, excessive zero drift, EEPROM read fault, motor parameter auto-tuning fault, short circuit to ground, SVC stall alarm, and braking status detection fault
	Capacitance leakage detection	Supports capacitance leakage detection
	Self-check	Supports drive and motor detection, IGBT short circuit detection, current sensor sampling fault, short circuit to ground, phase loss self-check, and inter-phase short circuit self-check

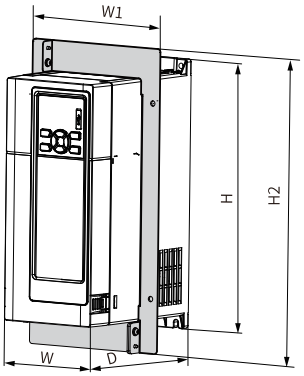
Item		Technical Specification
Environment	Operating location	Indoors without direct sunlight, conductive dust, oil mist, corrosive gas, combustible gas, water vapor, drip, or salt
	Altitude	For altitude equal to or below 1000 m, derating is not required. For altitude ranging from 1000 m to 3000 m, derate 1% for every additional 100 m. For altitude above 3000 m, contact Inovance.
	Ambient temperature	Storage temperature: -40°C to +60°C Transportation temperature: -20°C to +60°C Operating temperature: -20°C to +60°C. If the ambient temperature exceeds 50°C, the system derates by 2.5% for each 1°C higher.
	Humidity	< 95% RH, non-condensing
Long-distance drive		V/f, rated load, unshielded circuit: • 0.37 kW, 200 M (carrier frequency reduced to 1 kHz) • 0.75 kW/1.1 kW, 300 M (carrier frequency reduced to 1 kHz) • 1.5 kW, 500 M (carrier frequency reduced to 1 kHz) • 2.2 kW or above, 500 M (default carrier frequency) • Performance not compromised in vector mode, 100 M (Full series) Supports long-distance driving of the motor and various types of output filters; Shielded cable performance is two-thirds that of unshielded cables.

9.3 Product Dimensions

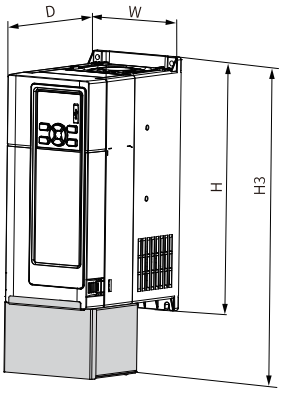
This section describes the size specifications of different models with different options (the following illustrations are based on the T4 model).



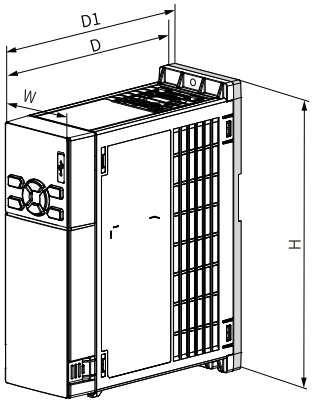
Dimension with EMC grounding bracket of cable shield



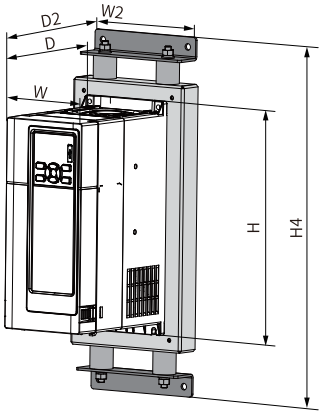
Dimension with through-hole mounting bracket



Dimension with junction box protection accessory

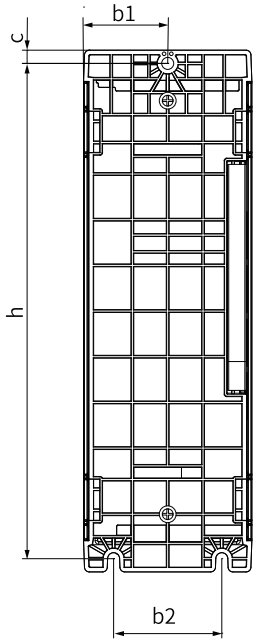


Dimension with DIN rail (optional)

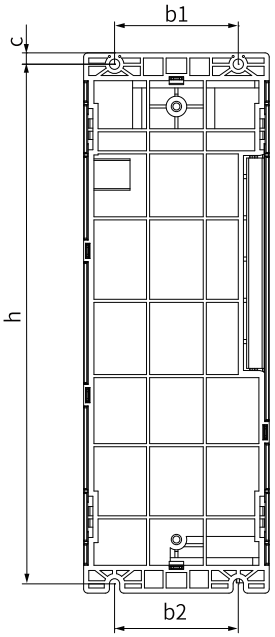


Dimension with vibration-damping bracket for punching press

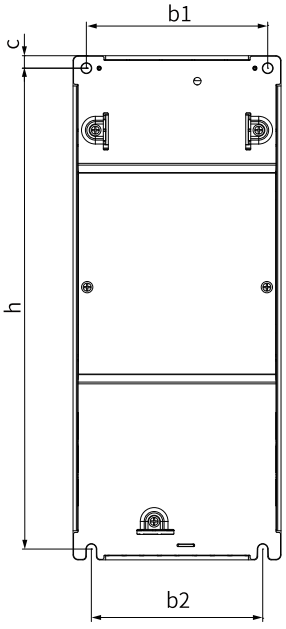
Figure 9-1 Product dimensions



Mounting hole dimensions of T1 and T2



Mounting hole dimensions of T3



Mounting hole dimensions of T4 and T5

Figure 9-2 Mounting hole position

Table 9–3 Product dimensions

Dimension			Drive Structure (kW)				
			T1 (0.37 to 1.5)	T2 (2.2 to 4)	T3 (5.5 to 7.5)	T4 (11 to 15)	T5 (18.5 to 22)
Outline dimensions mm (in.)	Width	W (for only AC drive)	70 (2.76)	75 (2.95)	90 (3.54)	125 (4.92)	165 (6.50)
		W1 (with through-hole mounting bracket)	-	-	-	174.7 (6.88)	214.7 (8.45)
		W2 (with vibration-damping bracket for punching press)	110 (4.33)	110 (4.33)	110 (4.33)	175 (6.89)	175 (6.89)
	Depth	D (for only AC drive)	169.5 (6.67)	169.5 (6.67)	190 (7.48)	186 (7.32)	200 (7.87)
		D (with DIN rail (optional))	177.5 (6.99)	177.5 (6.99)	-	-	-
		D2 (with vibration-damping bracket for punching press)	207.5 (8.17)	207.5 (8.17)	228 (8.98)	226 (8.90)	240 (9.45)
	Height	H (for only AC drive)	217 (8.54)	217 (8.54)	262 (10.31)	303 (11.93)	330 (12.99)
		H1 (with EMC grounding bracket of cable shield)	248 (9.76)	248 (9.76)	303.5 (11.95)	370 (14.57)	415 (16.34)
		H2 (with through-hole mounting bracket)	-	-	-	332 (13.07)	370 (14.57)
		H3 (with junction box protection accessory)	272.3 (10.72)	272.3 (10.72)	323 (12.72)	403 (15.87)	420 (16.54)
		H4 (with vibration-damping bracket for punching press)	415 (16.34)	415 (16.34)	415 (16.34)	466 (18.35)	466 (18.35)
Mounting hole dimension mm (in.)	b1		35 (1.38)	37.5 (1.48)	60 (2.36)	109 (4.29)	140 (5.51)
	b2		45 (1.77)	45 (1.77)	60 (2.36)	103 (4.06)	140 (5.51)
	c		5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	7.5 (0.30)	8 (0.31)
	h		206 (8.15)	206 (8.15)	252 (9.92)	289 (11.38)	314 (12.36)
Hole diameter mm (in.)			Φ5 (0.20)	Φ5 (0.20)	Φ5 (0.20)	Φ6 (0.24)	Φ6 (0.24)
Tightening torque N·m			1.2	1.2	1.2	2.8	2.8
Weight kg (lb)			1.25 (2.76)	1.36 (3.00)	2.08 (4.59)	4.01 (8.84)	5.94 (13.10)

9.4 Motor compatibility

The following three motor types are supported. Select the motor type according to the actual working conditions.

- Three-phase asynchronous motor
- Three-phase permanent magnet synchronous motor
- Three-phase synchronous reluctance motor

9.5 Overload capacity of the AC drive

Definition of overload capacity:

Overload capacity refers to the ability of the AC drive to output more than 100% of its rated load within a short period of time. Generally, the overload capacity is defined according to the normal 1-minute overload capacity, which is divided into heavy overload and light overload:

- Heavy overload: It indicates that 150% of the rated output current of the heavy load is allowed to overload for 1 minute and 100% of the rated output current for 4 minutes per 5-minute running cycle.
- Light overload: During every 5-minute running cycle, 110% of the rated output current of light load is allowed to overload for 1 minute and 100% of the rated output current of light load for 4 minutes.

Typical load cycle of the AC drive

Typical applications for heavy overload include the following three categories:

- Lifting loads such as cranes, elevators, and elevators
- Metal machining applications such as machine tools and punches
- Other applications where high overload multiples such as heavy load start occur

In the above three scenarios, sudden load/sudden load unloading or even shock load may occur. Occasionally, output current may exceed the rated current. The heavy-overload model meets the following cyclic overload conditions.

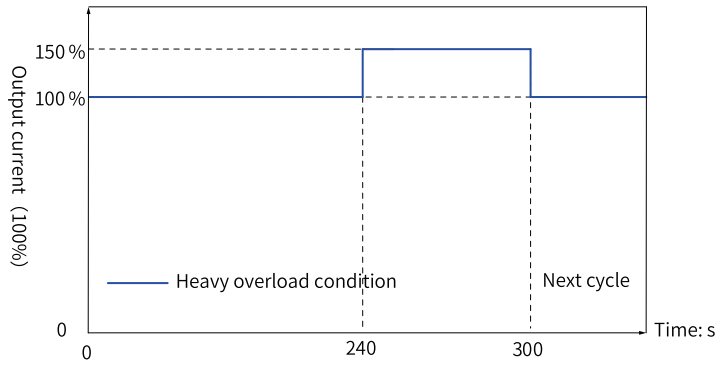


Figure 9-3 Cyclic overload (heavy load)

Typical applications of light overload include the following two types:

- It includes applications such as fans, pumps, air conditioner cooling, HVAC, and air compressors
- Other applications where only low overload multiples occur occasionally

In these cases, the load is generally stable, and the load rarely changes. Light overload models meet the following cyclic overload conditions.

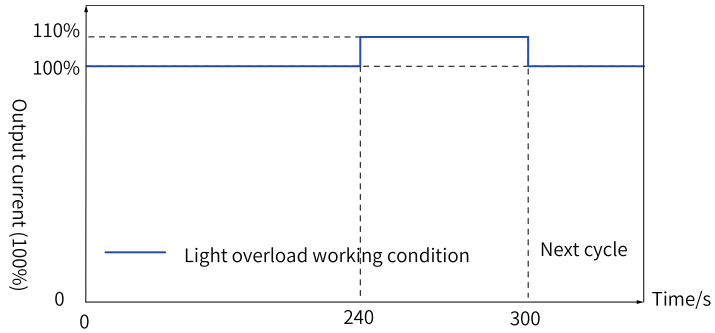


Figure 9-4 Cyclic overload (light load)

9.6 Electromagnetic Compatibility of AC Drive

9.6.1 Electromagnetic compatibility

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. Therefore, EMC includes two requirements:

- On the one hand, the electromagnetic interference generated by the equipment to the environment during normal operation cannot exceed a certain limit, that is, electromagnetic interference (EMI).
- On the other hand, it refers to the ability to operate normally with a certain degree of immunity to electromagnetic interference in the environment, that is, electromagnetic sensitivity (EMS).

EN IEC 61800-3 defines the following two types of environments:

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Based on the intended use environment, the products are divided into the following four categories:

- Class C1 equipment: The rated power of the electric drive system is lower than 1000 V and is used in the first environment.
- Category C2 equipment: PDS with rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.
- Category C3 equipment: PDS with rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.
- Class C4 equipment: The rated voltage of the electric drive system is not less than 1000 V or the rated current is not less than 400 A, or it is suitable for complex systems in the second environment.

9.6.2 Electromagnetic Compatibility of AC Drive

In order to be suitable for the application in the above environment (see section *"9.6.1 Electromagnetic compatibility" on page 1176*), the AC drive shall follow the conditions:

Second environment - class C3

Interference resistance

The AC drive complies with the standard requirements.

Interference generated by the AC drive

When the following conditions are met, the AC drive meets the standard requirements.

- The AC drive is connected to a TN or TT grid with the neutral point is grounded.
- Low-capacitance shielded motor cables are used.
- The motor cable length does not exceed 10 m.
- The AC drive and motor have been installed in accordance with the EMC requirements of the installation instructions.

Second environment - class C2

Interference resistance

The AC drive complies with the standard requirements.

Interference generated by the AC drive

When the following conditions are met, the AC drive meets the standard requirements.

- Use the recommended external filter.
- The AC drive is connected to a TN or TT grid with the neutral point is grounded.
- Low-capacitance shielded motor cables are used.
- The motor cable length does not exceed 10 m.
- The AC drive and motor have been installed in accordance with the EMC requirements of the installation instructions.

9.7 Derating

When the AC drive is operating above the rated conditions (ambient temperature, altitude, and carrier frequency), derate the AC drive, that is, reduce the output current of the AC drive. Failure to comply may result in damage to the AC drive.

9.7.1 Carrier frequency-based derating

There are requirements on carrier frequency increase of the drive in actual application. Increasing the carrier frequency delivers many benefits, such as reduced motor noise, less output current harmonics, and low torque ripple; increased carrier ratio when high-speed motor is used enhances control performance. However, increase in carrier frequency intensifies heat output of the drive, thus

triggering alarms of the drive. Prolonged operation beyond rated specifications may accelerate component degradation.

Therefore, if carrier frequency increase is required, derate the drive at the same time. You can lower the output current to derate the drive. For details on carrier frequency-based derating of MD630 series, see the following figure and table.

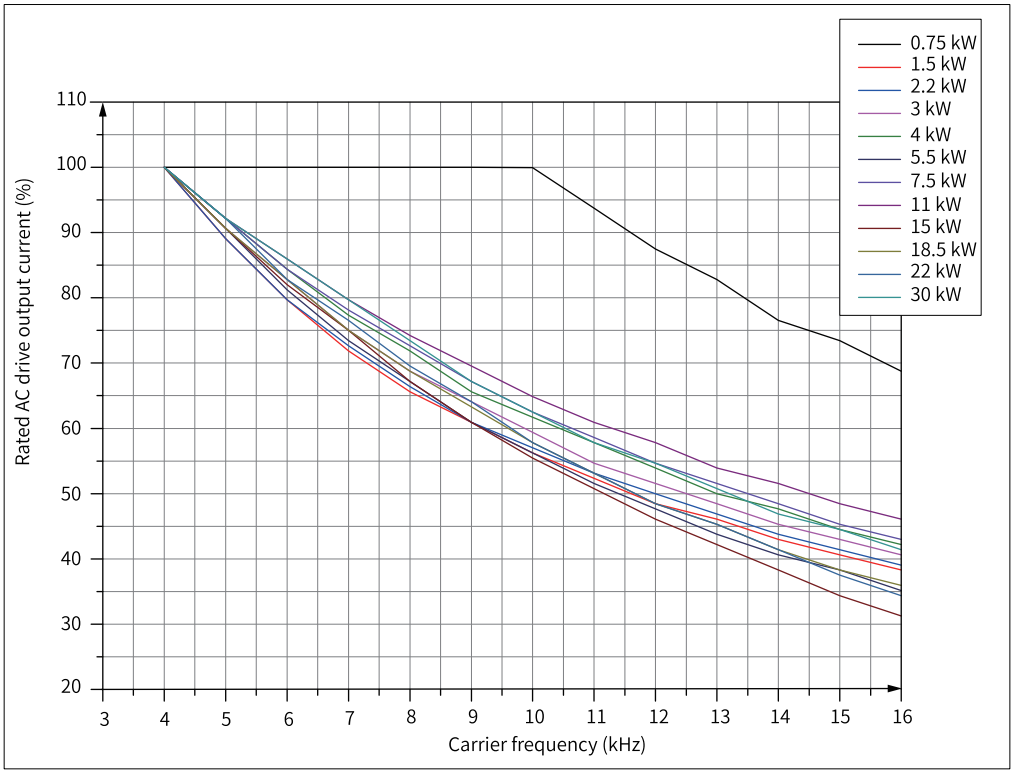


Figure 9-5 Derating curve based on light-load carrier frequency

Size	**Rated power (kW)**	Rated output current (A)	Carrier frequency-based derating (7-segment)												
			4k	5k	6k	7k	8k	9k	10k	11k	12k	13k	14k	15k	16k
T1	0.37	1.5	100%	100%	100%	100%	100%	100%	100%	93.8%	87.5%	82.8%	76.6%	73.4%	68.8%
	0.75	2.1	100%	89.1%	79.7%	71.9%	65.6%	60.9%	56.3%	52.3%	48.4%	46.1%	43.0%	40.6%	38.3%
	1.5	3.8	100%	89.1%	79.7%	72.7%	66.4%	60.9%	57.0%	53.1%	50.0%	46.9%	43.8%	41.4%	39.1%
T2	2.2	5.1	100%	90.6%	82.8%	75.0%	68.8%	64.1%	59.4%	54.7%	51.6%	48.4%	45.3%	43.0%	40.6%
	3	7.2	100%	92.2%	84.4%	77.3%	71.9%	65.6%	61.7%	57.8%	53.9%	50.0%	47.7%	44.5%	42.2%
	4	9	100%	90.6%	81.3%	73.4%	67.2%	60.9%	56.3%	51.6%	47.7%	43.8%	40.6%	38.3%	35.2%
T3	5.5	13	100%	92.2%	84.4%	78.1%	72.7%	67.2%	62.5%	58.6%	54.7%	51.6%	48.4%	45.3%	43.0%
	7.5	17	100%	92.2%	85.9%	79.7%	74.2%	69.5%	64.8%	60.9%	57.8%	53.9%	51.6%	48.4%	46.1%
T4	11	25	100%	90.6%	82.0%	75.0%	67.2%	60.9%	55.5%	50.8%	46.1%	42.2%	38.3%	34.4%	31.3%
	15	32	100%	90.6%	82.8%	75.0%	68.8%	63.3%	57.8%	53.1%	48.4%	45.3%	41.4%	38.3%	35.9%
T5	18.5	37	100%	92.2%	82.8%	76.6%	69.5%	64.1%	57.8%	53.1%	48.4%	45.3%	41.4%	37.5%	34.4%
	22	45	100%	92.2%	85.9%	79.7%	73.4%	67.2%	62.5%	57.8%	54.7%	50.8%	46.9%	44.5%	41.4%

9.7.2 Ambient derating

Current derating at ambient temperature

The operating ambient temperature of the AC drive ranges from -20℃ to +60℃. When the ambient temperature is above 50℃, derate 2.5% for every 1℃ rise, and the maximum temperature reaches 60℃. The derating curve of the ambient temperature is shown in the following figure.

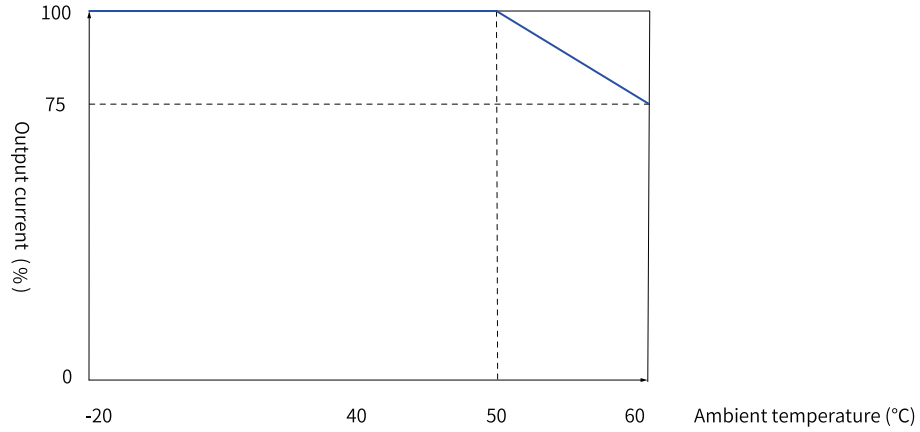


Figure 9-6 Ambient temperature derating curve

Current derating at installation altitude

No derating is required at altitudes below 1000 m. For every 100 m above 1000 m, derate 1% for every 100 mrise to a maximum of 3000 m. The derating curve is shown in the following figure.

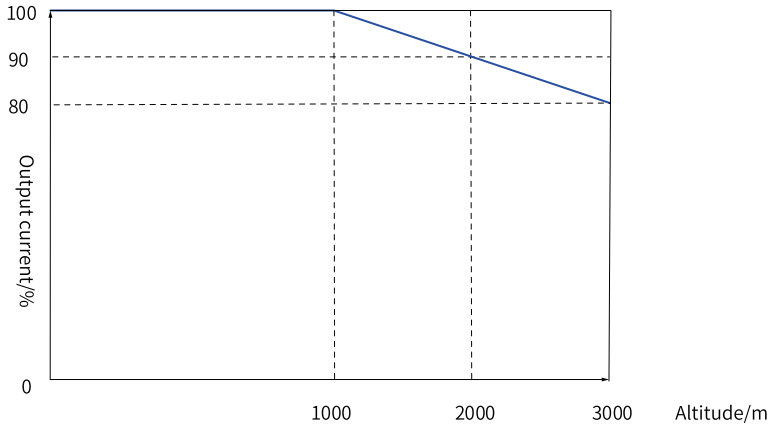


Figure 9-7 Installation of altitude derating curve

Current derating at installation clearance

- When the installation is not performed in parallel with the machine and the installation space recommended in *"2.3.2.1 Installation Clearance" on page 38* is used, the system is not derated below 50℃.
- When installed in parallel with zero clearance, the ambient temperature below 40℃ does not need to be derated. For each temperature above 40℃, derate 2.5% for every 1℃ rise to a maximum of 60℃. The following figure shows the derating curve of the installation clearance.

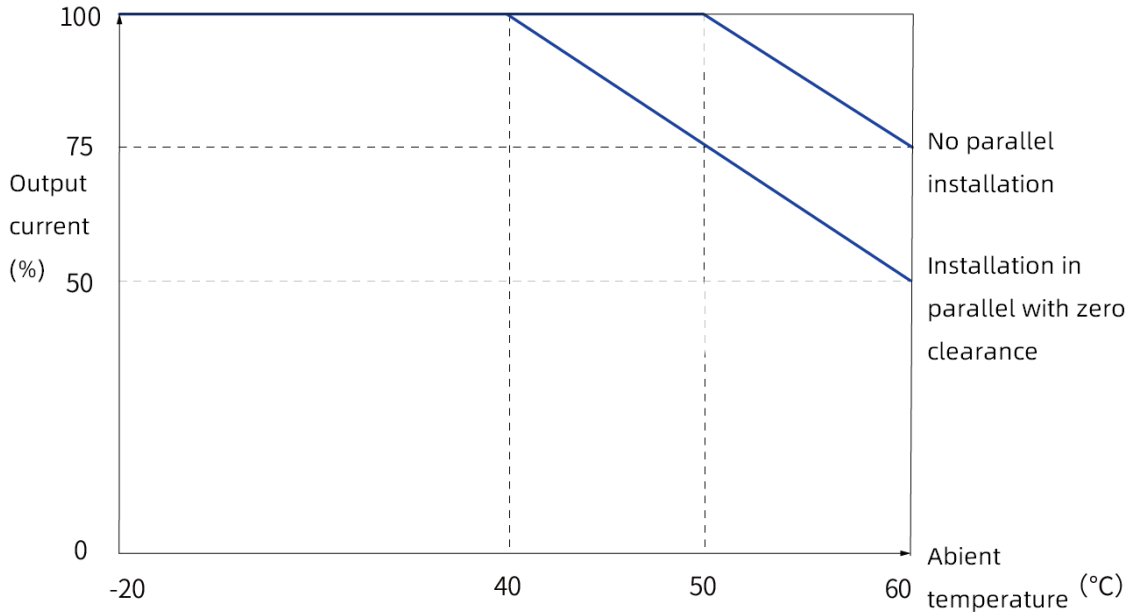


Figure 9-8 Installation clearance derating curve

9.8 Accessory Specifications

9.8.1 List of Accessories

Table 9–4 List of accessories

Category	Name	Option Model	Order No.	Applicable AC Drive Model	Function
Braking resistor	Braking resistor	See *"9.8.7 Braking Resistor" on page 1197* for the selection of the braking resistor.		All series AC drives	When the motor feedback energy is too large for the AC drive to consume, external braking resistor is required.
Cable	Power cable	For the recommended power cable selection, see "Power cable" in *" Cables" on page 1211*.		All series AC drives	It is recommended that the input and output main circuit cables use symmetrical shielded cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system. It is recommended that power cables also use symmetrical shielded cables.
	Control cable	For the recommended control cable selection, see "Control cable" in *" Cables" on page 1211*.		All series AC drives	All control circuit cables must be shielded cables. Use a separate shielded cable for each type of analog signal. It is recommended that digital signal cables use shielded twisted pair (STP) cables.
	Cable lug	For the recommended cable lug selection, see "Cable lug" in *" Cables" on page 1211*.		All series AC drives	Connect the cable so that it can transmit current safely and reliably.

Category	Name	Option Model	Order No.	Applicable AC Drive Model	Function
Expansion card	Multi-function I/O expansion card	MD-IO-M1	01040335	All series AC drives	I/O expansion card, supporting 2 DIs, 1 DO, 1 AI, 1 AO, 1 RO, and 1 temperature input. AI supports voltage/current input, AO supports voltage/current output, and RO supports long service life requirements of the lifting industry.
	Digital PG expansion card	MD-PG-AU1	01040321	All series AC drives	PG card that decodes digital encoders. Working with the AC drive, it can measure the motor speed, and realize speed and position closed loop control and encoder frequency division output.
	Resolver PG card	MD-PG-R1	01040322	All series AC drives	PG card that decodes digital encoders. Working with the AC drive, it can measure the motor speed, and realize speed and position closed loop control and encoder frequency division output.
	Sin-cos PG expansion card	MD-PG-S1	01040323	All series AC drives	Sin-cos analog PG card, which is used in conjunction with AC drive sin-cos analog encoder, conducts the signal processing, divided frequency output, and exchanges encoder data and commands with the control board via UART.
Mounting accessory	Options for guide rail installation	MD630-AZJ-A4T1	01040314	T1 to T2 (0.37 kW to 4 kW)	Supports rail mounting of AC drive
	Through-hole mounting bracket	MD630-AZJ-A1T4	01040312	T4 (11 kW to 15 kW)	Supports wall-through installation of the AC drive
		MD630-AZJ-A1T5	01040307	T5 (18.5 kW to 22 kW)	
	Junction box protection accessory	MD630-JXH-A5T1	01040313	T1 to T2 (0.37 kW to 4 kW)	Improve the protection capacity of the AC drive
		MD630-JXH-A5T3	01040317	T3 (5.5 kW to 7.5 kW)	
		MD630-JXH-A5T4	01040311	T4 (11 kW to 15 kW)	
		MD630-JXH-A5T5	01040308	T5 (18.5 kW to 22 kW)	
	Grounding bracket of cable shield	MD630-AZJ-A3T1	01040316	T1 to T2 (0.37 kW to 4 kW)	Meets 360° shielded grounding requirements
		MD630-AZJ-A3T3	01040318	T3 (5.5 kW to 7.5 kW)	
		MD630-AZJ-A3T4	01040310	T4 (11 kW to 15 kW)	
		MD630-AZJ-A3T5	01040309	T5 (18.5 kW to 22 kW)	
	Vibration-damping bracket for punching press	MD630-AZJ-A2T1	01040315	T1 to T3 (0.37 kW to 7.5 kW)	Supports high-vibration scenarios.
		MD630-AZJ-A2T4	01040306	T4 to T5 (11 kW to 22 kW)	

Note

For a list of peripheral electrical *"3.1 AC Drive and Peripheral Device" on page 61*devices, see section.

9.8.2 Circuit Breaker and Fuse (CE)

Table 9–5 Selection of circuit breakers and fuses

Size	Model MD630S/N-4T***BS-INT	Rated input current (A) (G)	Heavy overload G model		Light overload P model	
			Non-semiconductor fuse current (A)	Circuit breaker current (A)	Non-semiconductor fuse current (A)	Circuit breaker current (A)
T1	1R5	1.7	4	3	4	3
	2R1	2.4	6	7	6	7
	3R8	4.6	10	15	10	15
T2	5R1	6.3	15	15	15	15
	7R2	8.9	16	15	16	15
	9R0	11.4	25	30	25	30
T3	013	16.8	40	35	40	35
	017	22	50	50	50	50
T4	025	32.4	63	70	70	70
	032	41.6	80	70	80	70
T5	037	48.7	100	80	100	80
	045	58.5	125	100	125	100

Note

The recommended values in the preceding table are based on the following:

- The ambient temperature of the device is 40℃ and there is no forced air cooling method.
- The altitude is 2000 m.
- An individual AC drive is installed.
- The copper current density is 1.3 A/mm². The rated voltage is 480 V.

If the conditions are different, you need to select the model according to actual conditions.

9.8.3 Circuit Breaker (UL)

Table 9–6 Selection of circuit breakers

Size	Model MD630S/N-4T***BS-INT	Rated input current (A) (G)	Heavy overload G model	Light overload P model
			Circuit breaker current (A) (5 kA interrupting capacity, certified to UL 489.)	Circuit breaker current (A) (100 kA interrupting capacity, certified to UL 489.)
T1	1R5	1.7	3	3
	2R1	2.4	7	7
	3R8	4.6	15	15
T2	5R1	6.3	15	15
	7R2	8.9	15	15
	9R0	11.4	30	30
T3	013	16.8	35	35
	017	22	50	50
T4	025	32.4	70	70
	032	41.6	70	70
T5	037	48.7	80	80
	045	58.5	100	100

Note

The recommended values in the preceding table are based on the following:

- The ambient temperature of the device is 40℃ and there is no forced air cooling method.
- The altitude is 2000 m.
- An individual AC drive is installed.
- The copper current density is 1.3 A/mm². The rated voltage is 480 V.

If the conditions are different, you need to select the model according to actual conditions.

9.8.4 AC Input Reactor

The following table lists the application scenarios for different types of reactors.

Table 9–7 Reactor

Type	Description
Input reactor	Used to suppress the harmonics and surge current at the AC ports; recommended for customers with requirements on less harmonics and surge current suppression.
Output reactor	It is used to suppress oscillation of the output waveform when the UVW output cable is long, and to protect the motor.
DC reactor	Used to suppress the harmonics at the AC ports; recommended for models with reserved DC ports for reactor connection and requirements on less harmonics.

The optional AC input reactor is mainly used to reduce harmonics in the input current. In applications where harmonics must be suppressed, install an external AC input reactor to meet requirements of

the EN IEC 61000-3-2 standard. The following table lists the recommended reactor manufacturer and models.

Model selection

The recommended input reactor manufacturer is Shanghai Eagtop. For model description, see the following.

ACL ① - 0002 ② - EISC ③ - 9561A ④

Figure 9-9 AC input reactor model

①	**Code** ACL: AC input reactor	③	**Structure** EI: Iron core SC: Vertical copper tape/Copper foil ribbon winding SHL: 3-Phase vertical, hybrid Cu-Al, edge-wound coil
②	**Rated current** 0002: 2 A	④	**Code** 9561: Inovance code in Eagpeak A: Rank number under same current **Inductance** EM16: 0.16 mH D: Version NC: Temperature control switch

Table 9–8 Selection of AC input reactors (Three-phase 380 V to 480 V) (Heavy overload G-type)

Frame size	Drive model MD630S/N-4T*** BS-INT	Rated power (kW)	Rated Input Current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Power consumption (W)
T1	1R5	0.37	1.7	ACL-0002-EISC-9561A	10.5	11070911	5.9
	2R1	0.75	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	3R8	1.5	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
T2	5R1	2.2	6.3	ACL-0007-EISC-9561A	3.1	11070915	14.7
	7R2	3.0	8.9	ACL-0009-EISC-9561A	2.5	11070916	15.9
	9R0	4.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
T3	013	5.5	16.8	ACL-0017-EISHL-9561A	1.3	11070918	30.4
	017	7.5	22.0	ACL-0025-EISHL-9561A	0.89	11070919	43.6

Frame size	Drive model MD630S/N-4T*** BS-INT	Rated power (kW)	Rated Input Current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Power consumption (W)
T4	025	11	32.4	ACL-0037-EISHL-9561A	0.6	11070921	55.3
	032	15	41.6	ACL-0045-EISHL-9561A	0.49	11070922	58.8
T5	037	18.5	48.7	ACL-0060-EISHL-9561A	0.37	11070923	80
	045	22	58.5	ACL-0060-EISHL-9561A	0.37	11070923	80

Table 9–9 Selection of AC input reactors (Three-phase 380 V to 480 V) (Light overload P-type)

Frame size	Drive model MD630S/N-4T*** BS-INT	Rated power (kW)	Rated Input Current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Power consumption (W)
T1	1R5	0.37	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	2R1	0.75	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
	3R8	1.5	6.4	ACL-0007-EISC-9561A	3.1	11070915	14.7
T2	5R1	2.2	9	ACL-0009-EISC-9561A	2.5	11070916	15.9
	7R2	3.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
	9R0	4	17	ACL-0017-EISC-9561A	1.3	11070918	30.4
T3	013	5.5	22.7	ACL-0025-EISC-9561A	0.89	11070919	43.6
	017	7.5	33.4	ACL-0037-EISC-9561A	0.6	11070921	55.3
T4	025	11	42.1	ACL-0045-EISC-9561A	0.49	11070922	58.8
	032	15	49.1	ACL-0060-EISC-9561A	0.37	11070923	80
T5	037	18.5	60.1	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	045	22	71.6	ACL-0090-EISCL-EM16DNC	0.16	11070934	81

Dimensions

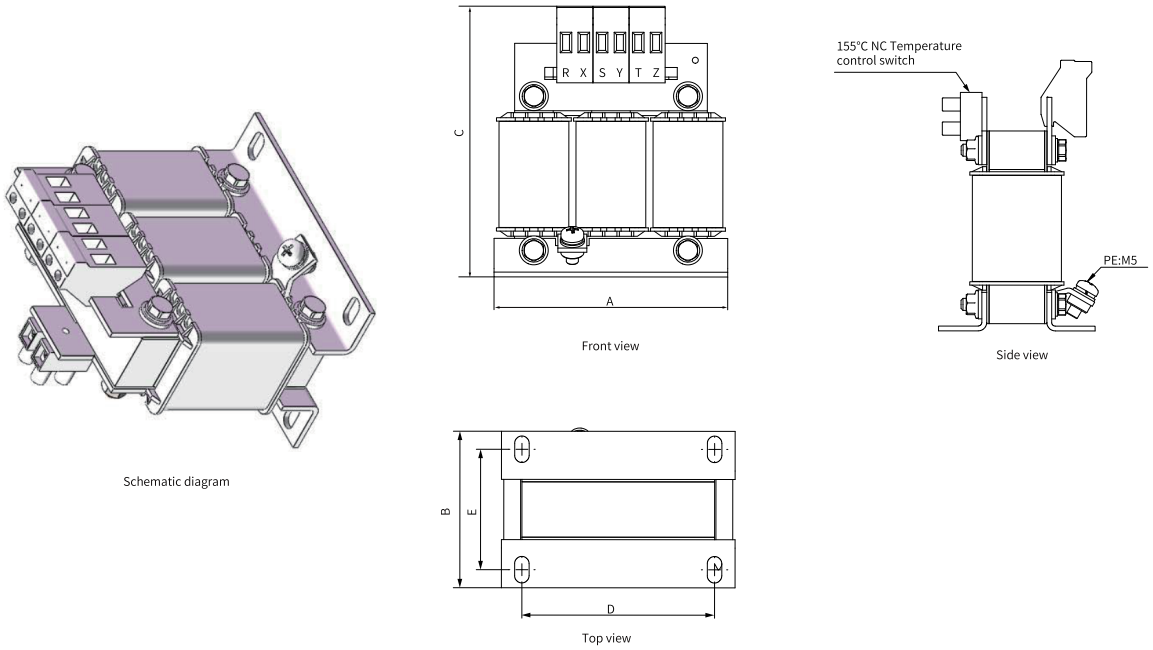


Figure 9-10 Dimensions of AC input reactors (2 A to 13 A)

Table 9–10 Dimensions of AC input reactors (2 A to 13 A)

Model	Dimensions	Drill hole dimensions	Mounting screws	Torque (kgf·cm)
	W x H x D (A x B x C)	W x H (D x E)		
ACL-0002-EISC-9561A	**Mm:**100 x 65 (±2) x 120 **In.:**3.94 x 2.56 (±0.08) x 4.72	**Mm:**80 (±2) × 50 (±2) **In.:**3.15 (±0.08) x 1.97 (±0.08)	M5	28
ACL-0003-EISC-9561A				
ACL-0005-EISC-9561A	**Mm:**115 x 85 (±2) x 130 **In.:**4.53 x 3.35 (±0.08) x 5.12	**Mm:**90 (±2) × 65 (±2) **In.:**3.54 (±0.08) x 2.56 (±0.08)	M5	28
ACL-0007-EISC-9561A				
ACL-0009-EISC-9561A	**Mm:**135 x 90 (±2) x 140 **In.:**5.31 x 3.54 (±0.08) x 5.51	**Mm:**100 (±2) × 70 (±2) **In.:**3.94 (±0.08) x 2.76 (±0.08)	M5	28
ACL-0013-EISC-9561A				

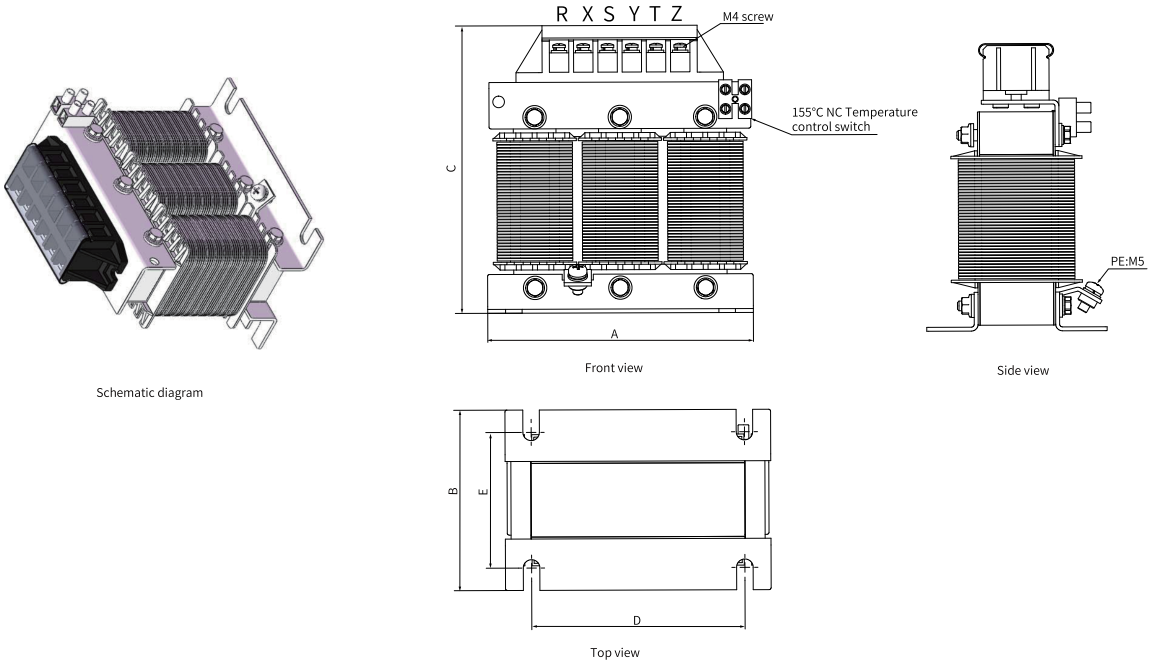


Figure 9-11 Dimensions of AC reactor input 17 A to 60 A

Table 9–11 Dimensions of AC input reactors (17 A to 60 A)

Model	Dimensions	Drill hole dimensions	Mounting screws	Torque (kgf·cm)
	W x H x D (A x B x C)	W x H (D x E)		
ACL-0017-EISC-9561A	**Mm:**140 x 93 (±2) x 160 **In.:**5.51 x 3.66 (±0.08) x 6.30	**Mm:**110 (±2) × 70 (±2) **In.:**4.33 (±0.08) x 2.76 (±0.08)	M6	48
ACL-0025-EISC-9561A	**Mm:**140 x 98 (±2) x 160 **In.:**5.51 x 3.86 (±0.08) x 6.30	**Mm:**110 (±2) x 75 (±2) **In.:**4.33 (±0.08) x 2.76 (±0.08)	M6	48
ACL-0037-EISC-9561A	**Mm:**160 x 113 (±2) x 180 **In.:**6.30 x 4.45 (±0.08) x 7.09	**Mm:**120 (±2) × 90 (±2) **In.:**4.72 (±0.08) x 3.54 (±0.08)	M6	48
ACL-0045-EISC-9561A	**Mm:**160 x 128 (±2) x 180 **In.:**6.30 x 5.04 (±0.08) x 7.09	**Mm:**120 (±2) × 105 (±2) **In.:**4.72 (±0.08) x 4.13 (±0.08)	M6	48
ACL-0060-EISC-9561A				

Dimensions

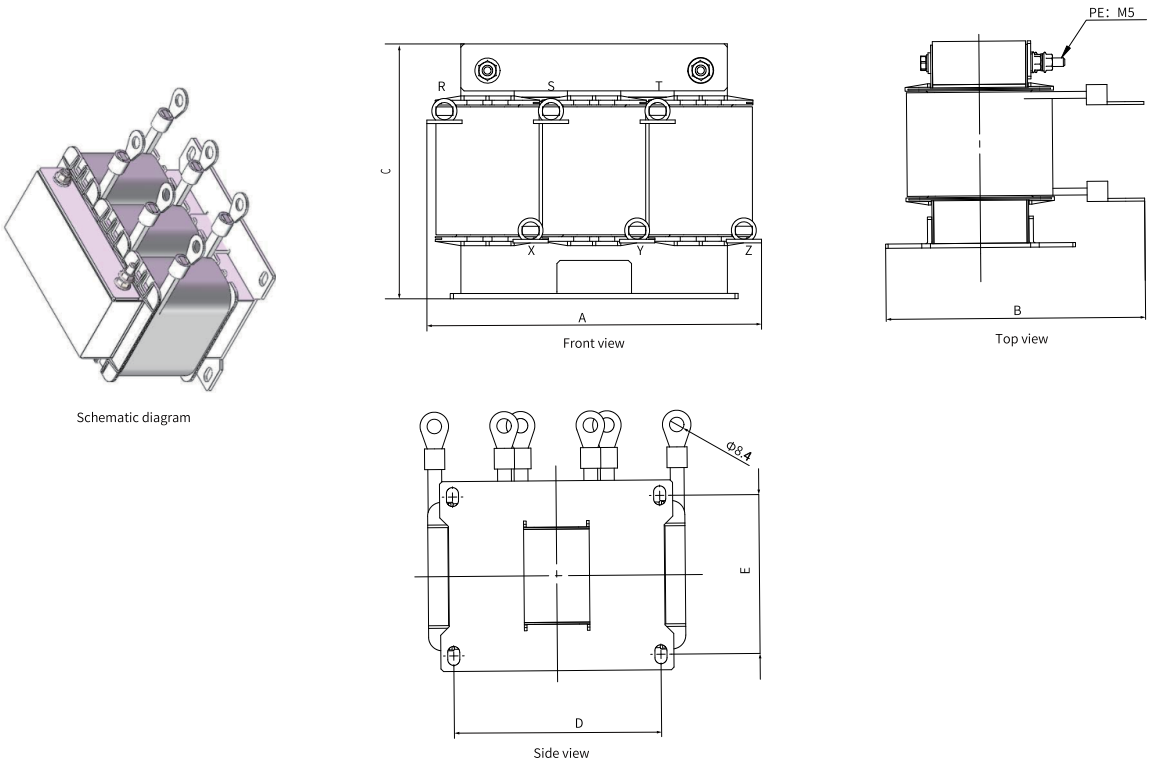
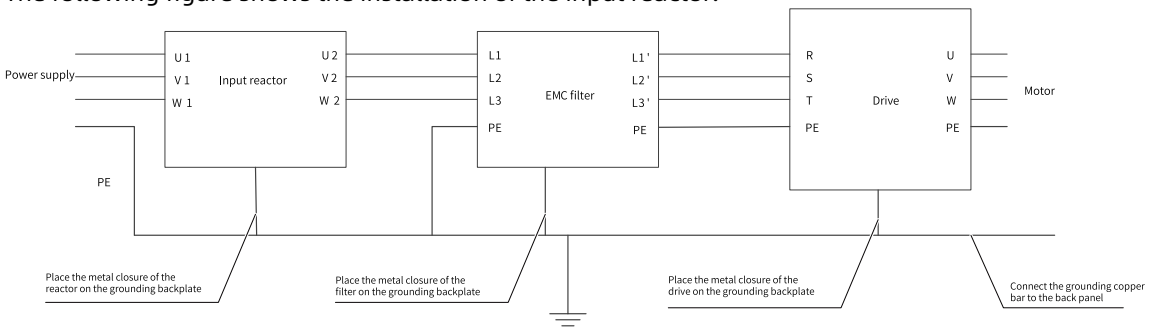


Figure 9-12 Dimensions of the AC input reactor (90 A)

Table 9–12 Dimensions of AC input reactors (90 A)

Model	Dimensions	Drill hole dimensions	Mounting screws	Torque (kgf·cm)
	W x H x D (A x B x C)	W x H (D x E)		
ACL-0090-EISCL-EM16D	**Mm:**165 x 150 (±10) x 130 **In.:**6.50 x 5.91 (±0.39) x 5.12	**Mm:**120 (±2) × 92 (±2) **In.:**4.72 (±0.08) x 3.62 (±0.08)	M6	48

The following figure shows the installation of the input reactor.



9.8.5 AC Output Reactor

With an output reactor installed on the output side of the AC drive, the excessive dV/dt can be reduced, lowering the voltage stress on the motor winding. This protects the motor winding, lowers the motor temperature, and prolongs the service life of the motor. Recommended manufacturers and models of the output reactor are shown in the following table.

Model selection

The recommended AC output reactors for this product is from EAGTOP. The details are as follows.

OCL - 0005 - EISC - E1M4DNC
① ② ③ ④

Figure 9-13 AC output reactor model

①	**Code** OCL: AC output reactor	③	**Structure** EI: Iron core SC: Vertical copper foil or copper strip winding SCL: Vertical copper wire vertical-layer winding
②	**Rated current** 0005: 5 A	④	**Inductance** EIM4: 1.4 mH D: Version NC: Temperature control switch

Table 9–13 Selection of AC output reactors (Three-phase 380 V to 480 V) (Heavy overload G-type)

Drive Structure	Models MD630S/N-4T***BS-INT	Motor Capacity (kW)	Rated Current (A)	Reactor Model	Reactor inductance (mH)	Ordering Code	Loss (W)
T1	1R5	0.37	1.5	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	2R1	0.75	2.1				
	3R8	1.5	3.8				
T2	5R1	2.2	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
	7R2	3.0	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	9R0	4.0	9				
T3	013	5.5	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
	017	7.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25
T4	025	11	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
	032	15	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
T5	037	18.5	37	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	045	22	45	OCL-0050-EISCL-EM14DNC	0.14	11070957	36

Table 9–14 Selection of AC output reactors (Three-phase 380 V to 480 V) (Light overload P-type)

Drive Structure	Models MD630S/N-4T***BS-INT	Motor Capacity (kW)	Rated Current (A)	Reactor Model	Reactor inductance (mH)	Ordering Code	Loss (W)
T1	1R5	0.37	2.1	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	2R1	0.75	3.8				
	3R8	1.5	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
T2	5R1	2.2	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	7R2	3.0	9				
	9R0	4	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
T3	013	5.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25
	017	7.5	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
T4	025	11	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	032	15	37				
T5	037	18.5	45	OCL-0050-EISCL-EM14DNC	0.14	11070957	36
	045	22	60	OCL-0060-EISCL-EM12DNC	0.12	11070958	42

Note

The output reactor in the preceding table can only be used for 50 Hz/60 Hz motors.

Dimensions

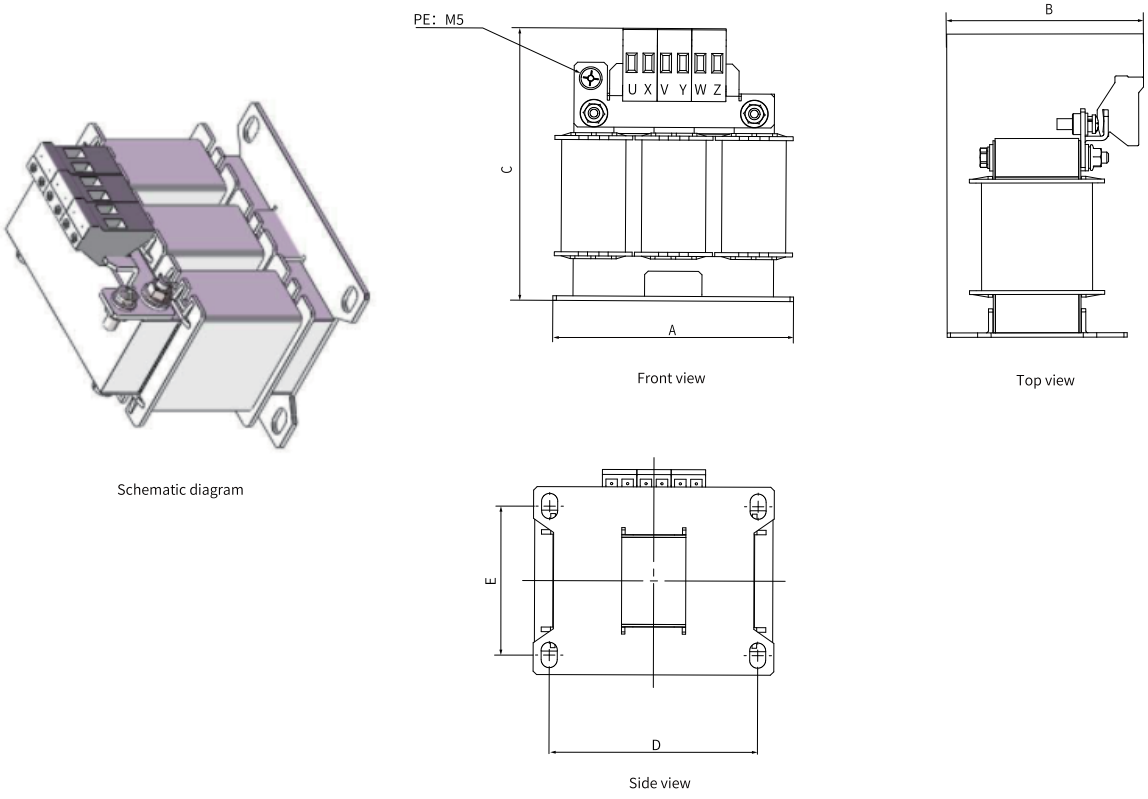


Figure 9-14 Dimensions of AC output reactors (5 A to 10 A)

Table 9–15 Dimensions of AC output reactors (5 A to 10 A)

Models	Dimensions	Drill hole dimensions	Mounting screws	Torque (kgf·cm)
	A × B × C (L x W x H)	D×E		
OCL-0005-EISC-E1M4D	**mm:** 110×95×125 **in.:** 4.33×3.74×4.92	**mm:** 91(±2)×65(±2) **in.:** 3.58(±0.08)×2.56(±0.08)	M6	48
OCL-0007-EISC-E1M0D				
OCL-0010-EISC-EM70D				

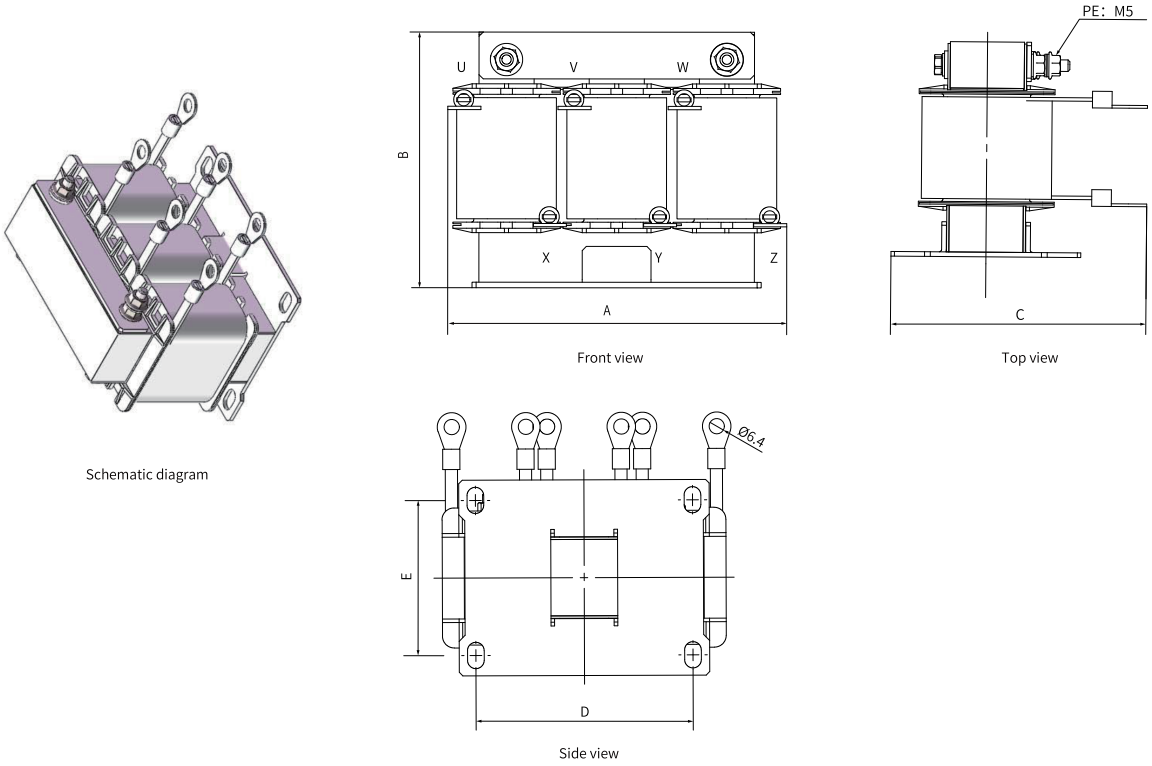
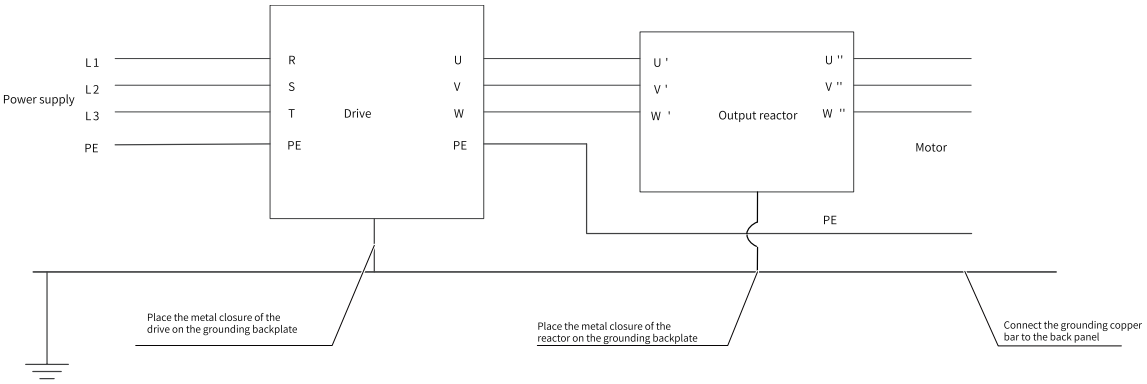


Figure 9-15 Dimensions of the output AC reactor (15 A to 60 A)

Table 9–16 Dimensions of AC output reactors (15 A to 60 A)

Models	Dimensions	Drill hole dimensions	Mounting screws	Torque (kgf·cm)
	A × B × C (L x W x H)	D × E (D x E)		
OCL-0015-EISCL-EM47D	**mm:** 130×110(±10)×100 **in.:** 5.12×4.33(±0.39)×3.94	**mm:** 91(±2)×65(±2) **in.:** 3.58(±0.08)×2.56(±0.08)	M6	48
OCL-0020-EISCL-EM35D				
OCL-0030-EISCL-EM23D	**mm:** 130×120(±10)×100 **in.:** 5.12×4.72(±0.39)×3.94	**mm:** 91(±2)×72(±2) **in.:** 3.58(±0.08)×2.83(±0.08)	M6	48
OCL-0040-EISCL-EM18D				
OCL-0050-EISCL-EM14D	**mm:** 140×120(±10)×120 **in.:** 5.51×4.72(±0.39)×4.72	**mm:** 91(±2)×72(±2) **in.:** 3.58(±0.08)×2.83(±0.08)	M6	48
OCL-0060-EISCL-EM12D				

The following figure shows the output reactor installation details.



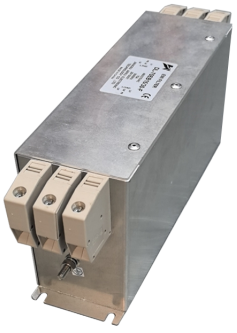
9.8.6 EMI Filter

To comply with the radiated and conducted emission requirements of EN IEC 61800-3 C2, install the EMI filter listed in the following table. EMI filter options are FN 3287 and DL 3258 series EMC filters manufactured by Schaffner. Select the EMC filter according to the rated input current of the drive, as shown in the following table.

Note

- If you need a filter of Schaffner, you can purchase it from the manufacturer.
- For Jianli filters, contact Inovance or Jianli.

Table 9–17 Standard EMI filter model and appearance

Filter Model		Appearance
Schaffner	FN 3287 series	
Jianli series	DL 3258 series	

Model selection (Schaffner)

Table 9–18 Selection of filters (Heavy overload G-type, three-phase 380 V to 480 V)

Drive Structure	Models MD630S/N-4T***BS-INT	Rated Power (kW)	Rated Current (A)	Filter Model	Power Consumption (W)
T1	1R5	0.37	1.5	FN 3287-10-44-C28-R65	6.9
	2R1	0.75	2.1		
	3R8	1.5	3.8		
T2	5R1	2.2	5.1	FN 3287-10-44-C28-R65	6.9
	7R2	3.0	7.2		
	9R0	4	9		
T3	013	5.5	13	FN 3287-16-44-C33-R65	8.5
	017	7.5	17	FN 3287-20-33-C33-R65	9.4
T4	025	11	25	FN 3287-40-33-C33-R65	19.2
	032	15	32		
T5	037	18.5	37	FN 3287-40-33-C33-R65	19.2
	045	22	45	FN 3287-50-53-C33-R65	21.7

Table 9–19 Selection of filters (Light overload P-type, three-phase 380 V to 480 V)

Drive Structure	Models MD630S/N-4T***BS-INT	Rated Power (kW)	Rated Current (A)	Filter Model	Loss (W)
T1	1R5	0.37	2.1	FN 3287-10-44-C28-R65	6.9
	2R1	0.75	3.8		
	3R8	1.5	5.1		
T2	5R1	2.2	7.2	FN 3287-10-44-C28-R65	6.9
	7R2	3.0	9		
	9R0	4	13	FN 3287-16-44-C33-R65	8.5
T3	013	5.5	17	FN 3287-20-33-C33-R65	9.4
	017	7.5	25	FN 3287-40-33-C33-R65	
T4	025	11	32	FN 3287-40-33-C33-R65	19.2
	032	15	37		
T5	037	18.5	45	FN 3287-50-53-C33-R65	21.7
	045	22	60	FN 3287-80-34-C33-R65	32.6

Dimensions of Schaffner FN 3287 series filters

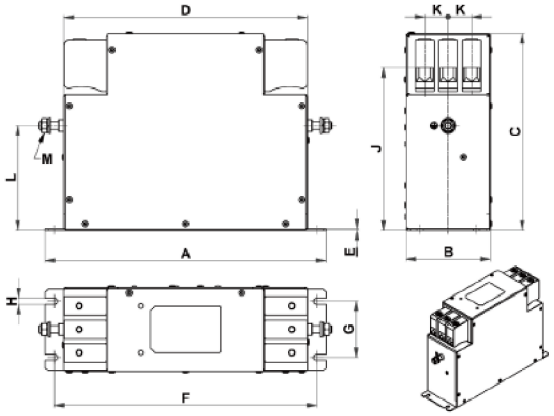


Figure 9-16 Dimensions of FN 3287 series filters

Table 9–20 Dimensions of FN 3258 series filters

Models	Dimensions	Drill hole dimensions	Mounting screws	Torque
	A × B × C (L x W x H)	F x G (Length x Width)		(N·m)
FN 3287-10-44-C28-R65	**mm:** 180 × 40 × 112 **in.:** 7.09×1.57×4.41	**mm:**: 170×20 **In.:** 6.69 × 0.79	M5	2.0 to 2.2
FN 3287-16-44-C33-R65	**mm:** 200 × 45 × 120 **in.:** 7.87×1.77×4.72	**mm:**: 185×25 **In.:** 7.28 × 0.98	M5	2.0 to 2.2
FN 3287-20-33-C33-R65	**mm:** 205 × 45 × 132 **in.:** 8.07×1.77×5.20	**mm:**: 190×25 **In.:** 7.48 × 0.98	M5	2.0 to 2.2
FN 3287-25-33-C33-R65	**mm:** 205 × 45 × 132 **in.:** 8.07×1.77×5.20	**mm:**: 190×25 **In.:** 7.48 × 0.98	M5	2.0 to 2.2
FN 3287-40-33-C33-R65	**mm:** 215 × 50 × 147 **in.:** 8.46×1.97×5.79	**mm:**: 200×30 **In.:** 7.87 × 1.18	M6	3.5 to 4.0
FN 3287-50-53-C33-R65	**mm:** 220 × 65 × 180 **in.:** 8.66×2.56×7.09	**mm:**: 204×45 **In.:** 8.03 × 1.77	M6	3.5 to 4.0
FN 3287-63-53-C33-R65	**mm:** 220 × 65 × 180 **in.:** 8.66×2.56×7.09	**mm:**: 204×45 **In.:** 8.03 × 1.77	M6	3.5 to 4.0
FN 3287-80-34-C26-R65	**mm:** 290 × 80 × 205 **in.:** 11.42×3.15×8.07	**mm:**: 270×50 **In.:** 10.63 × 1.97	M6	3.5 to 4.0

Model selection (JIANLI)

Table 9–21 Selection of filters (Heavy overload G-type)

Drive Structure	Models MD630S/N-4T***BS-INT	Rated Power (kW)	Rated Current (A)	Filter Model	Order Number	Power Consumption (W)
T1	1R5	0.37	1.5	DL 32580-7-44	11090211	3.8
	2R1	0.75	2.1			
	3R8	1.5	3.8			
T2	5R1	2.2	5.1	DL 32580-7-44	11090211	3.8
	7R2	3	7.2	DL 32580-16-44	11090212	6.1
	9R0	4	9			
T3 models	013	5.5	13	DL 32580-16-44	11090212	6.1
	017	7.5	17	DL 32580-30-33	11090213	11.8
T4	025	11	25	DL 32580-30-33	11090213	11.8
	032	15	32	DL 32580-42-33	11090214	15.7
T5	037	18.5	37	DL 32580-42-33	11090214	15.7
	045	22	45	DL 32580-55-34	11090215	25.9

Table 9–22 Selection of filters (Light overload P-type)

Drive Structure	Models MD630S/N-4T***BS-INT	Rated Power (kW)	Rated current (A)	Filter Model	Order Number	Power Consumption (W)
T1	1R5	0.37	2.1	DL 32580-7-44	11090211	3.8
	2R1	0.75	3.8			
	3R8	1.5	5.1			
T2	5R1	2.2	7.2	DL 32580-16-44	11090212	6.1
	7R2	3.0	9			
	9R0	4	13			
T3 models	013	5.5	17	DL 32580-30-33	11090213	11.8
	017	7.5	25			
T4	025	11	32	DL 32580-42-33	11090214	15.7
	032	15	37			
T5	037	18.5	45	DL 32580-55-34	11090215	25.7
	045	22	60	DL 32580-75-34	11090216	32.2

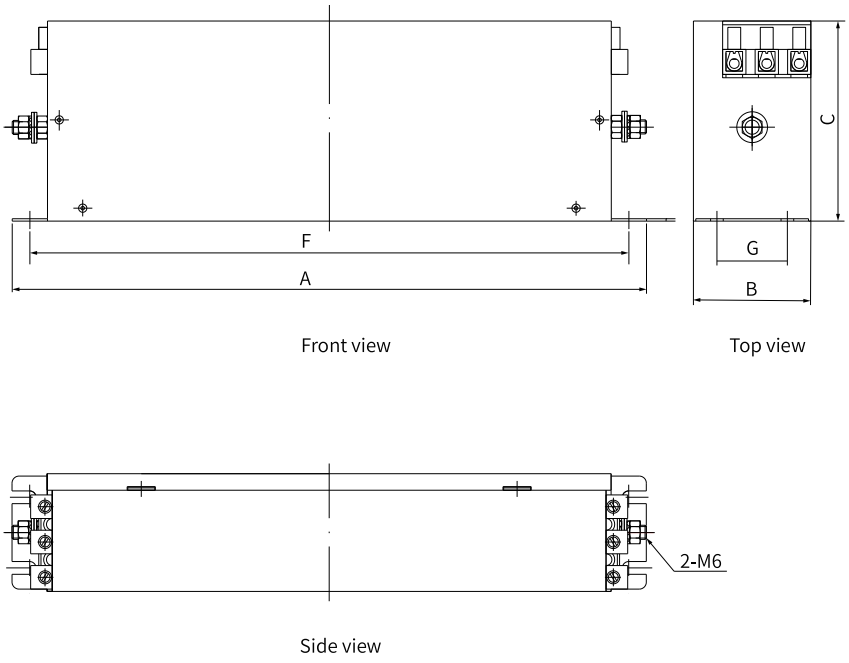


Figure 9-17 Dimensions of Jianli 3258 series filters

Table 9–23 Dimensions of Jianli 3258 series filters

Models	Dimensions	Drill hole dimensions	Mounting screws	Torque
	A × B × C (L x W x H)	F x G (Length x Width)		(N·m)
DL 32580-7-44	**mm:** 190(±2)×40(±1)×70(±2) **in.:** 7.48(±0.08)×1.57(±0.04)×2.76(±0.08)	**mm:** 180(±0.5)×20(±0.5) **in.:** 7.09(±0.02)×0.79(±0.02)	M5	1.7
DL 32580-16-44	**mm:** 250(±2)×45(±1)×70(±2) **in.:** 9.84(±0.08)×1.77(±0.04)×2.76(±0.08)	**mm:** 235(±0.5)×25(±0.5) **in.:** 9.25(±0.02)×0.98(±0.02)	M5	1.7
DL 32580-30-33	**mm:** 270(±2)×50(±1)×85(±2) **in.:** 10.63(±0.08)×1.97(±0.04)×3.35(±0.08)	**mm:** 255(±0.5)×30(±0.5) **in.:** 10.04(±0.02)×1.18(±0.02)	M5	2.5
DL 32580-42-33	**mm:** 310(±2)×50(±1)×85(±2) **in.:** 12.20(±0.08)×1.97(±0.04)×3.35(±0.08)	**mm:** 295(±0.5)×30(±0.5) **in.:** 11.61(±0.02)×1.18(±0.02)	M5	2.5
DL 32580-55-34	**mm:** 250(±2)×80(±1)×90(±2) **in.:** 9.84(±0.08)×3.15(±0.04)×3.54(±0.08)	**mm:** 235(±0.5)×60(±0.5) **in.:** 9.25(±0.02)×2.36(±0.02)	M6	3.0
DL 32580-75-34	**mm:** 270(±2)×80(±1)×135(±2) **in.:** 10.63(±0.08)×3.15(±0.04)×5.31(±0.08)	**mm:** 255(±0.5)×60(±0.5) **in.:** 10.04(±0.02)×2.36(±0.02)	M6	3.0

Installation

The optional EMC filter can meet the EN 61800-3 C2 emission requirements (For details, see *" Second environment - class C2" on page 1177*).

- Install the EMC filter close to the input terminals, and keep the connection cable shorter than 30 cm.

- Connect the grounding terminal of the EMC filter to that of the AC drive, and install the EMC filter and the AC drive on the same conductive installation surface, which is connected to the main ground of the cabinet.
- Connect the LINE terminal of the EMC filter to the power grid, and the LOAD terminal to the AC drive.

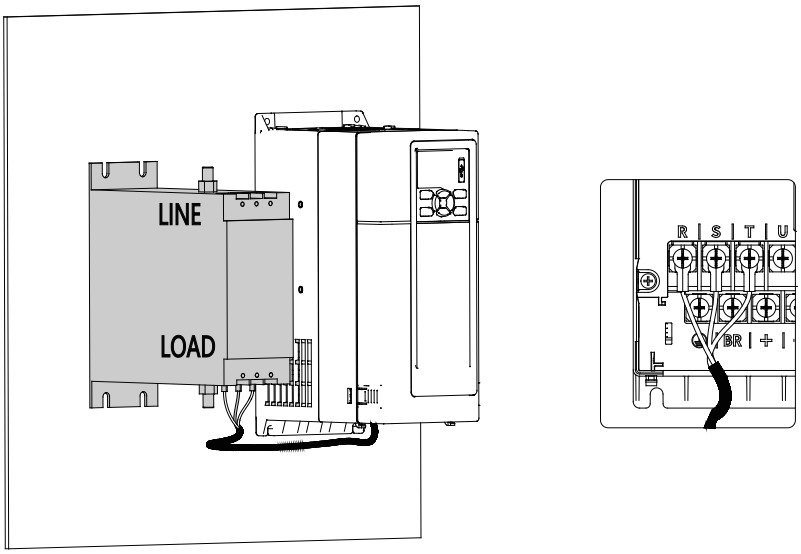


Figure 9-18 Installing an EMC filter

9.8.7 Braking Resistor

Resistance of braking resistors

The internal braking unit of the AC drive processes the regenerative energy generated by the motor during deceleration. When the voltage of the DC bus exceeds the limit set by the software, the braking unit automatically turns on and connects the braking resistor to the DC bus. The braking resistor consumes the regenerative energy to keep the bus voltage within the safe range. The braking resistor is disconnected until the bus voltage drops below a certain range. The resistance of the braking resistor is calculated by the following formula:

$$R = \frac{U_{BR}^{2}}{P_{BR}} = \frac{U_{BR}^{2}}{P_{N} \times k \times \eta_{motor} \times \eta_{inverter}}$$

R: Resistance of the braking resistor

U_{BR}: AC drive starting braking voltage (three-phase 380 V to 480 V models: 760 VDC by default; the default values can be modified.)

P_{BR}: Braking power that needs to be consumed by the braking resistor on the DC bus of the drive

P_n: Rated power of the AC drive

k: Multiple of the braking torque to the rated torque, which meets requirements of most typical braking conditions. Generally, it is set to 1.25 or around. The k value can be adjusted according to the actual situation.

n_{motor} : Motor efficiency. It is generally set to 0.85 or around or the actual motor efficiency. It can also be estimated by reference to the efficiency of the four-pole motor energy efficiency class IE3 specified in the IEC 60034-30-2 standard.

$n^{Inverter}$: It is generally set to a value between 0.9 and 0.98.

When the braking power is fed back from the motor to the U/V/W cable, and then fed back from the U/V/W cable to the DC bus of the drive, the braking power will be derated by the motor efficiency and the drive efficiency, respectively. Therefore, the braking power actually consumed by the braking resistor will be lower. The conversion coefficient is roughly estimated to be from 0.8 to 0.9.

Power of braking resistor

Generally, the power of the braking resistor and the average power of bus braking resistor are the same. However, because the braking resistor is naturally ventilated in the power supply distribution cabinet, power derating must be applied. Assume that the derating coefficient is α. You can select the rated power of the braking resistor according to the following formula:

$$P_{N_BR}=\frac{P_{BR}\times ED\%}{\alpha}$$

$$ED\% = \frac{T_{on}}{T_{on}+T_{off}}\times 100\%$$

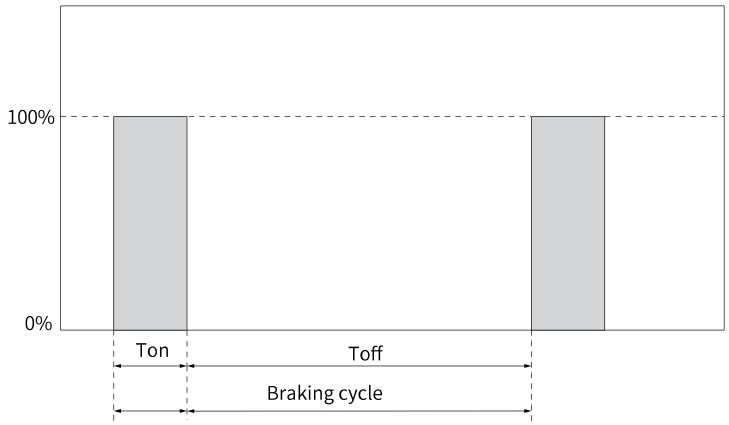


Figure 9-19 Braking cycle

P: Rated power of the braking resistor

α: Power derating of the braking resistor; set it to a value around 50%

ED%: Braking usage

T_{on} : Braking resistor ON time within one braking cycle

T_{off} : Braking resistor OFF time within one braking cycle

Braking resistor temperature rise: Dependent on many factors including braking resistor ON time (T_{on}), braking usage (ED%), resistor type (such as aluminum-housed resistors, ribbon-wound resistors, braking resistor cabinets, with different thermal time constants due to product design), heat dissipation conditions. A higher derating value is required if the temperature of the resistor rises.

Otherwise, a fire caused by overheating of the resistor may occur. Therefore, select the power according to the actual situation.

Braking usage (ED%) is determined by actual braking working condition. Typical values of braking usage in common applications are listed in the following table.

Common applications	Elevator	Winding/ Unwinding Machine	Centrifugal Fan	Occasional braking load	Regular application
ED%	20% to 30%	20% to 30%	50% to 60%	5%	10%

Recommended braking resistor

The following table describes the resistance and power selection of the braking resistor when it works at 125% of the braking torque with 10s of ON time (T_{on}) for each braking cycle and braking usage rate (ED%) being 10%.

Table 9–24 Selection of braking resistors (three-phase 380-480 V)

Frame size	Drive model MD630S/N-4T*** BS-INT	Heavy-load power (kW)	Braking unit	Recommended braking resistor specifications (125% of braking torque, ED: 10% ; Max. 10s)		Braking resistor selection (Inovance model)				Min. resistance of the braking resistor (Ω)
				Resistance (Ω)	Resistor power (W)	Model	Resistance (Ω) of single resistor	Power (W) of single resistor	Number of paralleled motors	
T1	1R5	0.37	Built-in standard configuration	1560	60	RXLG-50W-1560RJ-XZ1000-OE-B	1560	50	1	250
	2R1	0.75	Built-in, standard	770	110	RXLG-100W-770RJ-XZ1000-OE-B	770	100	1	250
	3R8	1.5	Built-in, standard	380	230	RXLG-200W-380RJ-XZ1000-OE-B	380	200	1	104
T2	5R1	2.2	Built-in standard configuration	260	330	RXLG-300W-260RJ-XZ1000-OE-B	260	300	1	104
	7R2	3	Built-in, standard	190	450	RXLG-400W-190RJ-XZ1000-OE-B	190	400	1	104
	9R0	4	Built-in, standard	140	600	RXLG-600W-140RJ-XZ1000-OE-B	140	600	1	124

Frame size	Drive model MD630S/N-4T*** BS-INT	Heavy-load power (kW)	Braking unit	Recommended braking resistor specifications (125% of braking torque, ED: 10% ; Max. 10s)		Braking resistor selection (Inovance model)				Min. resistance of the braking resistor (Ω)
				Resistance (Ω)	Resistor power (W)	Model	Resistance (Ω) of single resistor	Power (W) of single resistor	Number of paralleled motors	
T3 models	013	5.5	Built-in standard configuration	100	830	RXLG-800W-100RJ-XZ1000-OE-B	100	800	1	42
	017	7.5	Built-in, standard	77	1130	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	1	33
T4	025	11	Built-in, standard	52	1660	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	1	47
	032	15	Built-in, standard	38	2260	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	2	22
T5	037	18.5	Built-in, standard	31	2790	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	2	26
	045	22	Built-in, standard	26	3310	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	2	26

- The braking resistor values in the preceding table are based on 125% of the braking torque. During each braking cycle, the braking resistor is switched on for 10s (Ton) and the braking usage rate is 10% (ED%).
- For 380 V to 480 V models, the default starting braking voltage of the built-in braking unit is 760 V.
- The data in the preceding table is only for reference. You can select the resistance and power of the braking resistor as required. (Note that the resistance cannot be lower than the recommended minimum value, whereas the power can exceed the recommended value.) Select the braking resistor based on the generation power of the motor in the actual system, system inertia, deceleration time, and potential energy load.
- The higher the inertia of the system, the shorter the deceleration time required and the more frequent the braking frequency, the lower the resistance of the braking resistor. The braking resistor power needs to be larger.

Recommended power of braking resistor under different braking working conditions

The recommended braking resistor power in the preceding table is based on the working conditions where the resistor works at 125% of the braking torque with 10s of ON time (T_{on}) for each braking cycle and braking usage rate (ED%) being 10%. However, the braking working conditions may vary in actual applications, which cannot be represented by one typical working condition. To help users select the braking resistor power properly under different working conditions, the following table provides recommended braking resistor power for 125% of the braking torque with different braking ON time (T_{on}) and braking usage.

Braking working condition			Recommended braking resistor power for 125% of braking torque with different braking ON time (T_{on}) and braking usage											
Braking ON time (T_{on}/s)	Braking OFF time (T_{off}/s)	Braking usage (ED%)	T1			T2			T3		T4		T5	
			0.37	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22
3	27	10%	40	90	170	250	340	460	630	860	1250	1710	2110	2510
	17	15%	60	120	240	360	490	650	900	1220	1790	2450	3020	3590
	9	25%	100	200	390	570	780	1050	1440	1960	2870	3920	4840	5750
	4.5	40%	150	310	610	900	1230	1640	2250	3070	4500	6140	7570	9000
10	90	10%	60	110	230	330	450	600	830	1130	1660	2260	2790	3310
	56.7	15%	70	150	290	430	590	780	1080	1470	2150	2930	3620	4300
	30	25%	110	220	430	640	870	1150	1590	2160	3180	4330	5340	6350
	15	40%	160	320	650	950	1290	1720	2370	3230	4730	6450	7960	9460
20	180	10%	80	160	310	460	630	840	1150	1570	2310	3140	3880	4610
	113.3	15%	90	180	370	540	740	980	1350	1850	2710	3690	4550	5420
	60	25%	120	250	490	720	990	1320	1810	2470	3620	4940	6090	7240
	30	40%	170	350	690	1010	1380	1840	2530	3460	5070	6910	8520	10140
30	270	10%	100	200	410	600	820	1090	1500	2050	3000	4090	5050	6000
	170	15%	110	220	450	660	900	1200	1650	2250	3300	4500	5550	6590
	90	25%	140	280	560	820	1110	1480	2040	2780	4080	5560	6860	8160
	45	40%	180	370	740	1080	1470	1960	2700	3680	5400	7370	9090	10810
60	540	10%	170	340	680	1000	1360	1810	2490	3390	4980	6780	8370	9950
	340	15%	170	340	690	1010	1380	1840	2530	3450	5060	6890	8500	10110
	180	25%	180	370	740	1090	1490	1980	2730	3720	5460	7440	9180	10920
	90	40%	210	440	870	1280	1740	2320	3190	4360	6390	8710	10740	12780

Note

- The thermal time constant of the braking resistor (UT) ≥ 100s
- Braking rate ED% = Ton/(Ton+Toff) x 100%
- The recommended power of the braking resistor in the preceding table is given under the assumption that the braking torque is 125%. If Ton and ED% are unchanged in actual application, only the braking torque is different. The power of the braking resistor must also change linearly with the braking torque. For example, the recommended power of the braking resistor is 830W under 125% braking torque, 10% ED, and 10s. If the actual braking torque is 150% (150% braking torque is 1.2 times the braking torque of 125%), The recommended power of the braking resistor under the conditions of 150% braking torque, 10% ED, and 10s is 830W x 1.2 = 996W.
- In addition, the temperature rise of the braking resistor under different heat dissipation conditions may vary. Therefore, different heat dissipation conditions of the resistor may affect the power selection of the braking resistor.

Recommended solution for braking resistor overtemperature protection

In applications where a braking resistor is installed, it is recommended to use a resistor with a temperature switch to ensure safety and avoid overtemperature and burning of the braking resistor. Connect the temperature switch output to the electromagnetic contactor control circuit on the front end of the AC drive (as shown in the following figure) to implement the interlock protection function. When the resistor overheats, a tripping fault occurs, preventing the resistor from being burned.

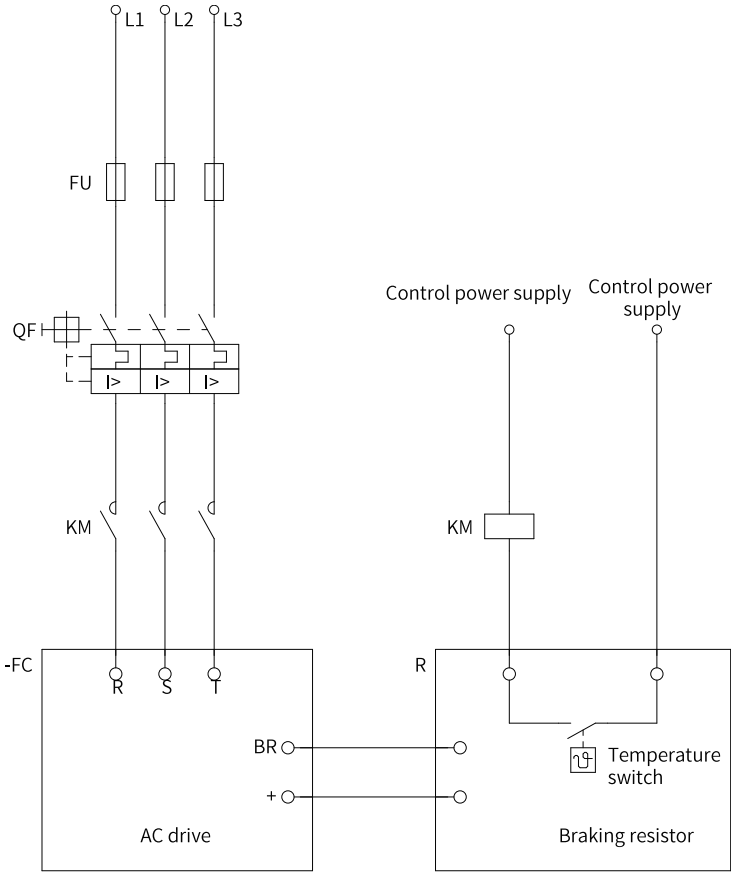


Figure 9-20 Braking resistor overtemperature protection

Note

- FU: Fuse
- KM: Contactor
- QF: Circuit breaker

9.8.8 EMC shield grounding bracket

Application conditions and effects:

The EMC shield bracket is used in scenarios where the cable shield requires 360° grounding.

Applicable model

The EMC shield grounding bracket is divided into the signal cable shield grounding bracket and the power cable shield grounding bracket, as shown in the following figure.

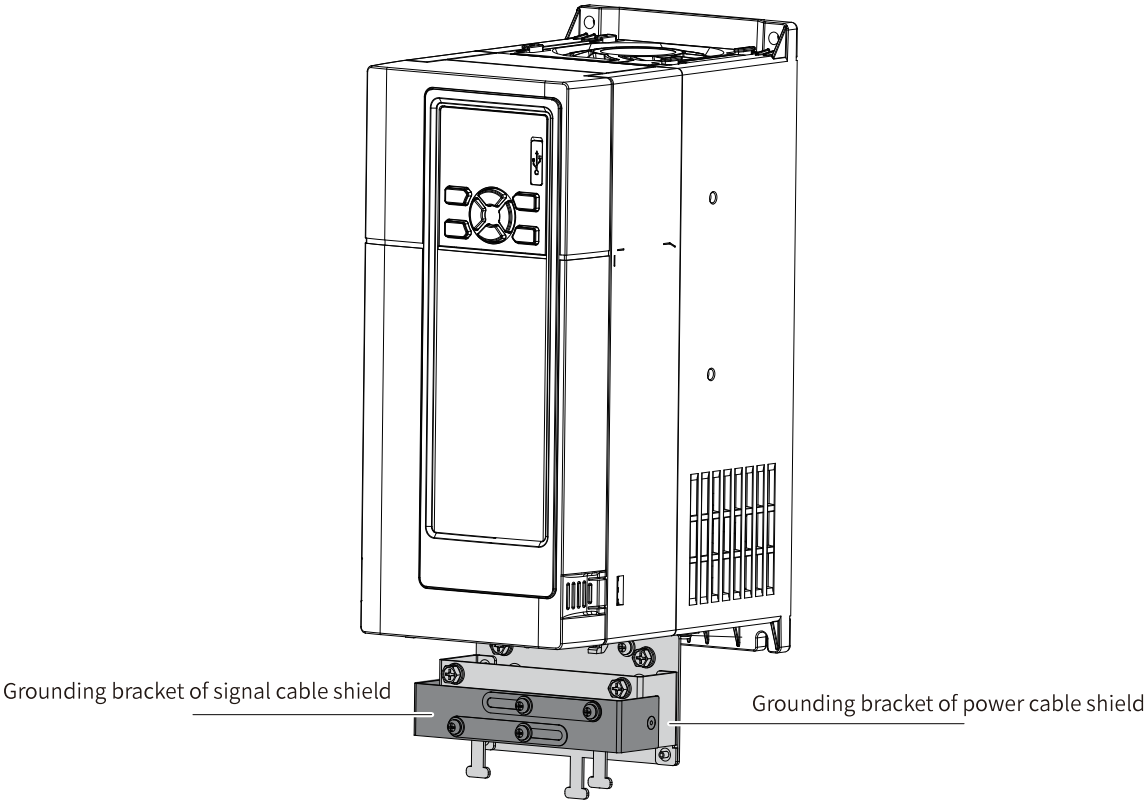


Figure 9-21 EMC shield grounding bracket

Table 9–25 EMC shield grounding bracket model

Drive Structure (kW)	Model of the bracket
T1 (0.37 to 1.5)	MD630-AZJ-A3T1
T2 (2.2 to 4)	
T3 (5.5 to 7.5)	MD630-AZJ-A3T3
T4 (11 to 15)	MD630-AZJ-A3T4
T5 (18.5 to 22)	MD630-AZJ-A3T5

Dimensions

The following figure shows the installation dimensions of the EMC shield grounding bracket. Unit: mm (in.)

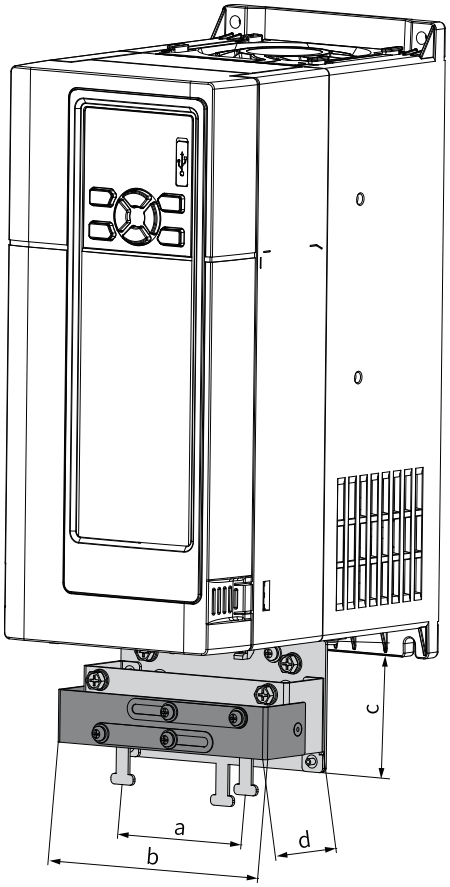


Figure 9-22 Dimensions of the EMC shield grounding bracket installation

Table 9–26 Dimensions of the EMC shield grounding bracket

Drive Structure (kW)	Dimensions (mm (in.)			
	a	b	c	d
T1 (0.37 to 1.5)	56 (2.20)	70 (2.76)	42 (1.65)	48.2 (1.90)
T2 (2.2 to 4)	56 (2.20)	70 (2.76)	42 (1.65)	48.2 (1.90)
T3 (5.5 to 7.5)	71 (2.80)	85 (3.35)	52 (2.05)	50.5 (1.99)
T4 (11 to 15)	47.1 (1.85)	122 (4.80)	82 (3.23)	44 (1.73)
T5 (18.5 to 22)	72 (2.83)	164.4 (6.47)	100 (3.94)	51 (2.01)

Note

For installation of the EMC shield grounding bracket, see *"2.9.1 Installing the Grounding Bracket of the Cable Shield" on page 54*.

9.8.9 Through-hole mounting bracket

Application conditions and effects:

The flush mounting bracket is used in situations where the air duct needs to be cleaned or there is no heat dissipation inside the cabinet.

Applicable model:

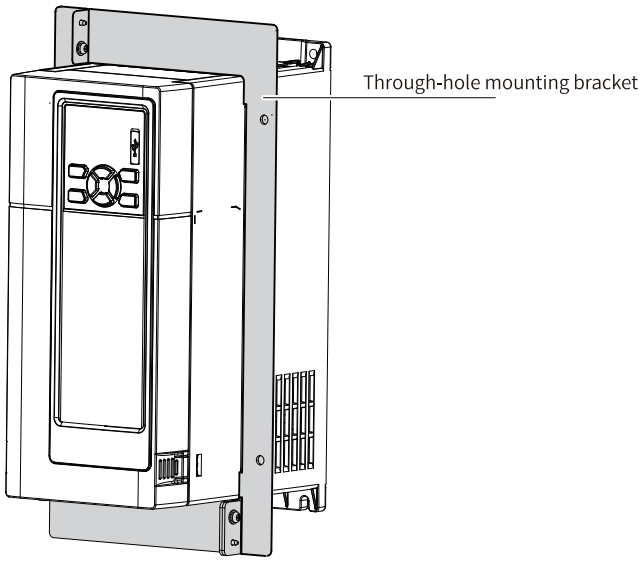


Figure 9-23 Through-hole mounting bracket

Table 9–27 Models of through-hole mounting brackets

Outline structure (kW)	Model of the bracket
T4 (11 to 15)	MD630-AZJ-A1T4
T5 (18.5 to 22	MD630-AZJ-A1T5

Dimension drawing:

The following figure shows the dimensions of the flush mounting bracket. Unit: mm (in.)

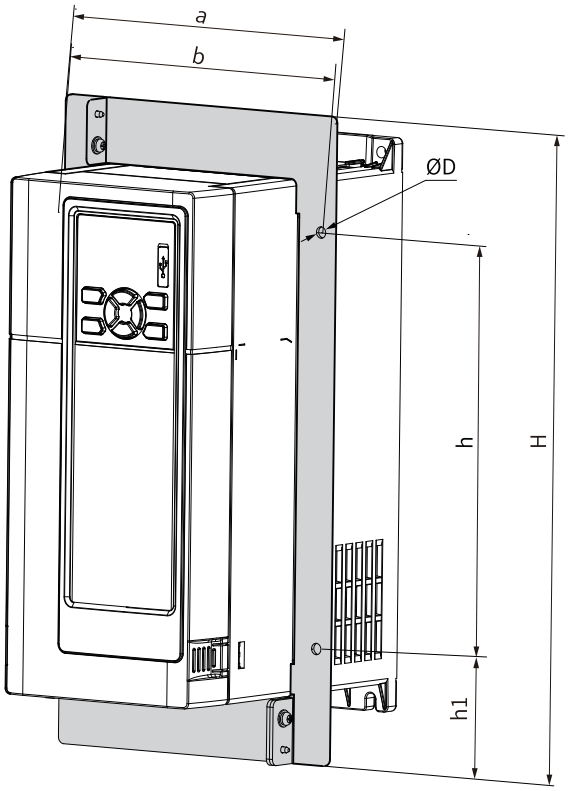


Figure 9-24 Dimensions of the flush mounting bracket

Table 9–28 Dimensions of the flush mounting bracket

Outline structure (kW)	Dimensions (mm (in.)					
	a	b	H	h	h1	Φ D.
T4 (11 to 15	174.7 (6.88)	158 (6.22)	343 (13.50)	220 (8.66)	61.5 (2.42)	6 (0.24)
T5 (18.5 to 22	214.7 (8.45)	198 (7.80)	370 (14.57)	220 (8.66)	75 (2.95)	6 (0.24)

Note

For an in-line mounting bracket, see *"2.6 Through-hole Mounting" on page 50*.

9.8.10 Guide rail mounting options

Application conditions and effects:

The guide rail mounting option is intended for applications where screw fixing is not convenient and time saving is required.

Applicable model

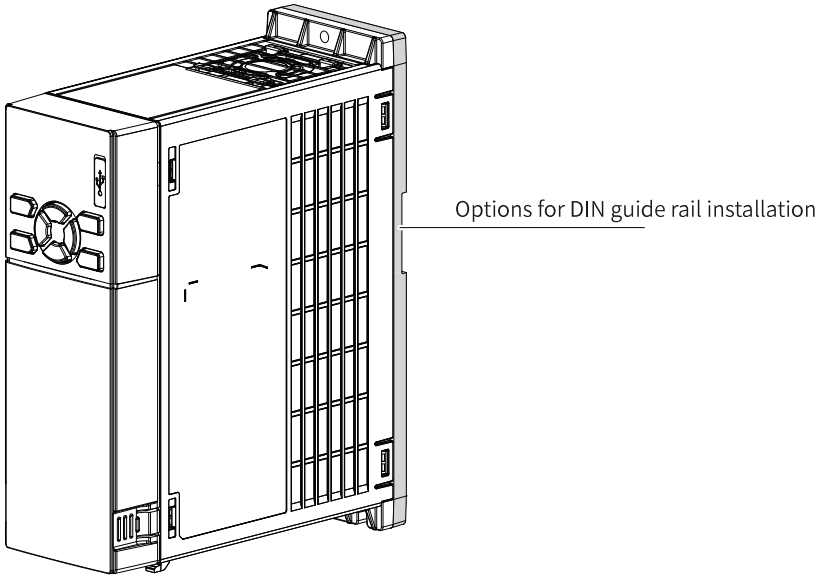


Figure 9-25 Guide rail mounting options

Table 9–29 Model list of guide rail mounting options

Outline structure (kW)	Accessory model
T1 (0.37 to 1.5)	MD630-AZJ-A4T1
T2 (2.2 to 4)	MD630-AZJ-A4T1

Dimension drawing:

The following figure shows the mounting dimensions of the guide rail mounting options. Unit: mm (in.)

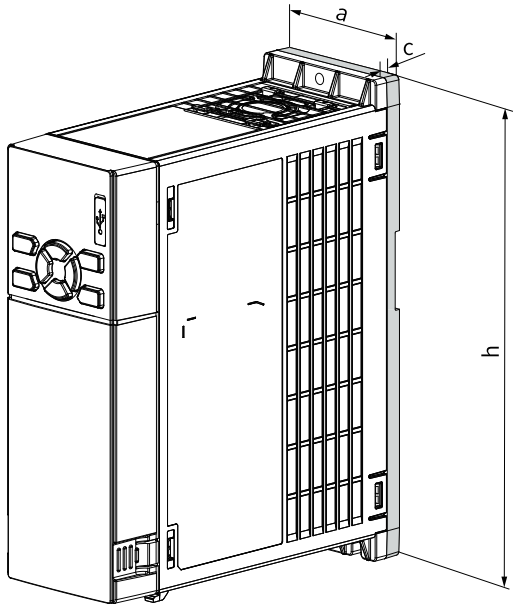


Figure 9-26 Mounting dimensions of the guide rail mounting options

Table 9–30 Mounting dimensions of guide rail mounting options

Outline structure (kW)	Dimensions (mm (in.))		
	a	c	h
T1 (0.37 to 1.5)	70 (2.76)	8 (0.31)	217 (8.54)
T2 (2.2 to 4)			

For installation of the guide rail, see *"2.7 Rail Mounting" on page 53*.

9.8.11 Punch vibration damping bracket

Application conditions and effects:

The punch damping bracket is used in high-vibration applications to reduce the vibration of the unit relative to the AC drive. Long-term vibration causes damage to the AC drive, such as mining machinery.

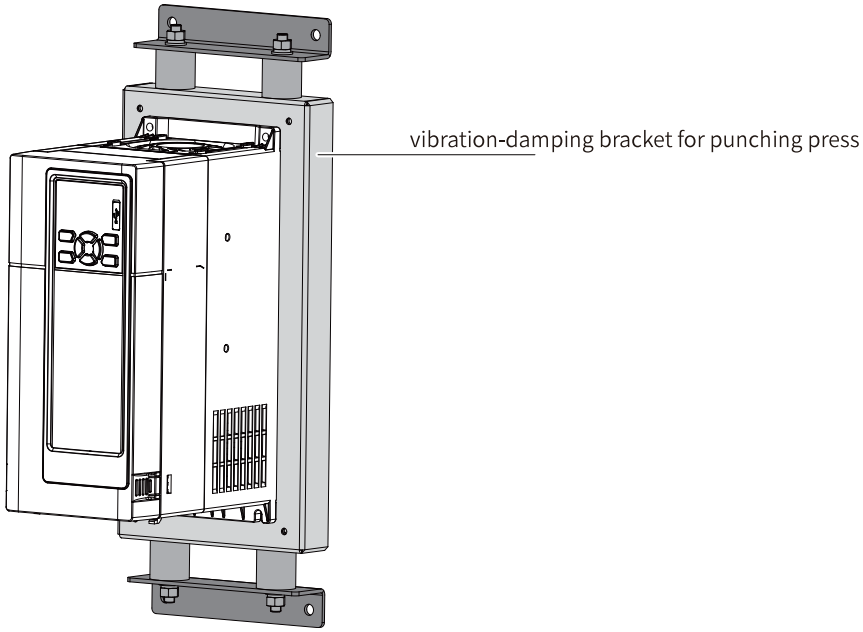


Figure 9-27 Punch vibration damping bracket

Table 9–31 Table of the models of the punch damping bracket

Outline structure (kW)	Model of the bracket
T1 (0.37 to 1.5)	MD630-AZJ-A2T1
T2 (2.2 to 4)	MD630-AZJ-A2T1
T3 (5.5 to 7.5)	MD630-AZJ-A2T1
T4 (11 to 15)	MD630-AZJ-A2T4
T5 (18.5 to 22	MD630-AZJ-A2T4

Dimension drawing:

The following figure shows the dimensions of the punch damping bracket for different sizes. Unit: mm (in.)

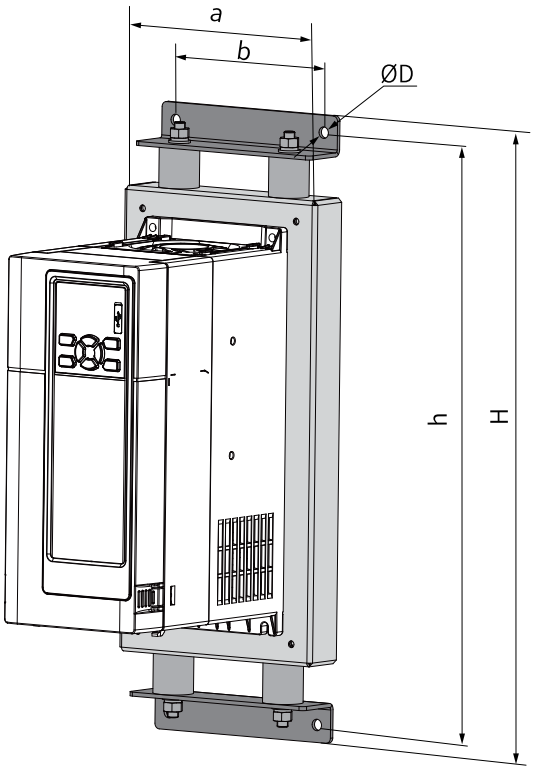


Figure 9-28 Dimensions of the punch damping bracket

Table 9–32 Mounting dimensions of the punch damping bracket

Outline structure (kW)	Dimensions (mm (in.)				
	a	b	H	h	Φ D.
T1 (0.37 to 1.5)	110 (4.33)	85 (3.35)	415 (16.34)	389 (15.31)	8.5 (0.33)
T2 (2.2 to 4)					
T3 (5.5 to 7.5)					
T4 (11 to 15)	175 (6.90)	135 (5.31)	466 (18.35)	440 (17.32)	8.5 (0.33)
T5 (18.5 to 22					

9.8.12 Wiring protection box option

Application conditions and effects:

The protection option of the junction box is installed below the main circuit wiring of the AC drive. It is mainly used in applications with graphite dust and carbon fiber. The purpose is to prevent objects such as external dust from entering the AC drive. The main application scenario is the lithium-electric processing workshop.

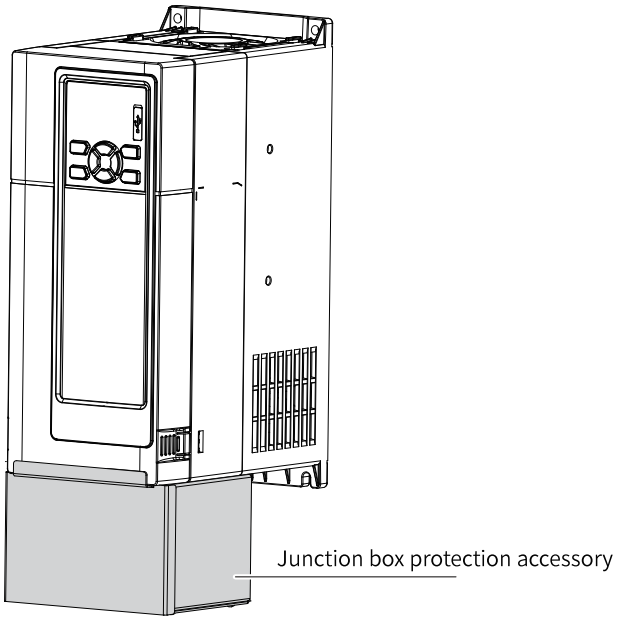


Figure 9-29 Wiring box protection options

Table 9–33 Model list of protective options for the junction box

Outline structure (kW)	Model of the bracket
T1 (0.37 to 1.5)	MD630-JXH-A5T1
T2 (2.2 to 4)	MD630-JXH-A5T1
T3 (5.5 to 7.5)	MD630-JXH-A5T3
T4 (11 to 15)	MD630-JXH-A5T4
T5 (18.5 to 22	MD630-JXH-A5T5

Dimension drawing:

The following figure shows the dimensions of the protective options of the junction box. Unit: mm (in.)

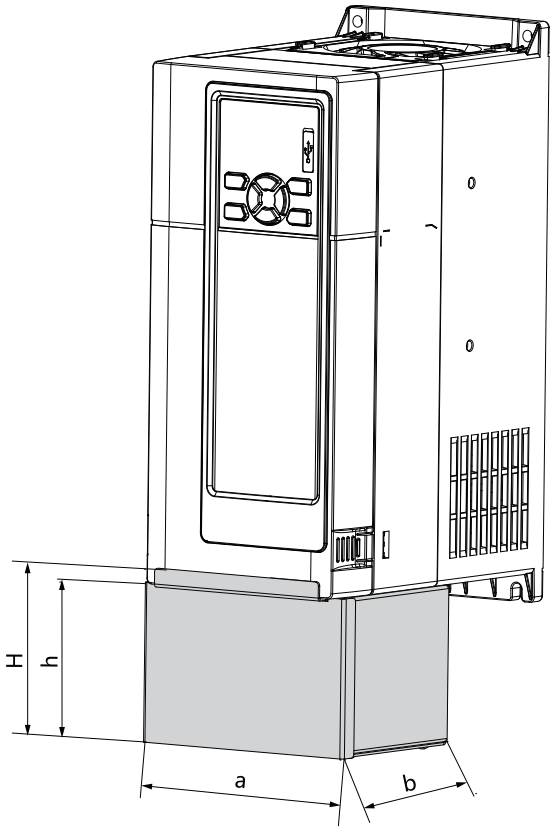


Figure 9-30 Installation dimensions of the protective options of the junction box

Outline structure (kW)	Dimensions (mm (in.)			
	a	b	H	h
T1 (0.37 to 1.5)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)
T2 (2.2 to 4)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)
T3 (5.5 to 7.5)	85 (3.35)	92 (3.62)	41.5 (1.63)	72.3 (2.85)
T4 (11 to 15)	125 (4.92)	96.2 (3.79)	114.2 (4.50)	83.4 (3.28)
T5 (18.5 to 22	168.4 (6.63)	96.2 (3.79)	105 (4.13)	72 (2.83)

9.8.13 Cables

Power cable selection requirements

For the selection of power cables, follow national or regional regulations. Select IEC cables based on the following requirements:

- EN 602041 and IEC 60364552 standards
- PVC insulated cables with copper conductors
- Ambient temperature of 40°C and cable surface temperature of 70°C (Note: When the ambient temperature exceeds 40°C, contact Inovance.)
- Symmetric cable with copper-braided shield

If recommended cables for peripheral devices or options are not suitable for the product, contact Inovance.

Use shielded cables to comply with the EMC requirements. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the shield of the three-conductor shielded cable cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE cable. To suppress the radio frequency interference effectively, the cable shield uses cooper braid as the material. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

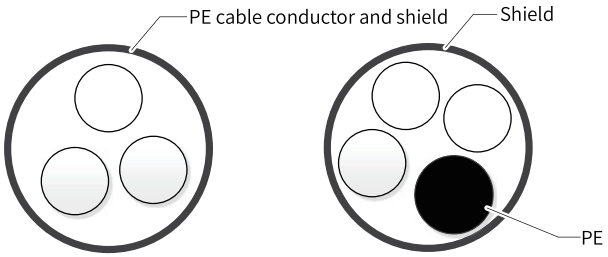


Figure 9-31 Recommended power cables

The preceding recommended terminals are of TG-JT and TO series.

Power cable

Table 9–34 Input/output/grounding terminal cable specifications

Structure	Model MD630S/N-4T***BS-INT	Input/Output Terminal				Grounding Terminal				Allowable cable length	Cable OD Diameter (mm)	Screw Specification	Tightening Torque N·m (lb.in)
		UL (AWG)		IEC (mm²)		UL (AWG)		IEC (mm²)					
		Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications				
T1	1R5	3 x 14	E2510	3 x 2.5	E2510	14	E2510	2.5	E2510	Customized	9.2±0.2	M3.5	1.0 (8.85)
	2R1	3 x 14	E2510	3 x 2.5	E2510	14	E2510	2.5	E2510	Customized	9.2±0.2	M3.5	1.0 (8.85)
	3R8	3 x 14	E2510	3 x 2.5	E2510	14	E2510	2.5	E2510	Customized	9.2±0.2	M3.5	1.0 (8.85)
T2	5R1	3 x 14	E2510	3 x 2.5	E2510	14	E2510	2.5	E2510	Customized	9.2±0.2	M3.5	1.0 (8.85)
	7R2	3 x 14	E2510	3 x 2.5	E2510	14	E2510	2.5	E2510	Customized	9.2±0.2	M3.5	1.0 (8.85)
	9R0	3 x 10	E6010	3 x 6	E6010	10	E6010	6	E6010	Customized	13.5±0.3	M3.5	1.0 (8.85)
T3 models	013	3 x 10	E6010	3 x 6	E6010	10	E6010	6	E6010	Customized	13.5±0.3	M4	1.2 (10.62)
	017	3 x 8	E10-10	3 x 10	E10-10	8	E10-10	10	E10-10	Customized	18.6±0.4	M4	1.2 (10.62)

Structure	Model MD630S/N-4T***BS-INT	Input/Output Terminal				Grounding Terminal				Allowable cable length	Cable OD Diameter (mm)	Screw Specification	Tightening Torque N·m (lb.in)
		UL (AWG)		IEC (mm²)		UL (AWG)		IEC (mm²)					
		Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications	Recommended cable specifications	Recommended terminal specifications				
T4	025	3 x 6	RNB14-5	3 x 10	RNB14-5	6	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0 (17.7)
	032	3 x 6	RNB14-5	3 x 10	RNB14-5	6	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0 (17.7)
T5	037	3 x 4	RNBS22-6	3 x 16	RNBS22-6	4	RNBS22-6	16	RNBS22-6	Customized	26.0±0.6	M6	2.5 (22.2)
	045	3 x 4	RNBS22-6	3 x 16	RNBS22-6	4	RNBS22-6	16	RNBS22-6	Customized	26.0±0.6	M6	2.5 (22.2)

Table 9–35 Cable specifications for braking terminals

Size	Model MD630S/N-4T***BS-INT	Braking Terminal						Screw Specification	Tightening torque (N·m) (lb.in)
		UL (AWG)		IEC (mm²)		Allowable Cable Length (m)	OD (mm)		
		Recommended Cable Specification	Recommended Lug Specification	Recommended Cable Specification	Recommended Lug Specification				
T1	1R5	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	2R1	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	3R8	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
T2	5R1	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	7R2	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	9R0	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
T3 models	013	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M4	1.2 (10.62)
	017	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M4	1.2 (10.62)
T4	025	2 x 12	RNB5.5-5	2 x 4	RNB5.5-5	Customized	8.5±0.2	M6	2.0 (17.7)
	032	2 x 12	RNB5.5-5	2 x 4	RNB5.5-5	Customized	8.5±0.2	M5	2.0 (17.7)
T5	037	2 x 12	RNB5.5-6	2 x 4	RNB5.5-6	Customized	8.5±0.2	M6	2.5 (22.2)
	045	2 x 12	RNB5.5-6	2 x 4	RNB5.5-6	Customized	8.5±0.2	M6	2.5 (22.2)

Table 9–36 Cable specifications for bus terminals

Size	Model MD630S/N-4T***BS-INT	Bus terminal						Specification	Tightening torque (N·m) (lb.in)
		UL (AWG)		IEC (mm^2)		Allowable cable length (m)	OD (mm)		
		Recommended Cable Specification	Recommended Lug Specification	Recommended Cable Specification	Recommended Lug Specification				
T1	1R5	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	2R1	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	3R8	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
T2	5R1	2 x 14	E2510	2 x 2.5	E2510	Customized	8.1±0.2	M3.5	1.0 (8.85)
	7R2	2 x 12	E4009	2 x 4	E4009	Customized	8.5±0.2	M3.5	1.0 (8.85)
	9R0	2 x 10	E6010	2 x 6	E6010	Customized	11.7±0.3	M3.5	1.0 (8.85)
T3 models	013	2 x 8	E10-10	2 x 10	E10-10	Customized	15.4±0.3	M4	1.2 (10.62)
	017	2 x 8	E10-10	2 x 10	E10-10	Customized	15.4±0.3	M4	1.2 (10.62)
T4	025	2 x 4	RNBS22-5	2 x 16	RNBS22-5	Customized	22.3±0.3	M5	2.0 (17.7)
	032	2 x 4	RNBS22-5	2 x 16	RNBS22-5	Customized	22.3±0.3	M5	2.0 (17.7)
T5	037	2 x 2	RNB38-6	2 x 25	RNB38-6	Customized	26.3±0.3	M6	2.5 (22.2)
	045	2 x 2	RNB38-6	2 x 25	RNB38-6	Customized	26.3±0.3	M6	2.5 (22.2)

Note

- Observe national or regional regulations during selection. The preceding table is based on the following:
  - PVC insulation and copper conductor
  - Ambient temperature of 40°C and cable surface temperature of 75°C (Remark: When the ambient temperature exceeds 40°C, contact Inovance.)
  - Cable layout type E is adopted (see IEC60204-1).
- If the conditions are different, you need to select the model according to actual conditions.
- For bare OT terminals, the end of the terminal is protected by a heat shrink tube.

Control cable

Note

Observe the requirements in standard EN 60204-1 during connecting control circuit cables.

To prevent peripheral interference and noise, use shielded cables with the shield for control signal cables. Install a signal shield bracket at both ends of the shield to reliably connect the shield to the AC drive in 360°. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

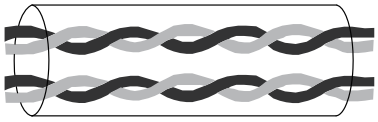


Figure 9-32 Shielded twisted pairs

Table 9–37 Control signal terminals

Size	Control Signal Terminal			
	Recommended Cable Specification	Allowable Cable Length (m)	OD (mm)	Recommended terminal specifications
T1 to T5 models	22	Customized	Customized	E0508

Table 9–38 Relay signal terminals

Size	Control Signal Terminal			
	Recommended Cable Specification	Allowable Cable Length (m)	OD (mm)	Recommended terminal specifications
T1 to T5 models	22	Customized	Customized	E0508
	20	Customized	Customized	E7508
	18	Customized	Customized	E1008
	16	Customized	Customized	E1508

Cable lug terminal

It is recommended to use the lugs produced by Zhejiang KISE Terminal Co., Ltd., including tube pre-insulated lugs (TG-JT type) and circular naked lugs (TO type).

Tubular pre-insulated lug

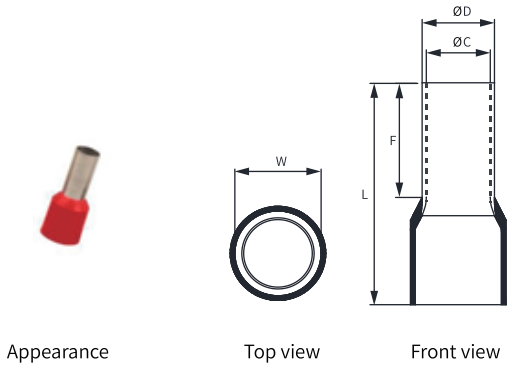


Figure 9-33 Appearance and dimensions of the tube pre-insulated lug (TG-JT type)

Table 9–39 Specifications and dimensions of the tube pre-insulated lug (TG-JT type)

Cross sectional area	Model	Dimensions (mm)					Insulation Sheath Color (1) For Germany (2) For France	Crimping Tool
		F	L	W	D	C		
22AWG 0.5 mm^2	E0508	8.0	14	2.7	1.3	1.0	(1) Orange (2) White	OPT AN-04WF
A.W.G.20 0.75 mm^2	E7508	8.0	14	2.8	1.5	1.2	(1) White (2) Blue	OPT AN-04WF
A.W.G.18 1.0 mm^2	E1008	8.0	14.5	2.9	1.7	1.4	(1) Yellow (2) Red	OPT AN-04WF
A.W.G.16 1.5 mm^2	E1508	8.0	14.5	3.5	2.0	1.7	(1) Red (2) Black	OPT AN-04WF
A.W.G.14 2.5 mm^2	E2510	10.0	17.5	4.1	2.6	2.3	(1) Blue (2) Gray	OPT AN-04WF
A.W.G.10 6 mm^2	E6012	12.0	20.0	6.4	3.85	3.5	(1) Black (2) Green	OPT AN-10WF
A.W.G.8 10 mm^2	E10-12	12.0	22.5	7.7	5.05	4.7	(1) Milk white (2) Brown	OPT AN-16WF

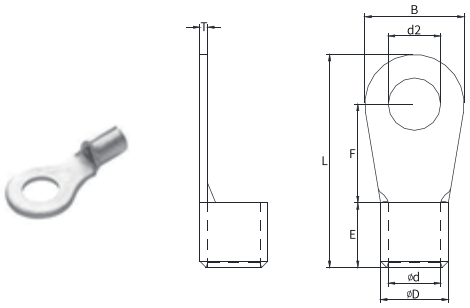


Figure 9-34 Appearance and dimensions of the circular naked lugs (TO type)

Table 9–40 Specification and dimensions of the circular naked lugs (TO type)

Cross sectional area	Model	Dimensions (mm)								Crimping Tool
		d2	B	F	L	E	D	d	T	
A.W.G.6 14 mm^2	RNB14-5	5.3	12.0	13.5	29.5	10.5	9.0	6.0	1.4	OPT TP-150D
A.W.G.4 22 mm^2	RNBS22-6	6.4	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D
A.W.G.2 38 mm^2	RNB38-6	6.4	15.5	18.5	40.0	14.0	13.5	9.5	1.8	OPT TP-150D
AWG12 4 mm^2	RNB5.5-5	5.3	9.5	8.0	20.0	7.0	5.5	3.5	1.0	IZUMI 5N18

Cross sectional area	Model	Dimensions (mm)								Crimping Tool
		d2	B	F	L	E	D	d	T	
AWG12 4 mm^2	RNB5.5-6	6.4	12.2	105	23.5	7.0	5.5	3.5	1.0	IZUMI 5N18
AWG4 22 mm^2	RNBS22-5	5.3	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D

9.8.14 Expansion Card

9.8.14.1 Outline dimensions

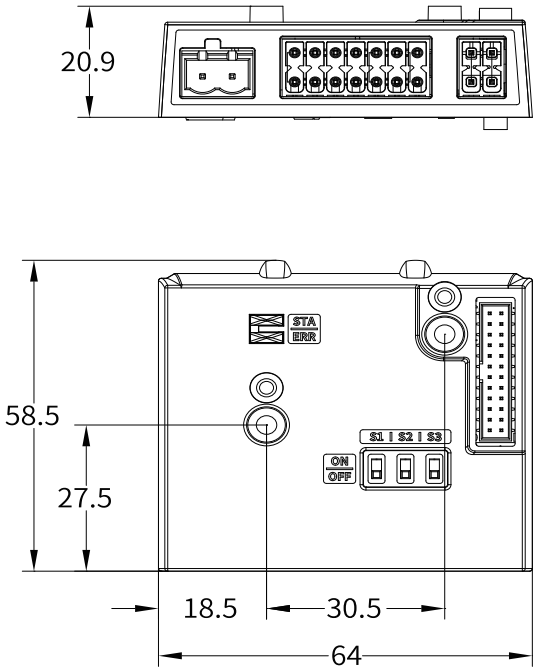


Figure 9-35 Dimensions of IO expansion card MD-IO-M1 (unit: mm)

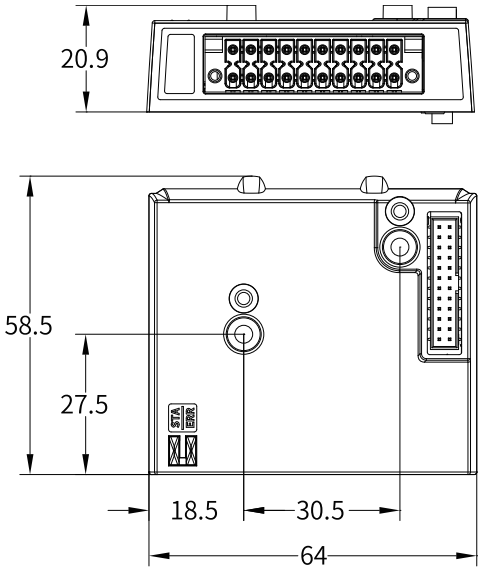
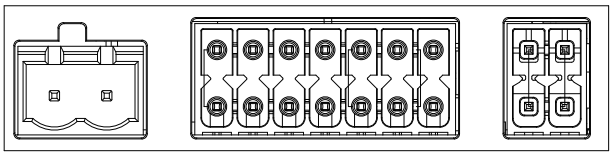


Figure 9-36 Dimensions of PG expansion cards (MD-PG-AU1, MD-PG-S1, MD-PG-R1) (unit: mm)

9.8.14.2 Description of IO Expansion Card Interface

Interface layout

The following figure shows the interface layout of the I/O expansion card.



T/A	T/C	COM	CME	DO1	+10V	GND	AI1	AO1	RTD+	RTD-
		+24V	OP	COM	DI1	DI2	GND	GND	RTD_I+	RTD_I-

Figure 9-37 Interface layout

Interface description

Type	Mark	Name	Function
Power supply	+24V-COM	24 V digital voltage output	Provides external 24 V power supply for DI/DO and external sensors. Maximum output current: 200 mA [1]
	+10 V-GND	10 V analog power supply output	Provides 10 V analog power supply for external potentiometers, ranging from 1 kΩ to 5 kΩ
	OP	Digital input common terminal	Shorted to +24 V through a jumper by default. When the DI is powered up by an external power supply, the jumper must be removed.
Analog output (AO)	AO1-GND	Analog output 1	The output signal type is selected by the DIP switch S5: • S1 = OFF: 0 V to 10 V (default) • S1 = ON: 0 mA to 20 mA 12-bit resolution; correction accuracy: 0.5%; maximum load output current in voltage mode: 2 mA; load impedance in voltage mode: 5 kΩ; load impedance in current mode: < 500 Ω
Digital output (DO)	DO1-CME	Digital output 1	Photocoupler isolation; dual-polarity open collector output; It is forbidden to connect the DO directly to the power supply, and a load must be connected in series for use. • Output voltage range: 0 to 24 V • Maximum output frequency: 100 Hz • Output current range: 0 mA to 50 mA
Analog input (AI)	AI1-GND	Analog input 1	The input signal type is selected by the DIP switch S2: • S2 = OFF: -10 V to +10 V (default) • S2 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after correction: 0.3%; response time: < 2 ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
Digital input	DI1-COM	DI1	Photocoupler isolation, compatible with dual-polarity input: • Input impedance: 4.6 kΩ • Maximum input frequency: 100 Hz • The working voltage ranges from 15 V to 30 V. The voltage lower than 5 V is invalid and the voltage higher than 15 V is valid.
	DI2-COM	Digital input 2	
Temper-ature sensor input	RTD_I+	RTD excitation port +	By setting switch S3, you can select the type of motor temperature sensor. • S3 = OFF: PT100/PT1000/KTY84-130 • S3 = ON: PTC130 single-core/three-core Range and accuracy: PT100 (-25°C to 200°C, ±0.5°C); PT1000 (-25°C to 200°C, ±0.5°C); KTY84-130 (-40°C to 260°C, ±0.5°C); PTC130 (100 to 180°C, ±5°C)
	RTD	RTD acquisition port +	
	RTD_I-	RTD excitation port-	
	RTD	RTD acquisition port -	
Relay output	T/A-T/C	NO terminal	Support the long life requirements of the lifting industry Contact capacity: 250 VAC 8A, 30 VDC 8A

Note

[Note 1]: The +24 V on the control board and IO expansion card (reserved function) is the same power supply. When the +24 V power supply of the AC drive body is used, the total load current cannot exceed 200 mA.

Slide switch description

Name		Description	
S1	AO mode selection	ON	Current output
		OFF	Voltage output
S2	AI mode selection	ON	Current Input
		OFF	Voltage input
S3	Temperature sensor selection	ON	PTC130 (single-core/three-core)
		OFF	PT100/PT1000/KTY84-130

9.8.14.3 MD-PG-AU1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

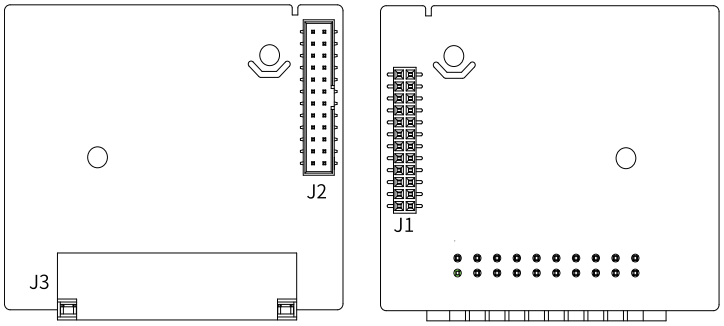


Figure 9-38 Expansion card interface

Name	Description	Remarks
J1	Interface for connecting the PG card and the control board of the drive	-
J2	PG card expansion interface for connecting another expansion card	-
J3	Encoder power supply, signal input, and frequency-division output terminals	See the following table.

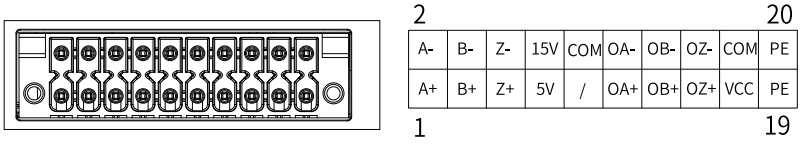


Figure 9-39 Pins of encoder signal input terminal J3

Interface description

Table 9–41 Pin definition of encoder signal input terminal J3

Pin No.	Name	Description	Notes
1	A+	External encoder input differential pair	Common/Differential mode voltage range: ±15 V Positive input threshold: VTH+ ≥ -0.02 V Negative input threshold: VTH- ≤ -0.2 V. Isolation requirement: No isolation Termination resistance requirement: Selective junction Pull-up resistance requirement: X11 + pull up 67k X11 - pull up 10k Maximum number of connected nodes: 1
2	A–		
3	B+	External encoder input differential pair	
4	B–		
5	Z+	External encoder input differential pair	
6	Z-		
7	5V	5 V power supply for the encoder	Standard voltage: +5.24 V Voltage fluctuation range: ±10% Maximum voltage ripple: 100 mV Maximum output current: 300 mA
8	15V	15 V power supply for the encoder	Standard voltage: +15.24 V Voltage fluctuation range: ±10% Maximum voltage ripple: 300 mV Maximum output current: 300 mA
9	NC	Reserved	-
10	COM	C5V/C15V power supply common ground External input power ground for frequency-division output	-
11	OA+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the output is from the + side. The amplitude of the frequency-division output signal follows the +EXT_VCC0 power supply, and the internal 5 V output is used by default.
12	OA–		
13	OB+	Frequency-division output push-pull pair	
14	OB–		
15	OZ+	Frequency-division output push-pull pair	
16	OZ–		
17	VCC	External input power for frequency-division output	The internal 5 V output is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	C5V/C15V power supply common ground External input power ground for frequency-division output	-
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

Note

- The ABZ incremental encoder OC level is connected to the A11+/B11+/Z11+ pins of terminal J3; the single-ended push-pull level is connected to the A11-/B11-/Z11- pins of terminal J3.
- The 23-bit magnetic encoder is connected to the A11+/A11- pins of terminal J3.
- The DATA differential signal terminal of the SSI, Endat, and BISS encoders is connected to A11+/A11- pins of terminal J3, and CLOCK to B11+/B11-pins.
- You need to select the encoder type in the background properly to enable the PG card to work.

Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection, frame fault, and data check fault occur.

9.8.14.4 MD-PG-S1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

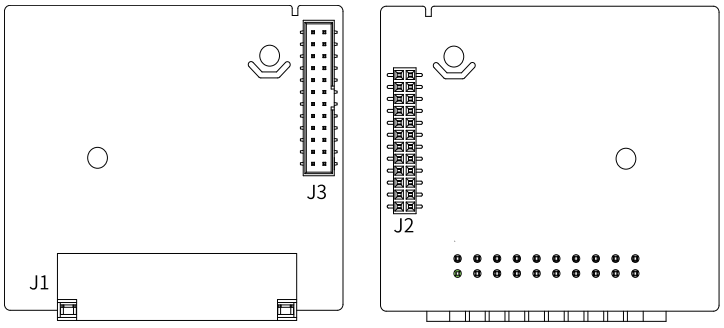
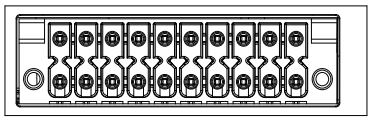


Figure 9-40 Expansion card interface

Name	Description	Remarks
J1	Encoder input and frequency-division output	User terminal
J2	Encoder power supply and communication	Connected to the control board
J3	PG card expansion interface for connecting another expansion card	Cascaded with the next-level expansion card



2									20
A-	B-	C/D/Z-	COM	/	OA-	OB-	OZ-	COM	PE
A+	B+	C/D/Z+	5V	/	OA+	OB+	OZ+	VCC	PE
1									19

Figure 9-41 Pins of encoder signal input terminal J3

Interface description

Table 9–42 Pin definition of encoder signal input terminal J1

Pin No.	Name	Description	Notes
1	A+	Analog encoder signal differential pair	Sin/Cos: A/B/CDZ signal Differential mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V. Common mode voltage: Vcm = 3.0 V (Max.)
2	A–		
3	B+		
4	B–		
5	CDZ+		
6	CDZ-		
7	+C5V	5 V power supply	Standard voltage: +5.24 V Voltage fluctuation range: ±5% Maximum output current 300 mA
8	COM	External encoder ground	-
9	NC	Reserved	-
10	NC	Reserved	-
11	DIV_a+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the is from the + side.
12	DIV_a-		
13	DIV_b+	Frequency-division output push-pull pair	
14	DIV_b-		
15	DIV_Z+	Frequency-division output push-pull pair	
16	DIV_Z-		
17	+EXT_VCC0	External input power for frequency-division output	The internal 5 V is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	External encoder ground	-
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection occur.

9.8.14.5 MD-PG-R1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

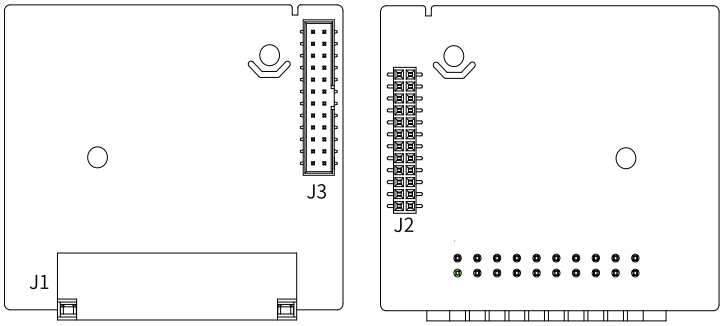


Figure 9-42 Expansion card interface

Name	Description	Remarks
J1	Encoder input and frequency-division output	User terminal
J2	Encoder power supply and communication	Connected to the control board
J3	PG card expansion interface for connecting another expansion card	Cascaded with the next-level expansion card

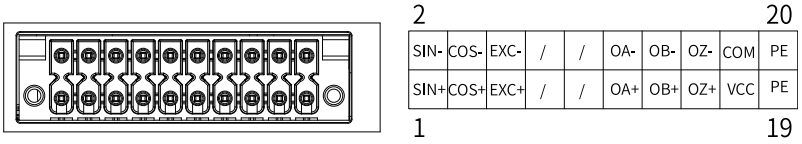


Figure 9-43 Pins of encoder signal input terminal J3

Interface description

Table 9–43 Pin definition of encoder signal input terminal J1

Pin No.	Name	Description	Notes
1	SIN+	Analog encoder signal differential pair	Resolver: SIN/COS/EXC signal Excitation output: Vpp = 18.8 V to 19.8 V to 21.1 V Excitation frequency: 10 kHz/12 kHz/15 kHz/20 kHz (adjustable)
2	SIN-		
3	COS+		
4	COS-		
5	EXC+		
6	EXC-		
7	NC	Reserved	-
8	NC		
9	NC		
10	NC		

Pin No.	Name	Description	Notes
11	DIV_a+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the is from the + side.
12	DIV_a-		
13	DIV_b+	Frequency-division output push-pull pair	
14	DIV_b-		
15	DIV_Z+	Frequency-division output push-pull pair	
16	DIV_Z-		
17	+EXT_VCC0	External input power for frequency-division output	The internal 5 V is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	External encoder ground	-
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

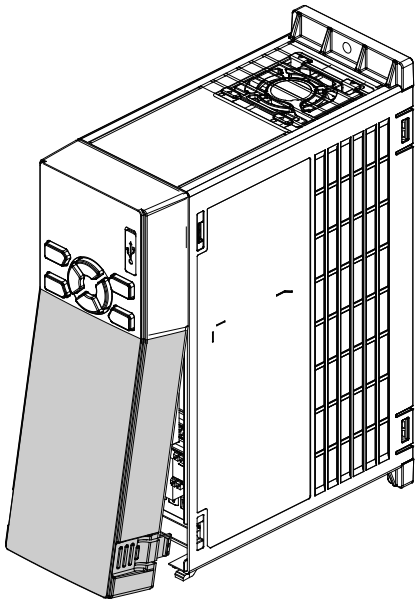
Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection occur.

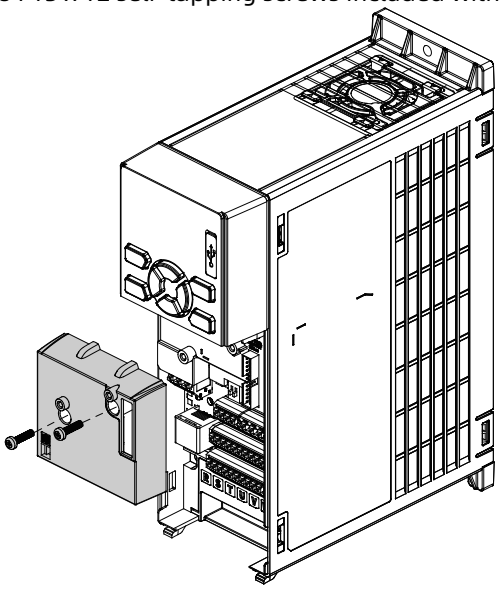
9.8.14.6 Installation

The expansion card is embedded in the MD630 series AC drive. Before installation, power off the AC drive, wait at least 10 minutes until the charging indicator on the AC drive becomes off. Then, insert the expansion card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by external signal cable tension. The following figure describes the installation of the card.

1. Press the snap-fit joint to remove the upper cover.



2. Ensure that the expansion card and control board terminals are connected, and secure the expansion card with the two PT3 x 12 self-tapping screws included with the product.



10 Parameter

10.1 Parameter Groups

10.1.1 Parameter Group Introduction

Scenarios

The parameters of MD630 series AC drives are grouped according to function to facilitate unified management and parameter setting. To implement a function, you can locate the corresponding parameter group and set according to the function category.

Function description

Parameters of the AC drive are displayed in three levels of menus, as shown below.

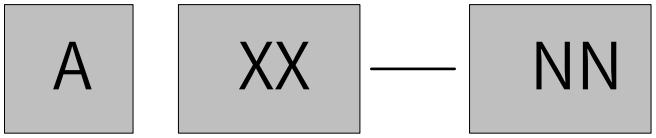


Figure 10-1 Parameter display

- A indicates the level-I menu, which is represented by one letter and corresponds to a group of complete functions. For example, group A corresponds to the system function and group b corresponds to the command channel.
- XX indicates the level-II menu, which is represented by one or two-digit number, corresponding to the function category when combined with level-I menus. For example, group A0 is related to parameter management, and group A2 is related to system information.
- NN indicates the level-III menu, which is represented by a a 2-digit number, corresponding to a certain parameter when combined with level-I and level-II menus. For example, A0-00 is the system initialization parameter.
- Level-II and level-III menus are usually separated by the symbol “-” .

10.1.2 Common Parameter

Scenarios

This product supports common parameter group (Group F, which is combined by the common parameters from other groups. You can quickly configure common functions through group F parameters

Description

As shown in the following figure, group F parameters are the mapping of other common function parameters. If the parameters discussed in this manual are mapped to group F, their corresponding settings within group F are also introduced. Setting these parameters either in Group F or directly on the original parameters yields the same results,

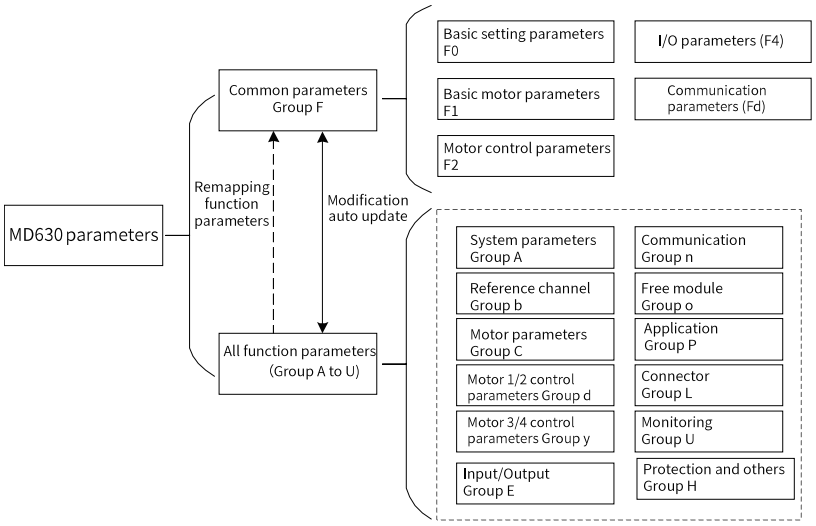


Figure 10-2 Parameter group diagram

Precautions

1. The product provides two control channels for setting running commands. Group F only includes parameters commonly used for running commands in channel 1 (default setting).
2. The product provides two set channels for setting frequency or torque reference. Group F only includes parameters commonly used for frequency or torque references in channel 1 (default setting).
3. The product supports multiple groups of motor parameter settings. Only motor 1 parameters are available in group F.

10.2 List of Parameters

10.2.1 Common Parameters (F group)

10.2.1.1 F0 Basic parameter settings

Item	Address:	Name	Value Range	Default	Unit	Change:
F0-00	0xF000	Load type display	0: Heavy load application 1: Light load application	0	/	Unchangeable
F0-01	0xF001	Motor control mode	0: SVC 1: FVC 2: V/f	2	/	Change at stop
F0-02	0xF002	Motor control method	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
F0-03	0xF003	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	/	Change at stop
F0-25	0xF019	Frequency decimal place	1: One decimal place 2: Two decimal places	2	/	Change at stop
F0-29	0xF01D	Main frequency source	0: F0-30-10 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F0-30	0xF01E	Digital setting of main frequency	0.00 to A2-17	50.00	Hz	Real-time
F0-31	0xF01F	Auxiliary frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F0-32	0xF020	Main and auxiliary frequency operation	0: Main source X + Auxiliary source Y 1: Main source X - Auxiliary source Y 2: Max. (X, Y) 3: Min. (X, Y) 4: Main source X x Auxiliary source Y	0	/	Real time
F0-33	0xF021	Additional frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
F0-34	0xF022	Main frequency gain factor source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F0-38	0xF026	Multi-reference 0 setting mode	0: F0-39 1: AI1 2: AI2 4: HDI pulse (valid only for MD630S) 5: PID 6: b5-01/b6-01 (digital setting of the main frequency of the active setting source) Others: F connector	0	/	Real time
F0-39	0xF027	Multi-reference 0	b8-43 to b8-42	0.0	/	Real time
F0-40	0xF028	Multi-reference 1	b8-43 to b8-42	0.0	/	Real time
F0-41	0xF029	Multi-reference 2	b8-43 to b8-42	0.0	/	Real time
F0-42	0xF02A	Multi-reference 3	b8-43 to b8-42	0.0	/	Real time
F0-45	0xF02D	Ramp acceleration/ deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	/	Real time
F0-46	0xF02E	Base for ramp acceleration/ deceleration time	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Set frequency	1	/	Real time
F0-48	0xF030	Ramp 1 acceleration time	0.0 to 6500.0	20.0	s	Real-time
F0-49	0xF031	Ramp 1 deceleration time	0.0 to 6500.0	20.0	s	Real-time
F0-50	0xF032	Ramp 1 acceleration initial arc	0.00 to 655.00	0.00	s	Real-time
F0-51	0xF033	Ramp 1 acceleration final arc	0.00 to 655.00	0.00	s	Real-time
F0-52	0xF034	Ramp 1 deceleration initial arc	0.00 to 655.00	0.00	s	Real-time
F0-53	0xF035	Ramp 1 deceleration final arc	0.00 to 655.00	0.00	s	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
F0-56	0xF038	Jog 1 frequency source	0: F0-57 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F0-57	0xF039	Digital setting of jog 1 frequency	-50.00 to 50.00	2.00	Hz	Real-time
F0-58	0xF03A	Jog 2 frequency source	0: F0-59 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F0-59	0xF03B	Digital setting of jog 2 frequency	-50.00 to 50.00	-2.00	Hz	Real-time
F0-62	0xF03E	Jogging ramp source	0: Normal running ramp time 1: Jogging ramp time	0	/	Real time
F0-63	0xF03F	Jog ramp acceleration time	0.00 to 655.00	20.00	s	Real-time
F0-64	0xF040	Jog ramp deceleration time	0.00 to 655.00	20.00	s	Real-time

10.2.1.2 F1 Basic parameters of motor 1

Param.	Address	Name	Value Range	Default	Unit	Change:
F1-00	0xF100	Motor type	0: Normal asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without field strengthening 4: Synchronous reluctance motor with field strengthening	0	/	Change at stop
F1-01	0xF101	Rated motor power	0.01 to 655.35	3.70	kW	Change at stop
F1-03	0xF103	Rated motor voltage	1 to 2000	380	V	Change at stop
F1-04	0xF104	Rated motor current	0.01 to 655.35	9.00	A	At stop
F1-06	0xF106	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
F1-07	0xF107	Rated motor speed	1 to 65535	1460	RPM	At stop
F1-10	0xF10A	Maximum motor frequency	F1-06 to 599.00	50.00	Hz	At stop

Param.	Address	Name	Value Range	Default	Unit	Change:
F1-11	0xF10B	Minimum motor frequency	0.00 to F1-10	0.00	Hz	At stop
F1-12	0xF10C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
F1-13	0xF10D	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
F1-14	0xF10E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	/	Change at stop
F1-15	0xF10F	Number of effective motor pole pairs	0 to 128	0	/	Unchangeable
F1-20	0xF114	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
F1-22	0xF116	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
F1-24	0xF118	Asynchronous motor stator leakage inductance	0.01 to 655.35	5.28	mH	Real time
F1-26	0xF11A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
F1-28	0xF11C	Mutual inductance (asynchronous motor)	0.1 to 6553.5	156.8	mH	Real time
F1-30	0xF11E	No-load current (asynchronous motor)	0.01 to 655.35	4.20	A	Real time
F1-32	0xF120	Synchronous motor shaft D inductance	0.01 to 655.35	5.28	mH	Real time
F1-34	0xF122	Synchronous motor shaft Q inductance	0.01 to 655.35	5.28	mH	Real time
F1-48	0xF130	Inertia ratio	0.0 to 6553.5	120.0	%	Change at stop
F1-49	0xF131	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change:
F1-55	0xF137	Motor brake control	0: Disable 1: Enable	1	/	Change at stop
F1-69	0xF145	Motor parameter auto-tuning mode	0: No operation 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Asynchronous motor static complete auto-tuning 4: Inertia auto-tuning 5: Dead zone auto-tuning 11: Permanent magnet motor with-load auto-tuning (excluding back EMF) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning 15: MTPA of synchronous reluctance motor without field strengthening 21: Static auto-tuning of synchronous reluctance motor 22: Dynamic auto-tuning of synchronous reluctance motor	0	/	Change at stop

10.2.1.3 F2 Control parameters of motor 1

Param.	Address	Name	Value Range	Default	Unit	Change:
F2-00	0xF200	FVC speed loop proportional gain	0.0 to 6000.0	8.0	/	Real time
F2-01	0xF201	FVC speed loop integral time	0.000 to 20.000	0.080	s	Real-time
F2-02	0xF202	SVC speed loop Kp	0.0 to 6000.0	5.0	/	Real time
F2-03	0xF203	SVC speed loop Ti	0.000 to 20.000	0.127	s	Real-time
F2-04	0xF204	Zero speed switchover frequency	0.0–d3-09	1.0	%	Real-time
F2-05	0xF205	Zero speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
F2-06	0xF206	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
F2-07	0xF207	Low speed switchover frequency	0.0–d3-12	10.0	%	Real-time
F2-08	0xF208	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
F2-09	0xF209	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
F2-10	0xF20A	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real-time
F2-11	0xF20B	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change:
F2-12	0xF20C	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
F2-14	0xF20E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	/	Change at stop
F2-15	0xF20F	Start mode	0: Direct start 1: Flying start	0	/	Change at stop
F2-16	0xF210	Mode of speed tracking	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	4	/	Real time
F2-17	0xF211	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	/	Real time
F2-20	0xF214	Positive speed enable	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
F2-21	0xF215	Negative speed enable	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
F2-22	0xF216	Digital setting of forward frequency upper limit 1	F2-26 to 800.0	800.0	%	Change at stop
F2-23	0xF217	Digital setting of reverse frequency upper limit 1	-800.0–F2-27	-800.0	%	Change at stop
F2-24	0xF218	Source of forward frequency upper limit 2	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change:
F2-25	0xF219	Source of reverse frequency upper limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	/	Real time
F2-26	0xF21A	Digital setting of forward frequency lower limit 1	0.0-F2-22	0.0	%	Change at stop
F2-27	0xF21B	Digital setting of reverse frequency lower limit 1	F2-23 to 0.0	0.0	%	Change at stop
F2-30	0xF21E	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
F2-31	0xF21F	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
F2-32	0xF220	Torque upper limit 2 selection	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
F2-33	0xF221	Source selection of torque lower limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	/	Real time
F2-36	0xF224	Overexcitation gain (V/f)	0 to 200	90	%	Real-time
F2-37	0xF225	Overcurrent suppression	0: Disable 1: Enable	1	/	Change at stop
F2-38	0xF226	Overcurrent suppression threshold	80 to 300	200	%	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change:
F2-39	0xF227	Overvoltage suppression	Bit0: V/F overvoltage suppression enable 0: Disable 1: Enable Bit1: Vector overvoltage suppression enable 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
F2-40	0xF228	Overvoltage suppression action voltage	600.0–A3-57	770.0	V	Real-time
F2-43	0xF22B	Undervoltage action selection	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	/	Real time
F2-44	0xF22C	Undervoltage suppression action voltage	A3-55 to 500.0	430.0	V	Real-time
F2-48	0xF230	Overmodulation coefficient	0.0 to 110.0	103.0	%	Real-time
F2-50	0xF232	Set carrier frequency	0.8 to 20.0	4.0	kHz	Real-time
F2-51	0xF233	Carrier frequency	0.8 to 20.0	4.0	kHz	Unchangeable

10.2.1.4 F3 Encoder parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F3-00	0xF300	Encoder type	0：None 1：ABZ incremental encoder 2：23-bit encoder 3：Rotary encoder 4：SSI encoder 5：Sin-cos encoder 6：EnDat encoder 7：BISS encoder	0	/	Change at stop
F3-02	0xF302	Encoder PPR	1 to 65535	1024	/	Change at stop
F3-03	0xF303	Phase sequence of encoder	0: Forward 1: Reverse	0	/	Change at stop
F3-04	0xF304	Encoder installation angle	0.0 to 359.9	0.0	°	At stop
F3-05	0xF305	Encoder speed measurement filter time constant	0.0000 to 6.0000	0.0040	s	Real-time
F3-13	0xF30D	Number of resolver pole pairs	1 to 65535	1	/	Change at stop
F3-18	0xF312	ABZ encoder level type	1：Derivative output 2：TTL complementary push-pull output 3：HTL complementary push-pull output 4：TTL single-ended push-pull output 5：HTL single-ended push-pull output 6：OC output	1	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F3-51	0xF333	Number of single-turn bits of communication-type encoder	1 to 32	23	/	Change at stop
F3-52	0xF334	Number of multi-turn bits of communication-type encoder	0 to 32	0	/	Change at stop

10.2.1.5 F4 I/O parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-00	0xF400	Terminal start/stop module selection	0: Module A 1: Module B Others: B connector	0	/	Change at stop
F4-01	0xF401	Mode of start/stop module A by terminal	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	/	Change at stop
F4-02	0xF402	Mode of start/stop module B by terminal	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-03	0xF403	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A Jog 1 (JOG1) 5: Terminal start/stop module A Jog 2 (JOG2) 6: Frequency UP adjustment 7: Frequency DOWN adjustment 8: Free stop 9: Fault reset (RESET) 10: Running pause (terminal control) 11: External fault NO input 12: Multi-segment value terminal 1 13: Multi-segment value terminal 2 14: Multi-segment value terminal 3 15: Multi-segment value terminal 4 16: Acceleration/Deceleration selection terminal 1 17: Acceleration/Deceleration selection terminal 2 19: UP/DOWN adjustment clearing 21: Acceleration/Deceleration disable 22: PID pause 23: Simple PLC state reset 24: Wobble pause 29: Torque control inhibition 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: Reverse PID action direction 36: External stop terminal 1 38: PID integral pause 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/torque control selection 47: Emergency stop 49: Decelerate DC braking 50: This running time is cleared 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced local control 67: Forced terminal control continues	1	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-03	0xF403	DI1 function selection	Continued on 68: Forced communication control 69: Forced custom control 70: Control channel selection 71: Set channel selection 72: Terminal start/stop module A/B selection 76: Motor selection terminal 2 77: Running enable (all modes) 78: Forward running allowed 79: Negative running allowed 80: The RFG input is set to zero	1	/	Change at stop
F4-04	0xF404	DI2 function	Same as F4-03	4	/	Change at stop
F4-05	0xF405	DI3 function	Same as F4-03	9	/	Change at stop
F4-06	0xF406	DI4 function	Same as F4-03	12	/	Change at stop
F4-07	0xF407	DI5 function	Same as F4-03	13	/	Change at stop
F4-08	0xF408	DI6 function	Same as F4-03	0	/	Change at stop
F4-09	0xF409	DI7 function	Same as F4-03	0	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-14	0xF40E	RO1 function selection	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload alarm 7: AC drive overload alarm 11: Simple PLC cycle completed 12: Cumulative running time reach 13: Wobble frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication (Address 0x7312) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 42: STO output 43: Output upon minor fault or alarm 44: AI2 input limit exceeded 46: Component life alarm output Others: B connector	2	/	Real time
F4-15	0xF40F	DO1 output function selection	See F4-14.	2	/	Real time
F4-16	0xF410	FMR (HDO) function selection	See F4-14.	0	/	Real time
F4-21	0xF415	AI1 fitter time	0.00 to +10.00	0.10	s	Real-time
F4-22	0xF416	AI2 filter time	0.00 to +10.00	0.10	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-27	0xF41B	AI curve	Ones: AI1 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Tens: AI2 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Hundreds: Reserved Thousands: Reserved	0x0021	-	Real-time
F4-28	0xF41C	Minimum input of AI curve 1	-10.00–F4-30	0.00	V	Real-time
F4-29	0xF41D	Percentage corresponding to minimum input of AI curve 1	-800.0 to 800.0	0.0	%	Real-time
F4-30	0xF41E	Maximum input of AI curve 1	F4-28 to 10.00	10.00	V	Real-time
F4-31	0xF41F	Percentage corresponding to the maximum input of AI curve 1	-800.0 to 800.0	100.0	%	Real-time
F4-32	0xF420	Minimum input of AI curve 2	-10.00–F4-34	0.00	V	Real-time
F4-33	0xF421	Percentage corresponding to the minimum input of AI curve 2	-800.0 to 800.0	0.0	%	Real-time
F4-34	0xF422	Maximum input of AI curve 2	F4-32 to 10.00	10.00	V	Real-time
F4-35	0xF423	Percentage corresponding to the maximum input of AI curve 2	-800.0 to 800.0	100.0	%	Real-time
F4-36	0xF424	Minimum input of AI curve 3	-10.00–F4-38	0.00	V	Real-time
F4-37	0xF425	Percentage corresponding to minimum input of AI curve 3	-800.0 to 800.0	0.0	%	Real-time
F4-38	0xF426	Maximum input of AI curve 3	F4-36 to 10.00	10.00	V	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-39	0xF427	Percentage corresponding to the maximum input of AI curve 3	-800.0 to 800.0	100.0	%	Real-time
F4-40	0xF428	Minimum input of AI curve 4	-10.00–F4-42	0.00	V	Real-time
F4-41	0xF429	Percentage corresponding to minimum input of AI curve 4	-800.0 to 800.0	0.0	%	Real-time
F4-42	0xF42A	Inflection point 1 input of AI curve 4	F4-40 to F4-44	3.00	V	Real-time
F4-43	0xF42B	Percentage corresponding to inflection point 1 input of AI curve 4	-800.0 to 800.0	30.0	%	Real-time
F4-44	0xF42C	Inflection point 2 input of AI curve 4	F4-42 to F4-46	6.00	V	Real-time
F4-45	0xF42D	Percentage corresponding to inflection 2 input of AI curve 4	-800.0 to 800.0	60.0	%	Real-time
F4-46	0xF42E	Maximum input of AI curve 4	F4-44 to 10.00	10.00	V	Real-time
F4-47	0xF42F	Percentage corresponding to maximum input of AI curve 4	-800.0 to 800.0	100.0	%	Real-time
F4-48	0xF430	Minimum input of AI curve 5	-10.00–F4-50	-10.00	V	Real-time
F4-49	0xF431	Percentage corresponding to minimum input of AI curve 5	-800.0 to 800.0	-100.0	%	Real-time
F4-50	0xF432	Inflection point 1 input of AI curve 5	F4-48 to F4-52	-3.00	V	Real-time
F4-51	0xF433	Percentage corresponding to inflection point 1 input of AI curve 5	-800.0 to 800.0	-30.0	%	Real-time
F4-52	0xF434	Inflection point 2 input of AI curve 5	F4-50 to F4-54	3.00	V	Real-time
F4-53	0xF435	Percentage corresponding to inflection 2 input of AI curve 5	-800.0 to 800.0	30.0	%	Real-time
F4-54	0xF436	Maximum input of AI curve 5	F4-52 to 10.00	10.00	V	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-55	0xF437	Percentage corresponding to the maximum input of AI curve 5	-800.0 to 800.0	100.0	%	Real-time
F4-59	0xF43B	AO1 function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (Address: 0x7313) 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 V) 16: Output torque (actual value) 19: Taper output 20: Roll diameter output 21: Tension output Others: F connector	0	/	Real time
F4-60	0xF43C	Minimum input of AO curve	-800.0–F4-62	0.0	%	Real-time
F4-61	0xF43D	Percentage corresponding to minimum input of AO curve	0.00 to +10.00	0.00	V	Real-time
F4-62	0xF43E	Maximum input of AO curve	F4-60 to 800.0	100.0	%	Real-time
F4-63	0xF43F	Percentage corresponding to the maximum input of AO curve	0.00 to +10.00	10.00	V	Real-time
F4-68	0xF444	HDI terminal type selection	0: HDI 1: DI	1	/	Change at stop
F4-69	0xF445	HDI input	0: Disable 1: Enable Others: B connector	0	/	Unchangeable
F4-70	0xF446	HDI curve setting	Ones position: HDI curve selection 0: Two-point curve 1: Four-point curve Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
F4-71	0xF447	Minimum input of two-point HDI curve	0.00 to F4-73	0.00	kHz	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-72	0xF448	Percentage corresponding to minimum input of two-point HDI curve	-800.0 to 800.0	0.0	%	Real-time
F4-73	0xF449	Maximum input of two-point HDI curve	F4-71 to 20.00	20.00	kHz	Real-time
F4-74	0xF44A	Percentage corresponding to maximum input of two-point HDI curve	-800.0 to 800.0	100.0	%	Real-time
F4-75	0xF44B	Minimum input of four-point HDI curve	0.00 to F4-77	0.00	kHz	Real-time
F4-76	0xF44C	Percentage corresponding to minimum input of four-point HDI curve	-800.0 to 800.0	-100.0	%	Real-time
F4-77	0xF44D	Inflection 1 input of HDI four-point curve	F4-75 to F4-79	5.00	kHz	Real-time
F4-78	0xF44E	Percentage corresponding to inflection point 1 input of four-point HDI curve	-800.0 to 800.0	-30.0	%	Real-time
F4-79	0xF44F	Inflection 2 input of HDI four-point curve	F4-77 to F4-81	10.00	kHz	Real-time
F4-80	0xF450	Percentage corresponding to inflection point 2 input of four-point HDI curve	-800.0 to 800.0	30.0	%	Real-time
F4-81	0xF451	Maximum input of four-point HDI curve	F4-79 to 20.00	20.00	kHz	Real-time
F4-82	0xF452	Percentage corresponding to maximum input of four-point HDI curve	-800.0 to 800.0	100.0	%	Real-time
F4-83	0xF453	HDI filter time	0.00 to +10.00	0.10	s	Real-time
F4-88	0xF458	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Digital output (FMR)	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F4-89	0xF459	HDO output function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (Address: 0x7315) 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 V) 16: Output torque (actual value) 19: Taper output 20: Roll diameter output 21: Tension output Others: F connector	0	/	Real time
F4-90	0xF45A	Minimum input of HDO curve	-100.0–F4-92	0.0	%	Real-time
F4-91	0xF45B	Percentage corresponding to minimum input of HDO curve	0.00 to 100.00	0.00	%	Real-time
F4-92	0xF45C	Maximum input of HDO curve	F4-90 to 100.0s	100.0	%	Real-time
F4-93	0xF45D	Percentage corresponding to the maximum input of HDO curve	0.00 to 100.00	100.00	%	Real-time
F4-97	0xF461	Maximum frequency of HDO output	0.01 to 100.00	50.00	kHz	Real-time

10.2.1.6 Fd Basic Communication Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Fd-00	0xFD00	Commissioning address (used by commissioning software/operating panel)	1 to 127	1	-	Change at stop
Fd-01	0xFD01	Communication type	1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	1	-	Change at stop
Fd-04	0xFD04	Modbus communication enable	0: Not supported by the current device 1: Effective	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Fd-05	0xFD05	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	Change at stop
Fd-06	0xFD06	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	0	-	Real-time
Fd-07	0xFD07	Modbus local address	1 to 247	1	-	Change at stop
Fd-08	0xFD08	Modbus response delay	0 to 20	2	ms	Real-time
Fd-09	0xFD09	Modbus communication timeout	0.0 to 6000.0	0.0	s	Real-time
Fd-13	0xFD0D	CAN communication enable	0: Not supported by the current device 1: Effective	0	-	Unchangeable
Fd-14	0xFD0E	CAN communication protocol selection	1: CANopen 2: CANlink	2	-	Real-time
Fd-15	0xFD0F	CANopen baud rate	0: 20kbps 1: 50kbps 2: 100kbps 3: 125kbps 4: 250kbps 5: 500kbps 6: 1Mbps	5	-	Change at stop
Fd-16	0xFD10	CANopen station number	1 to 127	1	-	Change at stop
Fd-20	0xFD14	CANlink baud rate	0: 20kbps 1: 50kbps 2: 100kbps 3: 125kbps 4: 250kbps 5: 500kbps 6: 1Mbps	5	-	Change at stop
Fd-21	0xFD15	CANlink station number	1 to 63	1	-	Change at stop
Fd-28	0xFD1C	Number of CAN frames received per unit time	0 to 65535	0	-	Unchangeable
Fd-29	0xFD1D	Maximum CAN reception error count	0 to 65535	0	-	Unchangeable
Fd-30	0xFD1E	Maximum CAN transmission error count	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Fd-31	0xFD1F	Number of CAN bus disconnections per unit time	0 to 65535	0	-	Unchangeable
Fd-32	0xFD20	CAN communication disconnection coefficient	1 to 15	3	-	Change at stop
Fd-39	0xFD27	EtherCAT station name	0 to 65535	0	-	Unchangeable
Fd-40	0xFD28	EtherCAT station alias	0 to 65535	0	-	Real-time
Fd-41	0xFD29	EtherCAT station alias backup	0 to 65535	0	-	Unchangeable
Fd-47	0xFD2F	MAC1 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x0070	-	Unchangeable
Fd-48	0xFD30	MAC2 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00CA	-	Unchangeable
Fd-49	0xFD31	MAC3 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x004D	-	Unchangeable
Fd-50	0xFD32	MAC4 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-51	0xFD33	MAC5 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-52	0xFD34	MAC6 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-58	0xFD3A	EtherNet/IP-DHCP	0: Disable 1: Enable	0	-	Change at stop
Fd-59	0xFD3B	Highest order byte of EtherNet/IP-IP address	0 to 255	0	-	Change at stop
Fd-60	0xFD3C	Second highest order byte of EtherNet/IP-IP address	0 to 255	0	-	Change at stop
Fd-61	0xFD3D	Third highest order byte of EtherNet/IP-IP address	0 to 255	0	-	Change at stop
Fd-62	0xFD3E	Lowest order byte of EtherNet/IP-IP address	0 to 255	0	-	Change at stop
Fd-63	0xFD3F	EtherNet/IP - highest order byte of subnet mask	0 to 255	0	-	Change at stop
Fd-64	0xFD40	EtherNet/IP - second highest order byte of subnet mask	0 to 255	0	-	Change at stop
Fd-65	0xFD41	EtherNet/IP - third highest order byte of subnet mask	0 to 255	0	-	Change at stop
Fd-66	0xFD42	EtherNet/IP - lowest order byte of subnet mask	0 to 255	0	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Fd-67	0xFD43	EtherNet/IP - highest order byte of gateway	0 to 255	0	-	Change at stop
Fd-68	0xFD44	EtherNet/IP - second highest order byte of gateway	0 to 255	0	-	Change at stop
Fd-69	0xFD45	EtherNet/IP - third highest order byte of gateway	0 to 255	0	-	Change at stop
Fd-70	0xFD46	EtherNet/IP - lowest order byte of gateway	0 to 255	0	-	Change at stop
Fd-76	0xFD4C	PROFINET - highest order byte of IP address	0 to 65535	0	-	Unchangeable
Fd-77	0xFD4D	PROFINET - second highest order byte of IP address	0 to 65535	0	-	Unchangeable
Fd-78	0xFD4E	PROFINET - third highest order byte of IP address	0 to 65535	0	-	Unchangeable
Fd-79	0xFD4F	PROFINET - lowest order byte of IP address	0 to 65535	0	-	Unchangeable
Fd-80	0xFD50	PROFINET - highest order byte of subnet mask	0 to 65535	0	-	Unchangeable
Fd-81	0xFD51	PROFINET - second highest order byte of subnet mask	0 to 65535	0	-	Unchangeable
Fd-82	0xFD52	PROFINET - third highest order byte of subnet mask	0 to 65535	0	-	Unchangeable
Fd-83	0xFD53	PROFINET - lowest order byte of subnet mask	0 to 65535	0	-	Unchangeable
Fd-84	0xFD54	PROFINET - highest order byte of gateway	0 to 65535	0	-	Unchangeable
Fd-85	0xFD55	PROFINET - second highest order byte of gateway	0 to 65535	0	-	Unchangeable
Fd-86	0xFD56	PROFINET - third highest order byte of gateway	0 to 65535	0	-	Unchangeable
Fd-87	0xFD57	PROFINET - lowest order byte of gateway	0 to 65535	0	-	Unchangeable

10.2.2 Group A System

10.2.2.1 A0 Parameter Management

Parameter code	Communication address	Parameter name	Range	Default Value	Unit	Change mode
A0-00	0xA000	Parameter initialization	0: No action 1: Restore parameters (excluding motor parameters) to factory settings 2: Clear records 3: Restore parameters (including motor parameters) to factory settings 4: Back up current user parameters 5: Clear fault information 501: Restore user parameters from backup 503: Restore parameters (including motor parameters) to factory settings and clear records	0	-	At stop
A0-10	0xA00A	System parameter access level	0: Standard 1: Expansion 2: Expert 3: Factory	0	-	Unchangeable
A0-11	0xA00B	Parameter access level setting	0: Standard 1: Expansion 2: Expert	0	-	Real time
A0-14	0xA00E	Expert password status	0: Invalid expert password (no expert password) 1: Expert password locked (Expert password is set but locked.) 2: Expert password unlocked (The expert password is set and unlocked.)	0	-	Unchangeable
A0-15	0xA00F	Expert password input	0 to 65535	0	-	Real time
A0-20	0xA014	Status display of the factory password	1: Factory password locked 2: Factory password unlocked	0	-	Unchangeable
A0-21	0xA015	Factory password input	0 to 65535	0	-	Real time
A0-22	0xA016	Exit manufacturer level	0: No operation 1: Exit	0	-	Real time
A0-30	0xA01E	Parameter lock status	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	0	-	Unchangeable
A0-31	0xA01F	Parameter lock setting	0 to 65535	0	-	Real time
A0-32	0xA020	Unlock effective time of parameter lock	60 to 65535	3600	s	Real time
A0-33	0xA021	Lock parameter lock	0: No operation 1: Lock	0	-	Real time
A0-37	0xA025	Clear backed-up parameter	0: No action 500: Clear all backed-up user parameters	0	-	At stop

Parameter code	Communication address	Parameter name	Range	Default Value	Unit	Change mode
A0-38	0xA026	Backed-up parameter restoration	0: No action 500: Restore user backed-up parameters	0	-	At stop
A0-39	0xA027	User backup	0: No action 400: Back up user parameters	0	-	At stop
A0-44	0xA02C	Parameter write protection	0: Disable 1: Enable	0	-	Real time
A0-47	0xA02F	Parameter group display on operating panel	Bit 0: Group F Bit 1: Group A Bit 2: Group b Bit 3: Group C Bit 4: Group d Bit 5: Group y Bit 6: Group E Bit 7: Group H Bit 8: Reserved Bit 9: Group n Bit 10: Group o Bit 11: Group P Bit 12: Group L Bit 13: Group U Bit 14 to bit 15: Reserved Bit value 0: Hide 1: Display	0xFFFF	/	Real time

Parameter code	Communication address	Parameter name	Range	Default Value	Unit	Change mode
A0-48	0xA030	Interface macro selection	0: No action 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	At stop

Parameter code	Communication address	Parameter name	Range	Default Value	Unit	Change mode
A0-49	0xA031	Effective value of the interface macro	0: Not set 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	Unchangeable
A0-50	0xA032	Industry macro selection	0: No action 201: Regular wind turbine (valid only for MD630S) 202: Regular water pump (valid only for MD630S) 203: Packaging industry 204: Ceramic industry (valid only for MD630S)	0	-	At stop
A0-51	0xA033	Effective value of industry macro	0: Not set 201: Regular wind turbine (valid only for MD630S) 202: Regular water pump (valid only for MD630S) 203: Packaging industry 204: Ceramic industry (valid only for MD630S)	0	-	Unchangeable
A0-70	0xA046	Frequency decimal place	1: One decimal place 2: Two decimal places	2	-	At stop

Parameter code	Communication address	Parameter name	Range	Default Value	Unit	Change mode
A0-71	0xA047	Number of decimal places for load speed display (group U0)	Ones place: Number of decimal places of U0-14/U0-24 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places Tens place: Number of decimal places of U0-19/U0-29 1: 1 decimal place 2: 2 decimal places Hundreds place: Number of decimal places of U0-30/U0-31 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places Thousands place: Number of decimal places of U0-69 1: 1 decimal place 2: 2 decimal places Ten thousands place: Reserved	2220	-	Real time
A0-72	0xA048	Individualized parameter display	Ones place: User mode 0: Hidden 1: Displayed Tens place: Correction mode 0: Hidden 1: Displayed Hundreds place: Error menu 0: Hidden 1: Displayed Thousands place: Reserved Ten Thousands place: Reserved	111	-	Real time

10.2.2.2 A1: Active fault and alarm

Item	Address:	Name	Value Range	Default	Unit	Change:
A1-00	0xA100	Current fault 1	0.0 to 6553.5	0.0	/	Unchangeable
A1-02	0xA102	Active fault 2	0.0 to 6553.5	0.0	/	Unchangeable
A1-04	0xA104	Active fault 3	0.0 to 6553.5	0.0	/	Unchangeable
A1-06	0xA106	Active fault 4	0.0 to 6553.5	0.0	/	Unchangeable
A1-08	0xA108	Active fault 5	0.0 to 6553.5	0.0	/	Unchangeable
A1-10	0xA10A	Active fault 6	0.0 to 6553.5	0.0	/	Unchangeable
A1-12	0xA10C	Current minor fault 1	0.0 to 6553.5	0.0	/	Unchangeable
A1-14	0xA10E	Current minor fault 2	0.0 to 6553.5	0.0	/	Unchangeable
A1-16	0xA110	Current minor fault 3	0.0 to 6553.5	0.0	/	Unchangeable
A1-18	0xA112	Current minor fault 4	0.0 to 6553.5	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
A1-20	0xA114	Current minor fault 5	0.0 to 6553.5	0.0	/	Unchangeable
A1-22	0xA116	Current minor fault 6	0.0 to 6553.5	0.0	/	Unchangeable
A1-24	0xA118	Current warning 1	0.0 to 6553.5	0.0	/	Unchangeable
A1-26	0xA11A	Active alarm 2	0.0 to 6553.5	0.0	/	Unchangeable
A1-28	0xA11C	Active alarm 3	0.0 to 6553.5	0.0	/	Unchangeable
A1-30	0xA11E	Active alarm 4	0.0 to 6553.5	0.0	/	Unchangeable
A1-32	0xA120	Active alarm 5	0.0 to 6553.5	0.0	/	Unchangeable
A1-34	0xA122	Active alarm 6	0.0 to 6553.5	0.0	/	Unchangeable
A1-36	0xA124	Current prompt 1	0.0 to 6553.5	0.0	/	Unchangeable
A1-38	0xA126	Current prompt 2	0.0 to 6553.5	0.0	/	Unchangeable
A1-40	0xA128	Current prompt 3	0.0 to 6553.5	0.0	/	Unchangeable
A1-42	0xA12A	Current prompt 4	0.0 to 6553.5	0.0	/	Unchangeable
A1-44	0xA12C	Current prompt 5	0.0 to 6553.5	0.0	/	Unchangeable
A1-46	0xA12E	Current prompt 6	0.0 to 6553.5	0.0	/	Unchangeable

10.2.2.3 AF SN code

Parameter	Address	Parameter Name	Range	Default Value	Unit	Change Mode
AF-00	0xAF00	SN code serial number 1	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-01	0xAF01	SN code serial number 2	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-02	0xAF02	SN code serial number 3	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-03	0xAF03	SN code serial number 4	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-04	0xAF04	SN code serial number 5	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-05	0xAF05	SN code serial number 6	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-06	0xAF06	SN code serial number 7	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-07	0xAF07	SN code serial number 8	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-08	0xAF08	SN code serial number 9	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-09	0xAF09	SN code serial number 10	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-10	0xAF0A	SN code serial number 11	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-11	0xAF0B	SN code serial number 12	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-12	0xAF0C	SN code serial number 13	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-13	0xAF0D	SN code serial number 14	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-14	0xAF0E	SN code serial number 15	0x0 to 0xFFFF	0x0	-	Unchangeable

Parameter	Address	Parameter Name	Range	Default Value	Unit	Change Mode
AF-15	0xAF0F	SN code serial number 16	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-16	0xAF10	SN code serial number 17	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-17	0xAF11	SN code serial number 18	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-18	0xAF12	SN code serial number 19	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-19	0xAF13	SN code serial number 20	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-20	0xAF14	SN code serial number 21	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-21	0xAF15	SN code serial number 22	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-22	0xAF16	SN code serial number 23	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-23	0xAF17	SN code serial number 24	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-24	0xAF18	SN code serial number 25	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-25	0xAF19	SN code serial number 26	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-26	0xAF1A	SN code serial number 27	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-27	0xAF1B	SN code serial number 28	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-28	0xAF1C	SN code serial number 29	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-29	0xAF1D	SN code serial number 30	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-30	0xAF1E	SN code serial number 31	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-31	0xAF1F	SN code serial number 32	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-32	0xAF20	SN code serial number 33	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-33	0xAF21	SN code serial number 34	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-34	0xAF22	SN code serial number 35	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-35	0xAF23	SN code serial number 36	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-36	0xAF24	SN code serial number 37	0x0 to 0xFFFF	0x0	-	Unchangeable

Parameter	Address	Parameter Name	Range	Default Value	Unit	Change Mode
AF-37	0xAF25	SN code serial number 38	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-38	0xAF26	SN code serial number 39	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-39	0xAF27	SN code serial number 40	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-40	0xAF28	SN code serial number 41	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-41	0xAF29	SN code serial number 42	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-42	0xAF2A	SN code serial number 43	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-43	0xAF2B	SN code serial number 44	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-44	0xAF2C	SN code serial number 45	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-45	0xAF2D	SN code serial number 46	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-46	0xAF2E	SN code serial number 47	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-47	0xAF2F	SN code serial number 48	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-48	0xAF30	SN code serial number 49	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-49	0xAF31	SN code serial number 50	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-50	0xAF32	SN code serial number 51	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-51	0xAF33	SN code serial number 52	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-52	0xAF34	SN code serial number 53	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-53	0xAF35	SN code serial number 54	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-54	0xAF36	SN code serial number 55	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-55	0xAF37	SN code serial number 56	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-56	0xAF38	SN code serial number 57	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-57	0xAF39	SN code serial number 58	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-58	0xAF3A	SN code serial number 59	0x0 to 0xFFFF	0x0	-	Unchangeable

Parameter	Address	Parameter Name	Range	Default Value	Unit	Change Mode
AF-59	0xAF3B	SN code serial number 60	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-60	0xAF3C	SN code serial number 61	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-61	0xAF3D	SN code serial number 62	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-62	0xAF3E	SN code serial number 63	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-63	0xAF3F	SN code serial number 64	0x0 to 0xFFFF	0x0	-	Unchangeable

10.2.2.4 A2: System Information

Item	Address:	Name	Value Range	Default	Unit	Change:
A2-00	0xA200	Base value of per-unit voltage	0.0 to 6553.5	0.0	V	Unchangeable
A2-01	0xA201	Per-unit base value of current	0.0 to 6553.5	0.0	A	Unchangeable
A2-02	0xA202	Per-unit base value of speed	0 to 65535	0	RPM	Unchangeable
A2-04	0xA204	Per-unit base value of frequency	0.0 to 6553.5	0.0	Hz	Unchangeable
A2-05	0xA205	Per-unit base value of power	0.0 to 655.35	0.00	kW	Unchangeable
A2-06	0xA206	Per-unit base value of torque	0.0 to 655.35	0.00	N·m	Unchangeable
A2-09	0xA209	Per-unit base value of DC voltage	0 to 65535	0	V	Unchangeable
A2-16	0xA210	Maximum output frequency of the system	0.0 to 6553.5	599.0	Hz	Unchangeable
A2-17	0xA211	Effective maximum motor frequency	0.0 to 655.35	50.00	Hz	Unchangeable
A2-18	0xA212	Maximum effective frequency of the motor (fixed decimal place)	0.0 to 6553.5	50.0	Hz	Unchangeable
A2-20	0xA214	Product code	0: Reserved (MD630)	0	/	Unchangeable
A2-21	0xA215	Device type	0：MD630S (485 standard version) 1：MD630S (485 standard version + STO) 2：Reserved 3：MD630N (bus version) 4：MD630N (bus version + STO) 5：MD630S (CAN standard version) 6：MD630S (CAN standard version + STO)	0	/	Unchangeable
A2-22	0xA216	Performance software version	0.0 to 655.35	0.00	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
A2-23	0xA217	Function software version	0.0 to 655.35	0.00	/	Unchangeable
A2-24	0xA218	Performance software sub-version	0.0 to 655.35	0.00	/	Unchangeable
A2-25	0xA219	Function sub-version	0.0 to 655.35	0.00	/	Unchangeable
A2-45	0xA22D	Bus software (auxiliary integrated circuit) version	0 to 65535	0	/	Unchangeable
A2-62	0xA23E	Type of expansion card 1	0 to 65535	0	/	Unchangeable
A2-63	0xA23F	Expansion card 1 version	0.0 to 655.35	0.00	/	Unchangeable
A2-64	0xA240	Type of expansion card 2	0 to 65535	0	/	Unchangeable
A2-65	0xA241	Version of expansion card 2	0.0 to 655.35	0.00	/	Unchangeable
A2-68	0xA244	PG card type	0: No expansion card 32: Digital PG card 33: Analog PG card	0	/	Unchangeable
A2-69	0xA245	Main version of PG card	0.0 to 655.35	0.00	/	Unchangeable
A2-90	0xA25A	VRC version parameter 1	0.00 to 65535.00	0.00	/	Unchangeable
A2-91	0xA25B	VRC version parameter 2	0.00 to 65535.00	0.00	/	Unchangeable
A2-92	0xA25C	VRC version parameter 3	0.00 to 65535.00	0.00	/	Unchangeable
A2-93	0xA25D	VRC version parameter 4	0.00 to 65535.00	0.00	/	Unchangeable

10.2.2.5 A3: Model Information

Item	Address:	Name	Value Range	Default	Unit	Change:
A3-01	0xA301	Load type	0: Heavy load application 1: Light load application	0	/	Change at stop
A3-02	0xA302	Rated AC drive power	0.0 to 655.35	4.00	kW	Unchangeable
A3-03	0xA303	AC drive rated current	0.0 to 6553.5	9.0	A	Unchangeable
A3-04	0xA304	Rated AC drive voltage	0 to 65535	380	V	Unchangeable
A3-05	0xA305	Maximum AC drive current	0 to 600	150	%	Real-time
A3-30	0xA31E	AC drive transistor voltage drop	0.00 to 5.00	0.80	V	Real-time
A3-31	0xA31F	Dead zone curve current 1	0.0 to 150.0	1.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
A3-32	0xA320	Dead zone curve current 2	0.0 to 150.0	2.0	%	Real-time
A3-33	0xA321	Dead zone curve current 3	0.0 to 150.0	5.0	%	Real-time
A3-34	0xA322	Dead zone curve current 4	0.0 to 150.0	10.0	%	Real-time
A3-35	0xA323	Dead zone curve current 5	0.0 to 150.0	20.0	%	Real-time
A3-36	0xA324	Dead zone curve current 6	0.0 to 150.0	40.0	%	Real-time
A3-37	0xA325	Dead zone curve current 7	0.0 to 150.0	60.0	%	Real-time
A3-38	0xA326	Dead zone curve current 8	0.0 to 150.0	80.0	%	Real-time
A3-39	0xA327	Dead zone curve time 1	0.0 to 300.0	10.0	%	Real-time
A3-40	0xA328	Dead zone curve time 2	0.0 to 300.0	20.0	%	Real-time
A3-41	0xA329	Dead zone curve time 3	0.0 to 300.0	50.0	%	Real-time
A3-42	0xA32A	Dead zone curve time 4	0.0 to 300.0	80.0	%	Real-time
A3-43	0xA32B	Dead zone curve time 5	0.0 to 300.0	90.0	%	Real-time
A3-44	0xA32C	Dead zone curve time 6	0.0 to 300.0	90.0	%	Real-time
A3-45	0xA32D	Dead zone curve time 7	0.0 to 300.0	90.0	%	Real-time
A3-46	0xA32E	Dead zone curve time 8	0.0 to 300.0	90.0	%	Real-time
A3-51	0xA333	Module overtemperature threshold	0 to 65535	0	°C	Unchangeable
A3-52	0xA334	Module pre-overtemperature margin	0.0 to 60.0	5.0	°C	Real time
A3-53	0xA335	AC drive pre-overload threshold	0.0 to 100.0	90.0	%	Real-time
A3-54	0xA336	Custom software overcurrent threshold	0.0 to 600.0	300.0	%	Real-time
A3-55	0xA337	Undervoltage threshold	300.0 to 440.0	350.0	V	Real-time
A3-56	0xA338	Valid undervoltage threshold	300.0 to 440.0	350.0	V	Unchangeable
A3-57	0xA339	Overvoltage threshold	650.0 to 820.0	820.0	V	Real-time
A3-58	0xA33A	Valid overvoltage threshold	650.0 to 820.0	820.0	V	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
A3-59	0xA33B	AC drive protection command word	Bit 0: Output phase loss detection 0: Disable 1: Enable Bit 1: Input phase loss detection (software) 0: Disable 1: Enable Bit 2: Disable derating at low frequency 0: Enable derating 1: Disable derating Bit 3: Overvoltage report at stop 0: Enable 1: Disable Bit 4: Zero drift fault 0: Disable 1: Enable Bit 5: Bus voltage acquisition analysis 0: Disable 1: Enable Bit 6: Software overcurrent 0: Disable 1: Enable Bit 7: CBC 0: Disable 1: Enable	0x0392	-	Real-time
A3-67	0xA343	Automatic reset of undervoltage fault	0：Enable 1：Disable	0	/	Real time

10.2.2.6 A4: Hardware Configuration

Item	Address:	Name	Value Range	Default	Unit	Change:
A4-00	0xA400	Braking unit action voltage	600.0 to 820.0	760.0	V	Change at stop
A4-01	0xA401	Active braking unit action voltage	600.0 to 820.0	760.0	V	Unchangeable
A4-02	0xA402	Braking duty cycle	0 to 100	100	%	Real-time
A4-17	0xA411	Fan direction	0: Default 1: Opposite to the set direction	0	/	Real time

10.2.2.7 A5: Carrier Frequency and Pulsing Configuration

Item	Address:	Name	Value Range	Default	Unit	Change:
A5-00	0xA500	Max. carrier frequency	0.0 to 24.0	16.0	kHz	Unchangeable
A5-01	0xA501	Set carrier frequency	0.8 to 20.0	4.0	kHz	Real-time
A5-02	0xA502	Carrier frequency	0.8 to 20.0	4.0	kHz	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
A5-03	0xA503	DPWM switchover frequency	5.0 to 6000.0	2000.0	Hz	Real-time
A5-04	0xA504	Dead-zone compensation mode	0: No compensation 1: Compensation mode 1	1	/	Real time
A5-05	0xA505	Cut-off frequency for dead zone compensation	0.0 to 6000.0	2000.0	Hz	Real-time
A5-06	0xA506	Overmodulation coefficient	0.0 to 110.0	103.0	%	Real-time
A5-09	0xA509	Hysteresis for adjusting carrier frequency with sync frequency	0.0 to 100.0	3.0	Hz	Real-time
A5-10	0xA50A	Start frequency for adjusting carrier frequency with sync frequency	0.0 to 600.0	5.0	Hz	Real-time
A5-11	0xA50B	Random PWM depth	0 to 10	0	/	Real time
A5-12	0xA50C	Carrier frequency upper limit at low speed (V/f)	0.8 to 20.0	20.0	kHz	Real-time
A5-13	0xA50D	Carrier frequency upper limit at low speed (SVC)	0.8 to 20.0	2.0	kHz	Real-time

10.2.2.8 A6: Operating Panel and Display

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-01	0xA601	STOP/RESET key function	0: Valid only in operating panel control mode 1: Valid for ON_OFF1 (start/stop) command 2: Valid for OFF2 (coast to stop) command 3: Valid for OFF3 (quick stop)	1	-	Real-time change
A6-03	0xA603	Parameter 1 displayed on LED operating panel during operation	Bit 0: Running frequency (Hz) Bit 1: Set frequency (Hz) Bit 2: Bus voltage (V) Bit 3: Output voltage (V) Bit 4: Output current (A) Bit 5: Output power (kW) Bit 6: Output torque (%) Bit 7: DI input status Bit 8: DO output status Bit 9: AI1 voltage (V) Bit 10: AI2 voltage (V) Bit 11 to Bit 13: Reserved Bit 14: Load speed Bit 15: PID setting Value of bit: 0: Hidden 1: Displayed	0x001F	-	Real-time change

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-04	0xA604	Parameter 2 displayed on LED operating panel during operation	Bit 0: PID feedback Bit 1: PLC stage Bit 2: HDI input pulse frequency (kHz) (valid only for MD630S) Bit 3: Running frequency 2 (Hz) Bit 4: Remaining running time Bit 5: AI1 voltage before correction (V) Bit 6: Free mapping 0 Bit 7: Free mapping 1 Bit 8: Motor speed Bit 9: Current power-on time (Min) Bit 10: Current running time (Min) Bit 11: Reserved Bit 12: Communication setpoint Bit 13: Encoder feedback speed Bit 14: Main frequency X display Bit 15: Auxiliary frequency Y display Value of bit: 0: Hidden 1: Displayed	0x0	-	Real-time change
A6-05	0xA605	Parameter displayed on LED operating panel at stop	Bit 0: Set frequency (Hz) Bit 1: Bus voltage (V) Bit 2: DI input status Bit 3: DO output status Bit 4: AI1 voltage (V) Bit 5: AI2 voltage (V) Bit 6 to Bit 8: Reserved Bit 9: PLC stage Bit 10: Reserved Bit 11: PID setting Bit 12: HDI input pulse frequency (kHz) (valid only for MD630S) Bit 13: Reserved Bit 14: Free mapping 0 Bit 15: Free mapping 1 Value of bit: 0: Hidden 1: Displayed	0x0033	-	Real-time change
A6-07	0xA607	Address displayed by free mapping 0	0: Invalid address Others: K connector	0	-	Real-time change

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-08	0xA608	Format displayed by free mapping 0	Ones: Unit 0: None 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW 10: kWh 11: ℃ Tens: Number of decimal places 0: 0 1: 1 2: 2 3: 3 4: 4 Hundreds: Settings of the ones and tens places 0: Invalid 1: Valid Thousands: Reserved	0x0	-	Real-time change
A6-09	0xA609	Address displayed by free mapping 1	0: Invalid address Others: K connector	0	-	Real-time change
A6-10	0xA60A	Format displayed by free mapping 1	Ones: Unit 0: None 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW 10: kWh 11: ℃ Tens: Number of decimal places 0: 0 1: 1 2: 2 3: 3 4: 4 Hundreds: Settings of the ones and tens places 0: Invalid 1: Valid Thousands: Reserved	0x0	-	Real-time change
A6-15	0xA60F	Number of decimal places of floating connector	0: Two decimal places 1: One decimal place	1	-	Real-time change

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-16	0xA610	LED operating panel direction display	Ones: Direction display at stop 0: Not displayed 1: Displayed Tens: Running direction determination base 0: Output frequency 1: Feedback frequency Hundreds to ten thousands position: Reserved	1	-	Real-time change
A6-17	0xA611	LED display of update cycle	0 to 300	10	ms	Real-time change
A6-18	0xA612	LED error pop-up time	1 to 60	10	s	Real-time change
A6-28	0xA61C	Saving parameters displayed during operation of LED operating panel	0 to 65535	0	-	Unchangeable
A6-29	0xA61D	Parameter displayed on the LED operating panel at stop	0 to 65535	0	-	Unchangeable
A6-34	0xA622	SOP-20 communication control timeout time	0.00 to 655.35	0.50	s	Real-time change
A6-35	0xA623	Commissioning software communication control timeout time	0.1 to 130.0	3.0	s	Real-time change
A6-45	0xA62D	Commissioning software activation	0: Disabled 1: Enabled	1	-	Change at stop

10.2.2.9 Ab Function commissioning

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
Ab-94	0xAB5E	Motor frequency/speed filter time	0 to 10000	128	ms	Real-time
Ab-95	0xAB5F	Output voltage filter time	0 to 10000	256	ms	Real-time
Ab-96	0xAB60	Output current filter time	0 to 10000	128	ms	Real-time
Ab-97	0xAB61	Output power filter time	0 to 10000	128	ms	Real-time
Ab-98	0xAB62	Output torque filter time	0 to 10000	128	ms	Real-time

10.2.2.10 Ad: Counting Function

Item	Address:	Name	Value Range	Default	Unit	Change:
Ad-00	0xAD00	Cumulative running time (h)	0 to 65535	0	h	Unchangeable
Ad-01	0xAD01	Cumulative running time (s)	0 to 3599	0	s	Unchangeable
Ad-02	0xAD02	Cumulative power-on time (h)	0 to 65535	0	h	Unchangeable
Ad-03	0xAD03	Accumulative power-on time (s)	0 to 3599	0	s	Unchangeable
Ad-04	0xAD04	Cumulative power consumption	0 to 65535	0	kWh	Unchangeable
Ad-05	0xAD05	Auxiliary calculation 1 of cumulative power consumption	0 to 65535	0	/	This is not modifiable.
Ad-06	0xAD06	Auxiliary calculation 2 of cumulative power consumption	0 to 65535	0	/	This is not modifiable.
Ad-07	0xAD07	Cumulative power consumption k	0.0 to 6553.5	0.0	kWh	Unchangeable
Ad-08	0xAD08	Cumulative power consumption M	0 to 65535	0	MWh	This is not modifiable.
Ad-09	0xAD09	Cumulative energy auxiliary calculation 1	0 to 65535	0	/	This is not modifiable.
Ad-10	0xAD0A	Cumulative energy auxiliary calculation 2	0 to 65535	0	/	This is not modifiable.
Ad-11	0xAD0B	Cumulative saved energy (kWh)	0.0 to 999.9	0.0	kWh	Unchangeable
Ad-12	0xAD0C	Cumulative saved energy (MWh)	0 to 999	0	MWh	This is not modifiable.
Ad-13	0xAD0D	Cumulative saved energy (GWh)	0 to 65535	0	GWh	Unchangeable
Ad-14	0xAD0E	Cumulative amount of savings	0.0 to 999.9	0.0	/	This is not modifiable.
Ad-15	0xAD0F	Cumulative amount of savings (K)	0 to 65535	0	/	This is not modifiable.
Ad-16	0xAD10	Cumulative CO2 emission reduction (ton)	0.0 to 999.9	0.0	/	This is not modifiable.
Ad-17	0xAD11	Cumulative CO2 emission reduction (kiloton)	0 to 65535	0	/	This is not modifiable.
Ad-18	0xAD12	Energy tax rate 1	0.0 to 6553.5	0.0	/	Change at stop
Ad-19	0xAD13	Energy tax rate 2	0.0 to 6553.5	0.0	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
Ad-20	0xAD14	Tax rate selection	0: Energy tax rate 1 1: Energy tax rate 2	0	/	Change at stop
Ad-21	0xAD15	Currency unit	0: RMB 1: EUR 2: USD	0	/	Change at stop
Ad-22	0xAD16	CO2 conversion factor	0.000 to 65.535	0.000	/	Change at stop
Ad-23	0xAD17	Reference power	0.0 to 6553.5	0.0	kW	At stop:
Ad-24	0xAD18	Reset of cumulative energy calculation	0: Disable 1: Enable	0	/	Change at stop
Ad-50	0xAD32	Main circuit capacitor lifetime alarm threshold	0.00 to 30.00	10.00	%	Real-time
Ad-59	0xAD3B	Predicted lifetime margin of IGBT	0.00 to 100.00	100.00	%	Unchangeable
Ad-62	0xAD3E	IGBT lifetime alarm threshold	0.00 to 30.00	10.00	%	Real-time
Ad-64	0xAD40	Remaining operating time of the fan predicted in real time (x 10 h)	0 to 65535	0	/	This is not modifiable.
Ad-65	0xAD41	Displays the predicted lifetime margin of the fan.	0.00 to 100.00	100.00	%	Unchangeable

10.2.2.11 AE: User-Defined Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
AE-00	0x2F00	User-defined parameter 0	0x0 to 0xFFFF	0x0	-	Real-time
AE-01	0x2F01	User-defined parameter 1	0x0 to 0xFFFF	0x0	-	Real-time
AE-02	0x2F02	User-defined parameter 2	0x0 to 0xFFFF	0x0	-	Real-time
AE-03	0x2F03	User-defined parameter 3	0x0 to 0xFFFF	0x0	-	Real-time
AE-04	0x2F04	User-defined parameter 4	0x0 to 0xFFFF	0x0	-	Real-time
AE-05	0x2F05	User-defined parameter 5	0x0 to 0xFFFF	0x0	-	Real-time
AE-06	0x2F06	User-defined parameter 6	0x0 to 0xFFFF	0x0	-	Real-time
AE-07	0x2F07	User-defined parameter 7	0x0 to 0xFFFF	0x0	-	Real-time
AE-08	0x2F08	User-defined parameter 8	0x0 to 0xFFFF	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
AE-09	0x2F09	User-defined parameter 9	0x0 to 0xFFFF	0x0	-	Real-time
AE-10	0x2F0A	User-defined parameter 10	0x0 to 0xFFFF	0x0	-	Real-time
AE-11	0x2F0B	User-defined parameter 11	0x0 to 0xFFFF	0x0	-	Real-time
AE-12	0x2F0C	User-defined parameter 12	0x0 to 0xFFFF	0x0	-	Real-time
AE-13	0x2F0D	User-defined parameter 13	0x0 to 0xFFFF	0x0	-	Real-time
AE-14	0x2F0E	User-defined parameter 14	0x0 to 0xFFFF	0x0	-	Real-time
AE-15	0x2F0F	User-defined parameter 15	0x0 to 0xFFFF	0x0	-	Real-time
AE-16	0x2F10	User-defined parameter 16	0x0 to 0xFFFF	0x0	-	Real-time
AE-17	0x2F11	User-defined parameter 17	0x0 to 0xFFFF	0x0	-	Real-time
AE-18	0x2F12	User-defined parameter 18	0x0 to 0xFFFF	0x0	-	Real-time
AE-19	0x2F13	User-defined parameter 19	0x0 to 0xFFFF	0x0	-	Real-time
AE-20	0x2F14	User-defined parameter 20	0x0 to 0xFFFF	0x0	-	Real-time
AE-21	0x2F15	User-defined parameter 21	0x0 to 0xFFFF	0x0	-	Real-time
AE-22	0x2F16	User-defined parameter 22	0x0 to 0xFFFF	0x0	-	Real-time
AE-23	0x2F17	User-defined parameter 23	0x0 to 0xFFFF	0x0	-	Real-time
AE-24	0x2F18	User-defined parameter 24	0x0 to 0xFFFF	0x0	-	Real-time
AE-25	0x2F19	User-defined parameter 25	0x0 to 0xFFFF	0x0	-	Real-time
AE-26	0x2F1A	User-defined parameter 26	0x0 to 0xFFFF	0x0	-	Real-time
AE-27	0x2F1B	User-defined parameter 27	0x0 to 0xFFFF	0x0	-	Real-time
AE-28	0x2F1C	User-defined parameter 28	0x0 to 0xFFFF	0x0	-	Real-time
AE-29	0x2F1D	User-defined parameter 29	0x0 to 0xFFFF	0x0	-	Real-time
AE-30	0x2F1E	User-defined parameter 30	0x0 to 0xFFFF	0x0	-	Real-time
AE-31	0x2F1F	User-defined parameter 31	0x0 to 0xFFFF	0x0	-	Real-time

10.2.3 Group b Reference Channel

10.2.3.1 b0: Instruction Channel Configuration

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b0-00	0xB000	Motor parameter group selection 1	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Change at stop
b0-01	0xB001	Motor parameter group selection 2	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Change at stop
b0-02	0xB002	Control channel	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Change at stop
b0-03	0xB003	Reference channel selection	0: Reference channel 1 1: Reference channel 2 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Change at stop

10.2.3.2 b1 Main Command of Control Channel 1

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b1-00	0xB100	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	Change at stop
b1-01	0xB101	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
b1-02	0xB102	User-defined OFF2 (coast to stop) source 1	0: Active 0: Inactive 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	1	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b1-03	0xB103	User-defined OFF3 (quick stop) source 1	Same as b1-02	1	-	Real-time
b1-04	0xB104	Self-defined running permission command source	0: Running not allowed 1: Running allowed 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	1	-	Real-time
b1-05	0xB105	Self-defined fault reset command source 1	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
b1-06	0xB106	User-defined JOG1 (jogging) source	Same as b1-01	0	-	Real-time
b1-07	0xB107	User-defined JOG2 (jogging) source	Same as b1-01	0	-	Real-time
b1-08	0xB108	Self-defined speed inversion source	Same as b1-05	0	-	Real-time
b1-09	0xB109	Jog/ON_OFF1 priority mode selection	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	0	-	Real-time

10.2.3.3 b2 Control Channel 1 Auxiliary Command

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
b2-00	0xB200	OFF2 (coast to stop) source 2	0: Active 0: Inactive 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	1	-	Real-time
b2-01	0xB201	OFF2 (coast to stop) source 3	Same as b2-00	1	-	Real-time
b2-02	0xB202	OFF3 (quick stop) source 2	Same as b2-00	1	-	Real-time
b2-03	0xB203	OFF3 (quick stop) source 3	Same as b2-00	1	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
b2-04	0xB204	Fault reset source 2	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
b2-05	0xB205	Fault reset source 3	Same as b2-04	0	-	Real-time
b2-06	0xB206	RFG prohibition source	Same as b2-00	1	-	Real-time
b2-07	0xB207	RFG pause source	Same as b2-00	1	-	Real-time
b2-08	0xB208	Source of setting RFG reference to 0	Same as b2-00	1	-	Real-time

10.2.3.4 b3: Main command of control channel 2

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b3-00	0xB300	Main command source of control channel 2	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	/	Change at stop
b3-01	0xB301	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b3-02	0xB302	User-defined OFF2 (coast to stop) source 1	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b3-03	0xB303	User-defined OFF3 (quick stop) source 1	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b3-04	0xB304	Self-defined running permission command source	0: Running inhibited 1: Running allowed 3: DI1 4: DI2 5: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b3-05	0xB305	Self-defined fault reset command source 1	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b3-06	0xB306	User-defined JOG1 (jogging) source	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b3-07	0xB307	User-defined JOG2 (jogging) source	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b3-08	0xB308	Self-defined speed inversion source	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b3-09	0xB309	JOG/ON_OFF1 priority mode selection	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	0	/	Real time

10.2.3.5 b4: Control Channel 2 Auxiliary Command

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
b4-00	0xB400	OFF2 (coast to stop) source 2	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b4-01	0xB401	OFF2 (coast to stop) source 3	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b4-02	0xB402	OFF3 (quick stop) source 2	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
b4-03	0xB403	OFF3 (quick stop) source 3	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b4-04	0xB404	Fault reset source 2	0: Invalid1: Valid3: DI14: DI25 to 9: DI3 to DI7 (only valid for MD630S)Others: B connector	0	/	Real time
b4-05	0xB405	Fault reset source 3	0: Invalid1: Valid3: DI14: DI25 to 9: DI3 to DI7 (only valid for MD630S)Others: B connector	0	/	Real time
b4-06	0xB406	RFG prohibition source	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b4-07	0xB407	RFG pause source	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time
b4-08	0xB408	Source of setting RFG reference to 0	0: Valid 1: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	1	/	Real time

10.2.3.6 b5: Reference Channel 1

Item	Address:	Name	Value Range	Default	Unit	Change:
b5-00	0xB500	Main frequency source	0: b5-01 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-01	0xB501	Digital setting of main frequency	0.00 to A2-17	50.00	Hz	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b5-02	0xB502	Auxiliary frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-03	0xB503	Main and auxiliary frequency operation	0: Main source X + Auxiliary source Y 1: Main source X - Auxiliary source Y 2: Max. (X, Y) 3: Min. (X, Y) 4: Main source X x Auxiliary source Y	0	/	Real time
b5-04	0xB504	Additional frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-05	0xB505	Main frequency gain factor source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-06	0xB506	Auxiliary frequency gain factor source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
b5-07	0xB507	Jog 1 frequency source	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-08	0xB508	Digital setting of jog 1 frequency	-50.00 to 50.00	2.00	Hz	Real-time
b5-09	0xB509	Jog 2 frequency source	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-10	0xB50A	Digital setting of jog 2 frequency	-50.00 to 50.00	-2.00	Hz	Real-time
b5-11	0xB50B	Frequency ramp change	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b5-12	0xB50C	Frequency ramp change interval	2 to 10000	50	ms	Real-time
b5-13	0xB50D	Torque reference source	0: b5-14 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-14	0xB50E	Torque reference digital setting	-800.0 to 800.0	0.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b5-15	0xB50F	Torque reference gain factor	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-16	0xB510	Torque filter time	0 to 10000	0	ms	Real-time
b5-17	0xB511	Torque acceleration time	0.000 to 60.000	0.000	s	Real-time
b5-18	0xB512	Torque deceleration time	0.000 to 60.000	0.000	s	Real-time
b5-19	0xB513	Speed limit source in torque mode	0: b5-20 1: Speed channel	0	/	Real time
b5-20	0xB514	Digital setting of speed limit in torque control mode	-800.0 to 800.0	100.0	%	Real-time
b5-21	0xB515	Speed limit offset mode in torque mode	0: Bidirectional offset1: Unidirectional offset2: Overspeed control	0	/	Real time
b5-22	0xB516	Speed limit offset source in torque mode	0: b5-23 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-23	0xB517	Digital setting of speed limit offset in torque mode	0.0 to 800.0	5.0	%	Real-time
b5-24	0xB518	Source of supplementary torque reference 1	0: b5-25 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-25	0xB519	Supplementary torque 1 digital setting	-400.0 to 400.0	0.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b5-26	0xB51A	Source of supplementary torque reference 2	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b5-27	0xB51B	Additional torque reference 2 enable	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

10.2.3.7 b6: Reference Channel 2

Item	Address:	Name	Value Range	Default	Unit	Change:
b6-00	0xB600	Main frequency source	0: b6-01 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-01	0xB601	Digital setting of main frequency	0.00 to A2-17	50.00	Hz	Real-time
b6-02	0xB602	Auxiliary frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-03	0xB603	Main and auxiliary frequency operation	0: Main source X + Auxiliary source Y 1: Main source X - Auxiliary source Y 2: Max. (X, Y) 3: Min. (X, Y) 4: Main source X x Auxiliary source Y	0	/	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b6-04	0xB604	Additional frequency source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-05	0xB605	Main frequency gain factor source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-06	0xB606	Auxiliary frequency gain factor source	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-07	0xB607	Jog 1 frequency source	0: b6-08 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-08	0xB608	Digital setting of jog 1 frequency	-50.00 to 50.00	2.00	Hz	Real-time
b6-09	0xB609	Jog 2 frequency source	0: b6-10 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-10	0xB60A	Digital setting of jog 2 frequency	-50.00 to 50.00	-2.00	Hz	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b6-11	0xB60B	Frequency ramp change	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real-time
b6-12	0xB60C	Frequency ramp change interval	2 to 10000	50	ms	Real-time
b6-13	0xB60D	Torque reference source	0: b6-14 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-14	0xB60E	Torque reference digital setting	-800.0 to 800.0	0.0	%	Real-time
b6-15	0xB60F	Torque reference gain factor	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-16	0xB610	Torque filter time	0 to 10000	0	ms	Real-time
b6-17	0xB611	Torque acceleration time	0.000 to 60.000	0.000	s	Real-time
b6-18	0xB612	Torque deceleration time	0.000 to 60.000	0.000	s	Real-time
b6-19	0xB613	Speed limit source in torque mode	0: b6-20 1: Speed channel	0	/	Real-time
b6-20	0xB614	Digital setting of speed limit in torque control mode	-800.0 to 800.0	100.0	%	Real-time
b6-21	0xB615	Speed limit offset mode in torque mode	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control	0	/	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b6-22	0xB616	Speed limit offset source in torque mode	0: b6-23 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-23	0xB617	Digital setting of speed limit offset in torque mode	0.0 to 800.0	5.0	%	Real-time
b6-24	0xB618	Source of supplementary torque reference 1	0: b6-25 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-25	0xB619	Supplementary torque 1 digital setting	-400.0 to 400.0	0.0	%	Real-time
b6-26	0xB61A	Source of supplementary torque reference 2	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real-time
b6-27	0xB61B	Additional torque reference 2 enable	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real-time

10.2.3.8 b7 Ramp (Acceleration/Deceleration) setting

Item	Address:	Name	Value Range	Default	Unit	Change:
b7-00	0xB700	Ramp acceleration/ deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	/	Real time
b7-01	0xB701	Base for ramp acceleration/ deceleration time	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Set frequency	1	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
b7-02	0xB702	Ramp selection bit 0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b7-03	0xB703	Ramp selection bit 1	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b7-04	0xB704	Ramp 1 acceleration time	0.0 to 6500.0	20.0	s	Real-time
b7-05	0xB705	Ramp 1 deceleration time	0.0 to 6500.0	20.0	s	Real-time
b7-06	0xB706	Ramp 1 acceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-07	0xB707	Ramp 1 acceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-08	0xB708	Ramp 1 deceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-09	0xB709	Ramp 1 deceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-10	0xB70a	Ramp 2 acceleration time	0.0 to 6500.0	20.0	s	Real-time
b7-11	0xB70B	Ramp 2 deceleration time	0.0 to 6500.0	20.0	s	Real-time
b7-12	0xB70c	Ramp 2 acceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-13	0xB70d	Ramp 2 acceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-14	0xB70e	Ramp 2 deceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-15	0xB70f	Ramp 2 deceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-16	0xB710	Ramp 3 acceleration time	0.00 to 655.00	20.00	s	Real-time
b7-17	0xB711	Ramp 3 deceleration time	0.00 to 655.00	20.00	s	Real-time
b7-18	0xB712	Ramp 3 acceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-19	0xB713	Ramp 3 acceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-20	0xB714	Ramp 3 deceleration initial arc	0.00 to 655.00	0.00	s	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
b7-21	0xB715	Ramp 3 deceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-22	0xB716	Ramp 4 acceleration time	0.00 to 655.00	20.00	s	Real-time
b7-23	0xB717	Ramp 4 deceleration time	0.00 to 655.00	20.00	s	Real-time
b7-24	0xB718	Ramp 4 acceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-25	0xB719	Ramp 4 acceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-26	0xB71a	Ramp 4 deceleration initial arc	0.00 to 655.00	0.00	s	Real-time
b7-27	0xB71B	Ramp 4 deceleration final arc	0.00 to 655.00	0.00	s	Real-time
b7-28	0xB71c	Ramp 1/2 frequency switchover	0: Disable 1: Enable	0	/	Real time
b7-29	0xB71d	Ramp 1/2 acceleration switchover frequency	0.0–A2-18	0.0	Hz	Real-time
b7-30	0xB71e	Ramp 1/2 deceleration switchover frequency	0.0–A2-18	0.0	Hz	Real-time
b7-31	0xB71f	Jogging ramp source	0: Normal running ramp time 1: Jogging ramp time	0	/	Real time
b7-32	0xB720	Jog ramp acceleration time	0.00 to 655.00	20.00	s	Real-time
b7-33	0xB721	Jog ramp deceleration time	0.00 to 655.00	20.00	s	Real-time
b7-34	0xB722	Deceleration time for quick stop	0.00 to 655.00	1.00	s	Real-time
b7-35	0xB723	Initial arc of quick stop	0.00 to 655.00	0.00	s	Real-time
b7-36	0xB724	Final arc of quick stop	0.00 to 655.00	0.00	s	Real-time
b7-37	0xB725	Frequency acceleration time in torque control	0.00 to 655.00	0.00	s	Real-time
b7-38	0xB726	Frequency deceleration time in torque control	0.00 to 655.00	0.00	s	Real-time
b7-39	0xB727	Ramp acceleration time gain coefficient	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
b7-40	0xB728	Ramp deceleration time gain coefficient	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b7-41	0xB729	Acceleration time gain coefficient at low speed	1.0 to 1000.0	100.0	%	Real-time
b7-42	0xB72a	Threshold at low speed	0.00 to 100.00	15.00	%	Real-time
b7-43	0xB72B	Ramp arc mode	0: Incontinuous smoothing 1: Continuous smoothing	0	/	Real time
b7-44	0xB72c	Ramp output force enable	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b7-45	0xB72d	Ramp output force value	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
b7-46	0xB72e	Ramp tracking	0：Disable 1：Enable 2：Torque limit reached Others: B connector	0	/	Real time
b7-47	0xB72f	Ramp tracking error	0.0 to 100.0	10.0	%	Real-time

10.2.3.9 b8 Multi-reference

Item	Address:	Name	Value Range	Default	Unit	Change:
b8-00	0xB800	Currently effective multi-reference X	0~15: Multi-reference 0 to multi-reference 15	0	/	Unchangeable
b8-01	0xB801	Currently valid multi-reference output	-3000.0 to 3000.0	0.0	%	Unchangeable
b8-02	0xB802	Multi-reference unit selection	0: % (100% = rated motor frequency) 1: % (100% = maximum motor frequency) 2: User-defined (100% = b8-41) 3: Hz 4: rpm	0	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
b8-03	0xB803	Multi-reference selection bit0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b8-04	0xB804	Multi-reference value bit0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b8-05	0xB805	Multi-reference value bit0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b8-06	0xB806	Multi-reference value bit0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
b8-08	0xB808	Multi-reference 0 setting mode	0: b8-09 1: AI1 2: AI2 4: HDI pulse reference 5: PID 6: b5-01/b6-01 (Digital setting of main frequency) Others: F connector	0	/	Real time
b8-09	0xB809	Multi-reference 0	b8-43 to b8-42	0.0	/	Real time
b8-10	0xB80A	Multi-reference 1	b8-43 to b8-42	0.0	/	Real time
b8-11	0xB80B	Multi-reference 2	b8-43 to b8-42	0.0	/	Real time
b8-12	0xB80C	Multi-reference 3	b8-43 to b8-42	0.0	/	Real time
b8-13	0xB80D	Multi-reference 4	b8-43 to b8-42	0.0	/	Real time
b8-14	0xB80E	Multi-reference 5	b8-43 to b8-42	0.0	/	Real time
b8-15	0xB80F	Multi-reference 6	b8-43 to b8-42	0.0	/	Real time
b8-16	0xB810	Multi-reference 7	b8-43 to b8-42	0.0	/	Real time
b8-17	0xB811	Multi-reference 8	b8-43 to b8-42	0.0	/	Real time
b8-18	0xB812	Multi-reference 9	b8-43 to b8-42	0.0	/	Real time
b8-19	0xB813	Multi-reference 10	b8-43 to b8-42	0.0	/	Real time
b8-20	0xB814	Multi-reference 11	b8-43 to b8-42	0.0	/	Real time
b8-21	0xB815	Multi-reference 12	b8-43 to b8-42	0.0	/	Real time
b8-22	0xB816	Multi-reference 13	b8-43 to b8-42	0.0	/	Real time
b8-23	0xB817	Multi-reference 14	b8-43 to b8-42	0.0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
b8-24	0xB818	Multi-reference 15	b8-43 to b8-42	0.0	/	Real time
b8-41	0xB829	User-defined base value	0.1 to 6553.5	100.0	/	Change at stop
b8-42	0xB82A	Multi-reference upper limit threshold	0.0 to 3000.0	3000.0	/	Real time
b8-43	0xB82B	Multi-reference lower limit threshold	-3000.0 to 0.0	-3000.0	/	Real time

10.2.3.10 b9 Terminal start/stop module

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
b9-00	0xB900	Terminal start/stop module selection	0: Module A 1: Module B Others: B connector	0	-	Change at stop
b9-01	0xB901	Mode of terminal start/stop module A	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	-	Change at stop
b9-02	0xB902	Terminal start/stop module A_IN1	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	0	-	Change at stop
b9-03	0xB903	Terminal start/stop module A_IN2	Same as b9-02	0	-	Change at stop
b9-04	0xB904	Terminal start/stop module A_IN3	Same as b9-02	0	-	Change at stop
b9-05	0xB905	Running permission source of terminal start/stop module A	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	1	-	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
b9-06	0xB906	Fault reset source of terminal start/stop module A	Same as b9-05	0	-	Change at stop
b9-07	0xB907	JOG1 source of terminal start/stop module A	Same as b9-02	0	-	Change at stop
b9-08	0xB908	JOG2 source of terminal start/stop module A	Same as b9-02	0	-	Change at stop
b9-09	0xB909	Mode of start/stop module B by terminal	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	-	Change at stop
b9-10	0xB90A	Terminal start/stop module B_IN1	Same as b9-02	0	-	Change at stop
b9-11	0xB90B	Terminal start/stop module B_IN2	Same as b9-02	0	-	Change at stop
b9-12	0xB90C	Terminal start/stop module B_IN3	Same as b9-02	0	-	Change at stop
b9-13	0xB90D	Running permission source of terminal start/stop module B	Same as b9-05	1	-	Change at stop
b9-14	0xB90E	Fault reset source of terminal start/stop module B	Same as b9-05	0	-	Change at stop
b9-15	0xB90F	JOG1 source of terminal start/stop module B	Same as b9-02	0	-	Change at stop
b9-16	0xB910	JOG2 source of terminal start/stop module B	Same as b9-02	0	-	Change at stop

10.2.4 Group C Motor Parameter

10.2.4.1 C0 Encoder 1 parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C0-00	0xC000	Encoder type	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Rotary encoder 4: SSI encoder 5: Sin-cosine encoder 6: EnDat encoder 7: BISS encoder	0	-	Change at stop
C0-01	0xC001	Encoder control word	Bit 0: Reserved Bit 1: Software open circuit detection 0: Disable; 1: Enable Bit 2: Deburring 0: Disable; 1: Enable Bit 3: Hardware open circuit detection 0: Disable; 1: Enable Bit 4: Moving average filter 0: Disable; 1: Enable Bit 5: Position-based deburring function 0: Disable; 1: Enable Bit 6 to bit 15: reserved	0x0008	-	Change at stop
C0-02	0xC002	Encoder PPR	1 to 65535	1024	-	Change at stop
C0-03	0xC003	Phase sequence of encoder	0: Forward 1: Reverse	0	-	Change at stop
C0-04	0xC004	Encoder installation angle	0.0 to 359.9	0.0	°	Change at stop
C0-05	0xC005	Encoder speed measurement filter time constant	0.0000 to 6.0000	0.0040	s	Real-time change
C0-06	0xC006	Speed measurement mode at low speed	0: Maintain 1: Attenuate 2: Optimized solution	2	-	Change at stop
C0-07	0xC007	Disconnection detection time of PG card for speed feedback	0.1 to 10.0	0.5	s	Change at stop
C0-08	0xC008	Encoder wire breakage software detection coefficient	0.0 to 800.0	100.0	%	Real-time change
C0-09	0xC009	Speed measurement exception count threshold	1 to 100	10	-	Real-time change
C0-10	0xC00A	Encoder gear ratio numerator	1 to 65535	1	-	Change at stop
C0-11	0xC00B	Encoder gear ratio denominator	1 to 65535	1	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C0-12	0xC00C	Z signal correction	0: Disable 1: Enable	1	-	Real-time change
C0-13	0xC00D	Number of resolver pole pairs	1 to 65535	1	-	Change at stop
C0-15	0xC00F	Number of frequency-division output pulses	4 to 65532	4096	-	Change at stop
C0-16	0xC010	ABZ encoder frequency-division coefficient	1 to 64	1	-	Change at stop
C0-17	0xC011	Frequency-division output configuration command word	Bit 0: Frequency-division signal source selection 0: Channel 1 1: Channel 2 Bit 1: Frequency-division output AB signal phase 0: Phase A leads phase B 1: Phase B leads phase A Bit 2: Frequency-division output Z signal level 0: Z signal is low level 1: Z signal is high level Bit 3 to Bit 15: Reserved	0x0004	-	Change at stop
C0-18	0xC012	ABZ encoder level type	1: Derivative output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	1	-	Change at stop
C0-19	0xC013	Command word of the ABZ encoder	Bit 0: A/B pulse selection in M/T speed measurement 0: A pulse 1: B pulse Bit 1: Reserved Bit 2: Interchange of input signals A and B 0: Disable; 1: Enable Bit 3: Interchange of A and B signals during frequency-division output 0: Disable; 1: Enable Bit 4: Z signal inversion during frequency-division output 0: Disable; 1: Enable Bit 5: Low bit of filter function selection 0: Disable; 1: Enable Bit 6: High bit of filter function selection 0: Disable; 1: Enable Bit 7 and Bit 8: Reserved Bit 9: Pulse A disconnection detection 0: Disable; 1: Enable Bit 10: Pulse B disconnection detection 0: Disable; 1: Enable Bit 11: Z pulse disconnection detection 0: Disable; 1: Enable Bit 12 to Bit 15: Reserved	0x0E60	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C0-20	0xC014	ABZ speed measurement mode is in quadrature counting	0: Quadrupled frequency 1: Quadrupled frequency at low speed, single frequency at high speed 2: Single frequency	0	-	Change at stop
C0-23	0xC017	23-bit encoder communication frequency selection	1: 2M 3: 4M 4: 8M	1	-	Change at stop
C0-27	0xC01B	Resolver encoder excitation signal selection	0: 10 kHz 1: 15 kHz 2: 12 kHz 3: 20 kHz	0	-	Change at stop
C0-28	0xC01C	Command word of the resolver encoder	Bit 0: Excitation amplification output 0: Disable; 1: Enable Bit 1: Input signal inversion 0: Forward; 1: Reverse Bit 2 to Bit 15: Reserved	0x0001	-	Change at stop
C0-29	0xC01D	Resolver encoder gear ratio selection	0: 0.5 1: 0.286	0	-	Change at stop
C0-31	0xC01F	SSI communication baud rate	0: 2M 1: 1.5M 2: 1M 3: 0.5M 4: 0.4M 5: 0.25M 6: 0.125M	3	-	Change at stop
C0-32	0xC020	SSI encoder signal check	0: None 1: Even parity 2: Odd parity	0	-	Change at stop
C0-33	0xC021	SSI encoder data encoding format	0: Binary 1: Gray code	0	-	Change at stop
C0-34	0xC022	Number of SSI encoder status bits	0 to 8	0	-	Change at stop
C0-41	0xC029	EnDat encoder communication frequency	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	1	-	Change at stop
C0-45	0xC02D	Communication frequency of BISS encoder	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	1	-	Change at stop
C0-46	0xC02E	BISS encoder signal check	0: Calculated CRC inconsistent with the received CRC 1: Calculated CRC same as received CRC	0	-	Change at stop
C0-47	0xC02F	Number of BISS encoder status bits	0 to 8	0	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C0-51	0xC033	Number of single-turn bits of communication-type encoder	1 to 32	23	-	Change at stop
C0-52	0xC034	Number of multi-turn bits of communication-type encoder	0 to 32	0	-	Change at stop
C0-58	0xC03A	Z signal interference detection enable	0: Disable 1: Enable	1	-	Real-time change
C0-59	0xC03B	Z signal interference fault threshold	0.5 to 10.0	0.5	%	Change at stop
C0-61	0xC03D	Z signal loss detection enable	0: Disable 1: Enable	1	-	Real-time change
C0-63	0xC03F	Orientation deviation detection enable	0: Disable 1: Enable	1	-	Real-time change

10.2.4.2 C2: Auto-tuning and Self-test

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C2-00	0xC200	Motor parameter auto-tuning mode	0: No operation 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Asynchronous motor static complete auto-tuning 4: Inertia auto-tuning 5: Dead zone auto-tuning 11: Permanent magnet motor with-load auto-tuning (excluding back EMF) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning 15: MTPA of synchronous reluctance motor without field strengthening 21: Static auto-tuning of synchronous reluctance motor 22: Dynamic auto-tuning of synchronous reluctance motor	0	/	Change at stop
C2-03	0xC203	Pre-running self-check configuration	Bit 0: IGBT short circuit inspection upon power-on 0: Disable 1: Enable Bit 1: Inspection on short-circuited to ground 0: Disable 1: Enable Bit 2: Phase loss inspection upon power-on 0: Disable 1: Enable Bit 3: Reserved	0x0	-	Change at stop
C2-04	0xC204	Manual self-check	0: No command 1: Static self-check preparation	0	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C2-06	0xC206	Self-check upon power-on	Bit 0: Self-check of IGBT shoot-through upon power-on 0: Disable 1: Enable Bit 1: Self-check of short circuit to ground upon power-on 0: Disable 1: Enable Bit 2: Phase loss self-check upon power-on 0: Disable 1: Enable Bit 3: Self-check of inter-phase short circuit upon power-on 0: Disable 1: Enable	0x0002	-	Change at stop
C2-07	0xC207	Direction selection	0: Default 1: Opposite to the set direction	1	/	Change at stop
C2-17	0xC211	Auto-tuning acceleration time	0.0 to 600.0	20.0	s	Change at stop
C2-18	0xC212	Auto-tuning deceleration time	0.0 to 600.0	20.0	s	Change at stop
C2-19	0xC213	Parameter Calculation	0: Invalid 1: Motor nameplate parameter calculation	0	/	Change at stop
C2-20	0xC214	Parameter calculation confirmation	0: Invalid 1: Valid	0	/	Change at stop
C2-21	0xC215	Trigger base calculation of synchronous motor	0: Invalid 1: Valid	0	/	Change at stop
C2-30	0xC21E	No load current vector auto-tuning	0: Disable 1: Enable	0	/	Change at stop
C2-31	0xC21F	Speed source for no-load current vector auto-tuning	0: User-defined 1: Internally-defined	0	/	Change at stop

10.2.4.3 C4 Basic parameters of motor 1

Item	Address:	Name	Value Range	Default	Unit	Change:
C4-00	0xC400	Motor type	0：Normal asynchronous motor 2：Permanent magnet synchronous motor 3：Synchronous reluctance motor without field strengthening 4：Synchronous reluctance motor with field strengthening	0	/	Change at stop
C4-01	0xC401	Rated motor power	0.01 to 655.35	3.70	kW	At stop:
C4-03	0xC403	Rated motor voltage	1 to 2000	380	V	Change at stop
C4-04	0xC404	Rated motor current	0.01 to 655.35	9.00	A	At stop
C4-06	0xC406	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop

Item	Address:	Name	Value Range	Default	Unit	Change:
C4-07	0xC407	Rated motor speed	1 to 65535	1460	RPM	At stop
C4-09	0xC409	Motor power factor	0.600 to 1.000	0.860	/	Change at stop
C4-10	0xC40A	Maximum motor frequency	C4-06 to 599.00	50.00	Hz	At stop
C4-11	0xC40B	Minimum motor frequency	0.00 to C4-10	0.00	Hz	At stop
C4-12	0xC40C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
C4-13	0xC40D	Number of parallel motors	1 to 200	1	/	Change at stop
C4-14	0xC40E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	/	Change at stop
C4-15	0xC40F	Number of effective motor pole pairs	0 to 128	0	/	This is not modifiable.
C4-20	0xC414	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
C4-22	0xC416	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
C4-24	0xC418	Asynchronous motor stator leakage inductance	0.01 to 655.35	5.28	mH	Real time
C4-26	0xC41A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
C4-28	0xC41C	Mutual inductance (asynchronous motor)	0.1 to 6553.5	156.8	mH	Real time
C4-30	0xC41E	No-load current (asynchronous motor)	0.01 to 655.35	4.20	A	Real time
C4-32	0xC420	Synchronous motor shaft D inductance	0.01 to 655.35	5.28	mH	Real time
C4-34	0xC422	Synchronous motor shaft Q inductance	0.01 to 655.35	5.28	mH	Real time
C4-62	0xC43E	Inertia ratio	0.0 to 6553.5	120.0	%	Change at stop
C4-63	0xC43F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
C4-64	0xC440	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
C4-70	0xC446	Motor brake control	0: Disable 1: Enable	1	/	Change at stop

10.2.4.4 C5 Expansion parameters of motor 1

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C5-02	0xC502	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	Change at stop
C5-03	0xC503	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	Change at stop
C5-04	0xC504	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	Change at stop
C5-05	0xC505	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	Change at stop
C5-06	0xC506	Flux coefficient 1 of mutual inductance curve.	10.0 to 100.0	50.0	%	Change at stop
C5-07	0xC507	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	Change at stop
C5-08	0xC508	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	Change at stop
C5-09	0xC509	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	Change at stop
C5-10	0xC50A	Speed point 1 of friction curve	0 to 30000	15	RPM	At stop
C5-11	0xC50B	Speed point 2 of friction curve	0 to 30000	30	RPM	At stop
C5-12	0xC50C	Speed point 3 of friction curve	0 to 30000	60	RPM	At stop
C5-13	0xC50D	Speed point 4 of friction curve	0 to 30000	120	RPM	At stop
C5-14	0xC50E	Speed point 5 of friction curve	0 to 30000	150	RPM	At stop
C5-15	0xC50F	Speed point 6 of friction curve	0 to 30000	300	RPM	At stop
C5-16	0xC510	Speed point 7 of friction curve	0 to 30000	600	RPM	At stop
C5-17	0xC511	Speed point 8 of friction curve	0 to 30000	1200	RPM	At stop
C5-18	0xC512	Speed point 9 of friction curve	0 to 30000	1500	RPM	At stop
C5-19	0xC513	Speed point 10 of friction curve	0 to 30000	3,000	RPM	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C5-20	0xC514	Torque point 1 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-21	0xC515	Torque point 2 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-22	0xC516	Torque point 3 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-23	0xC517	Torque point 4 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-24	0xC518	Torque point 5 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-25	0xC519	Torque point 6 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-26	0xC51A	Torque point 7 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-27	0xC51B	Torque point 8 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-28	0xC51C	Torque point 9 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-29	0xC51D	Torque point 10 of friction curve	-320.00 to 320.00	0.00	N·m	Change at stop
C5-30	0xC51E	Starting point of d/q-axis inductance curve current coefficient	-800.0 to 800.0	-200.0	%	Change at stop
C5-31	0xC51F	End point of d/q-axis inductance curve current coefficient	-800.0 to 800.0	200.0	%	Change at stop
C5-32	0xC520	d-axis inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-33	0xC521	d-axis inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-34	0xC522	d-axis inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-35	0xC523	d-axis inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-36	0xC524	d-axis inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-37	0xC525	d-axis inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-38	0xC526	d-axis inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C5-39	0xC527	d-axis inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-40	0xC528	d-axis inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-41	0xC529	d-axis inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-42	0xC52A	d-axis inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-43	0xC52B	d-axis inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-44	0xC52C	q-axis inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-45	0xC52D	q-axis inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-46	0xC52E	q-axis inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-47	0xC52F	q-axis inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-48	0xC530	q-axis inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-49	0xC531	q-axis inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-50	0xC532	q-axis inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-51	0xC533	q-axis inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-52	0xC534	q-axis inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-53	0xC535	q-axis inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C5-54	0xC536	q-axis inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop
C5-55	0xC537	q-axis inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	Change at stop

10.2.4.5 C7 Basic parameters of motor 2

Item	Address:	Name	Value Range	Default	Unit	Change:
C7-00	0xC700	Motor type	0：Normal asynchronous motor 2：Permanent magnet synchronous motor 3：Synchronous reluctance motor without field strengthening 4：Synchronous reluctance motor with field strengthening	0	/	Change at stop
C7-01	0xC701	Rated motor power	0.01 to 655.35	3.70	kW	At stop:
C7-03	0xC703	Rated motor voltage	1 to 2000	380	V	Change at stop
C7-04	0xC704	Rated motor current	0.01 to 655.35	9.00	A	At stop
C7-06	0xC706	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
C7-07	0xC707	Rated motor speed	1 to 65535	1460	RPM	At stop
C7-09	0xC709	Motor power factor	0.600 to 1.000	0.860	/	Change at stop
C7-10	0xC70A	Maximum motor frequency	C7-06 to 599.00	50.00	Hz	At stop
C7-11	0xC70B	Minimum motor frequency	0.00 to C7-10	0.00	Hz	At stop
C7-12	0xC70C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
C7-13	0xC70D	Number of parallel motors	1 to 200	1	/	Change at stop
C7-14	0xC70E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	/	Change at stop
C7-15	0xC70F	Number of effective motor pole pairs	0 to 128	0	/	This is not modifiable.
C7-20	0xC714	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
C7-22	0xC716	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
C7-24	0xC718	Asynchronous motor stator leakage inductance	0.01 to 655.35	5.28	mH	Real time
C7-26	0xC71A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
C7-28	0xC71C	Mutual inductance (asynchronous motor)	0.1 to 6553.5	156.8	mH	Real time
C7-30	0xC71E	No-load current (asynchronous motor)	0.01 to 655.35	4.20	A	Real time
C7-32	0xC720	Synchronous motor shaft D inductance	0.01 to 655.35	5.28	mH	Real time
C7-34	0xC722	Synchronous motor shaft Q inductance	0.01 to 655.35	5.28	mH	Real time
C7-62	0xC73E	Inertia ratio	0.0 to 6553.5	120.0	%	Change at stop
C7-63	0xC73F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
C7-64	0xC740	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
C7-70	0xC746	Motor brake control	0: Disable 1: Enable	1	/	Change at stop

10.2.4.6 CA Basic parameters of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
CA-00	0xCA00	Motor type	0: Normal asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without field strengthening 4: Synchronous reluctance motor with field strengthening	0	/	Change at stop
CA-01	0xCA01	Rated motor power	0.01 to 655.35	3.70	kW	At stop:
CA-03	0xCA03	Rated motor voltage	1 to 2000	380	V	Change at stop
CA-04	0xCA04	Rated motor current	0.01 to 655.35	9.00	A	At stop
CA-06	0xCA06	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
CA-07	0xCA07	Rated motor speed	1 to 65535	1460	RPM	At stop
CA-09	0xCA09	Motor power factor	0.600 to 1.000	0.860	/	Change at stop
CA-10	0xCA0A	Maximum motor frequency	CA-06 to 599.00	50.00	Hz	At stop
CA-11	0xCA0B	Minimum motor frequency	0.00 to CA-10	0.00	Hz	At stop
CA-12	0xCA0C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
CA-13	0xCA0D	Number of parallel motors	1 to 200	1	/	Change at stop
CA-14	0xCA0E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	/	Change at stop
CA-15	0xCA0F	Number of effective motor pole pairs	0 to 128	0	/	This is not modifiable.

Item	Address:	Name	Value Range	Default	Unit	Change:
CA-20	0xCA14	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
CA-22	0xCA16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
CA-24	0xCA18	Asynchronous motor stator leakage inductance	0.01 to 655.35	5.28	mH	Real time
CA-26	0xCA1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
CA-28	0xCA1C	Mutual inductance (asynchronous motor)	0.1 to 6553.5	156.8	mH	Real time
CA-30	0xCA1E	No-load current (asynchronous motor)	0.01 to 655.35	4.20	A	Real time
CA-32	0xCA20	Synchronous motor shaft D inductance	0.01 to 655.35	5.28	mH	Real time
CA-34	0xCA22	Synchronous motor shaft Q inductance	0.01 to 655.35	5.28	mH	Real time
CA-62	0xCA3E	Inertia ratio	0.0 to 6553.5	120.0	%	Change at stop
CA-63	0xCA3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
CA-64	0xCA40	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
CA-70	0xCA46	Motor brake control	0: Disable 1: Enable	1	/	Change at stop

10.2.4.7 Cd Basic parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
Cd-00	0xCD00	Motor type	0: Normal asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without field strengthening 4: Synchronous reluctance motor with field strengthening	0	/	Change at stop
Cd-01	0xCD01	Rated motor power	0.01 to 655.35	3.70	kW	Change at stop
Cd-03	0xCD03	Rated motor voltage	1 to 2000	380	V	Change at stop
Cd-04	0xCD04	Rated motor current	0.01 to 655.35	9.00	A	At stop
Cd-06	0xCD06	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
Cd-07	0xCD07	Rated motor speed	1 to 65535	1460	RPM	At stop
Cd-09	0xCD09	Motor power factor	0.600 to 1.000	0.860	/	Change at stop
Cd-10	0xCD0A	Maximum motor frequency	-06-599.00	50.00	Hz	At stop
Cd-11	0xCD0B	Minimum motor frequency	0.00--10	0.00	Hz	At stop

Item	Address:	Name	Value Range	Default	Unit	Change:
Cd-12	0xCD0C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
Cd-13	0xCD0D	Number of parallel motors	1 to 200	1	/	Change at stop
Cd-14	0xCD0E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	/	Change at stop
Cd-15	0xCD0F	Number of effective motor pole pairs	0 to 128	0	/	Unchangeable
Cd-20	0xCD14	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
Cd-22	0xCD16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
Cd-24	0xCD18	Asynchronous motor stator leakage inductance	0.01 to 655.35	5.28	mH	Real time
Cd-26	0xCD1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
Cd-28	0xCD1C	Mutual inductance (asynchronous motor)	0.1 to 6553.5	156.8	mH	Real time
Cd-30	0xCD1E	No-load current (asynchronous motor)	0.01 to 655.35	4.20	A	Real time
Cd-32	0xCD20	Synchronous motor shaft D inductance	0.01 to 655.35	5.28	mH	Real time
Cd-34	0xCD22	Synchronous motor shaft Q inductance	0.01 to 655.35	5.28	mH	Real time
Cd-62	0xCD3E	Inertia ratio	0.0 to 6553.5	120.0	%	Change at stop
Cd-63	0xCD3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
Cd-64	0xCD40	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
Cd-70	0xCD46	Motor brake control	0: Disable 1: Enable	1	/	Change at stop

10.2.5 Group d Control Parameters of Motor 1/2

10.2.5.1 d0 Basic control parameters of motor 1

Item	Address:	Name	Value Range	Default	Unit	Change:
d0-00	0xD000	Control mode	0: SVC 1: FVC 2: V/f	2	/	Change at stop
d0-01	0xD001	Motor control method	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
d0-02	0xD002	Start mode	0: Direct start 1: Flying start	0	/	Change at stop
d0-03	0xD003	Mode of speed tracking	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	4	/	Real time
d0-04	0xD004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	/	Real time
d0-05	0xD005	OFF2 (coast to stop) stop mode	0: Coast to stop	0	/	Unchangeable
d0-06	0xD006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	/	Real time
d0-07	0xD007	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	/	Real time
d0-08	0xD008	Stop mode in torque control	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	1	/	Change at stop
d0-09	0xD009	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
d0-10	0xD00A	Zero speed judgment time (actual speed)	0.00 to +10.00	0.10	s	Change at stop
d0-11	0xD00B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
d0-12	0xD00C	Zero speed judgment time of synchronous frequency	0.0 to 655.35	2.00	s	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
d0-13	0xD00D	Start/Stop frequency following	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
d0-14	0xD00E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	/	Change at stop
d0-16	0xD010	Shut-down time delay	0.0 to 655.35	0.00	s	Change at stop
d0-17	0xD011	Pre-excitation mode	0: Pre-excitation based on time 1: Pre-excitation based on the set current 2: Pre-excitation based on maximum current	1	/	Change at stop
d0-18	0xD012	Pre-excitation time	1 to 30000	1,000	ms	Real-time
d0-19	0xD013	Pre-excitation current	1 to 800	100	%	Real-time
d0-20	0xD014	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
d0-23	0xD017	Startup frequency	0.00 to +10.00	0.00	Hz	Real-time
d0-24	0xD018	Startup frequency hold time	0.0 to 1000.0	0.0	s	Change at stop
d0-25	0xD019	DC braking time at startup	0.0 to 100.0	0.0	s	Change at stop
d0-26	0xD01A	DC braking current at startup	0 to 800	50	%	Change at stop
d0-27	0xD01B	Start frequency of DC braking for stop	0.0 to 600.0	0.0	Hz	Real-time
d0-28	0xD01C	DC braking waiting time for stop	0.0 to 100.0	0.0	s	Real-time
d0-29	0xD01D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
d0-30	0xD01E	F6-13 (DC injection braking 2 level)	0 to 800	50	%	Real-time
d0-31	0xD01F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real-time
d0-32	0xD020	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
d0-35	0xD023	Current Limit during constant current	50.0 to 800.0	100.0	%	Real-time
d0-39	0xD027	Overexcitation selection (vector)	0: Inactive 1: Active	0	/	Real time
d0-40	0xD028	Overexciting current (vector)	0 to 800	100	%	Real-time
d0-41	0xD029	Overexcitation gain (V/f)	0 to 200	90	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
d0-61	0xD03D	Star connection	0: Disabled 1: Enabled Others: B connector	0	/	Change at stop
d0-62	0xD03E	Delay time for starting shorting motor stator	0.0 to 5000.0	0.0	ms	Change at stop
d0-63	0xD03F	Holding time of shorting motor stator at stop	0.1 to 3600.0	10.0	s	Change at stop
d0-70	0xD046	Magnetic pole position detection mode when synchronous motor SVC starts	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	/	Change at stop
d0-71	0xD047	Initial position detection method of synchronous motor before start	0: Pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	/	Change at stop
d0-72	0xD048	Auto-tuning configuration before start	Bit0: Reserved bit1: Start fast auto-tuning stator resistance 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection search 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	Change at stop
d0-75	0xD04B	Initial position detection current of synchronous motor	50 to 180	80	%	Change at stop
d0-76	0xD04C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop
d0-85	0xD055	Low speed handling mode	Ones: Synchronous motor V/f 0: Disable 1: Speed open-loop Tens: Synchronous motor SVC 0: Disable 1: Open loop normal mode of speed 2: Open loop advanced mode of speed Hundreds: Synchronous motor SVC 0: Disable 1: Speed open loop Thousands: Reserved Ten thousands: Reserved	101	/	Change at stop
d0-86	0xD056	Speed open loop current	0 to 800	100	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
d0-87	0xD057	Speed open loop switchover frequency	0.0 to 100.0	10.0	%	Real-time
d0-88	0xD058	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
d0-89	0xD059	Speed open loop waiting time in SVC	0.00 to 5.00	0.50	s	Real-time

10.2.5.2 d1 Limit and protection parameters of motor 1

Param.	Address	Name	Range	Default Value	Unit	Change Mode
d1-00	0xD100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
d1-01	0xD101	Positive speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
d1-02	0xD102	Negative speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
d1-03	0xD103	Digital setting of positive frequency upper limit 1	d1-07 to 800.0	800.0	%	Change at stop
d1-04	0xD104	Digital setting of reverse frequency upper limit 1	-800.0–d1-08	-800.0	%	Change at stop
d1-05	0xD105	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time

Param.	Address	Name	Range	Default Value	Unit	Change Mode
d1-06	0xD106	Source of reverse frequency upper limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d1-07	0xD107	Digital setting of forward frequency lower limit 1	0.0–d1-03	0.0	%	Change at stop
d1-08	0xD108	Digital setting of reverse frequency lower limit 1	d1-04 to 0.0	0.0	%	Change at stop
d1-09	0xD109	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
d1-10	0xD10A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
d1-11	0xD10B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d1-12	0xD10C	Source of torque lower limit 2	0: -800% 1: Inverted value of torque lower limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d1-13	0xD10D	Motoring power limit 1	0.0 to 1000.0	400.0	%	Real-time
d1-14	0xD10E	Generating power limit 1	0.0 to 1000.0	400.0	%	Real-time
d1-15	0xD10F	Generating power limit 2 setting	0: Disabled 1: Enabled in the whole process 2: Enabled at constant speed 3: Enabled during deceleration	0	-	Real-time
d1-17	0xD111	Generating power limit 2	0.0 to 800.0	20.0	%	Real-time

Param.	Address	Name	Range	Default Value	Unit	Change Mode
d1-33	0xD121	Motor protection	Bit 0: Reserved Bit 1: Current control error detection Bit 2: Motor step loss detection Bit 3: Reserved Bit 4: Permanent magnet synchronous motor demagnetization protection Bit 5: Runaway protection Bit 6: Speed reversal protection Bit7: Reserved Bit 8: Motor parameter error check Bit 9: Output single-phase loss detection Bit 10: Demagnetization protection for reluctance motor with field strengthening Bit 11 to Bit 15: Reserved Bit value 0: Disable Bit value 1: Enable	0x0687	-	Real-time
d1-35	0xD123	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
d1-36	0xD124	Overspeed protection time	0.0 to 60.0	0.5	s	Real-time
d1-37	0xD125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
d1-38	0xD126	Excessive speed deviation protection	0: Disable 1: Enable	1	-	Real-time
d1-39	0xD127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
d1-40	0xD128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
d1-41	0xD129	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
d1-45	0xD12D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
d1-46	0xD12E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
d1-47	0xD12F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real-time
d1-50	0xD132	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time

Param.	Address	Name	Range	Default Value	Unit	Change Mode
d1-54	0xD136	Overvoltage suppression	Bit 0: VF overvoltage suppression enable 0: Disable 1: Enable bit 1: Vector overvoltage suppression 0: Disable 1: Enable Bit 2 to Bit 15: reserved	0x0001	-	Real-time
d1-55	0xD137	Overvoltage suppression action voltage	600.0 to A3-57	770.0	V	Real-time
d1-56	0xD138	Effective voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Unchangeable
d1-57	0xD139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d1-58	0xD13A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d1-63	0xD13F	Undervoltage action	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real-time
d1-64	0xD140	Undervoltage suppression action voltage	A3-55 to 500.0	430.0	V	Real-time
d1-65	0xD141	Effective voltage threshold of undervoltage suppression	A3-55 to 500.0	430.0	V	Unchangeable
d1-66	0xD142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d1-67	0xD143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d1-68	0xD144	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
d1-69	0xD145	Time for decelerating to stop during undervoltage	0.0 to 300.0	20.0	s	Real-time
d1-70	0xD146	Recovery voltage hysteresis upon undervoltage	1 to 100	30	V	Real-time

Param.	Address	Name	Range	Default Value	Unit	Change Mode
d1-71	0xD147	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	Change at stop
d1-72	0xD148	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d1-73	0xD149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d1-77	0xD14D	Stall detection	0: Disable 1: Enable	0	-	Real-time
d1-78	0xD14E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
d1-79	0xD14F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
d1-80	0xD150	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
d1-81	0xD151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
d1-82	0xD152	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real-time
d1-83	0xD153	Motor stall detection time	0.0 to 10.0	0.5	s	Real-time
d1-84	0xD154	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
d1-87	0xD157	Current control exception detection time	0.00 to 1.00	0.05	s	Real-time
d1-88	0xD158	Current control exception detection threshold	0.0 to 200.0	25.0	%	Real-time
d1-89	0xD159	Output single-phase loss detection time	0.05 to 650.00	0.20	s	Real-time
d1-91	0xD15B	Asynchronous motor runaway protection time in SVC	0.05 to 0.50	0.10	s	Real-time
d1-92	0xD15C	Asynchronous motor runaway protection threshold in SVC	10.0 to 50.0	15.0	%	Real-time

10.2.5.3 d2 Motor 1 control optimization

Item	Address:	Name	Value Range	Default	Unit	Change:
d2-00	0xD200	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: V/f separation	0	/	Change at stop
d2-01	0xD201	Multi-point curve source	0: Three-point curve	0	/	Real time
d2-02	0xD202	Frequency point 1 on a multi-point V/f curve	0.0–d2-03	0.0	Hz	Real-time
d2-03	0xD203	Frequency point 2 on a multi-point V/f curve	d2-02 to d2-04	0.0	Hz	Real-time
d2-04	0xD204	Frequency point 3 on a multi-point V/f curve	d2-03 to 600.0	0.0	Hz	Real-time
d2-08	0xD208	Voltage point 1 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
d2-09	0xD209	Voltage point 2 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
d2-10	0xD20A	Voltage point 3 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
d2-14	0xD20E	Manual torque boost amount	0.0 to 100.0	3.0	%	Real-time
d2-15	0xD20F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real-time
d2-16	0xD210	Torque boost mode	0：Manual 1：Automatic 2：Manual+Automatic	2	/	Real time
d2-17	0xD211	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
d2-18	0xD212	Automatic torque boost gain	80 to 150	100	/	Real time
d2-22	0xD216	V/f oscillation suppression	0: Disable 1: Enable	1	/	Real time
d2-23	0xD217	V/f oscillation suppression gain	0 to 400	100	%	Real-time
d2-24	0xD218	Cut-off frequency of V/f oscillation suppression filter	1.0 to 50.0	8.0	Hz	Real-time
d2-25	0xD219	Cut-off frequency for active V/F oscillation suppression	0.0 to 600.0	400.0	%	Real-time
d2-26	0xD21A	Overcurrent suppression	0: Disable 1: Enable	1	/	Change at stop
d2-27	0xD21B	Overcurrent suppression threshold	80 to 300	200	%	Change at stop
d2-28	0xD21C	Overvoltage suppression Kp adjustment	1 to 500	100	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
d2-29	0xD21D	Overvoltage suppression Ki adjustment	10 to 1000	100	%	Change at stop
d2-30	0xD21E	Frequency threshold for overcurrent suppression field weakening	60 to 500	100	%	Real-time
d2-31	0xD21F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real-time
d2-32	0xD220	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real-time
d2-35	0xD223	Energy-saving in V/f control mode	0: Invalid 1: Valid	0	/	Real time
d2-36	0xD224	Cut-off frequency of V/f energy-saving control	20 to 100	30	%	Real-time
d2-37	0xD225	Voltage drop gain in V/f energy-saving control	10 to 500	100	%	Real-time
d2-38	0xD226	Boost gain in V/f energy-saving control	10 to 500	100	%	Real-time
d2-41	0xD229	Slip compensation mode	0: Disable 1: Enable	0	/	Change at stop
d2-42	0xD22A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
d2-43	0xD22B	Slip compensation filter time	0.1 to 10.0	0.5	s	Change at stop
d2-47	0xD22F	Upper limit of V/f separation voltage	50.0 to 200.0	100.0	%	Change at stop
d2-48	0xD230	Voltage source of V/f separation	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
d2-49	0xD231	Digital setting of V/f separation voltage	0–C4-03	0	V	Real-time
d2-50	0xD232	Voltage acceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
d2-51	0xD233	Voltage deceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
d2-52	0xD234	Frequency RFG time of V/f separation	0: RFG time forced to 0 1: Preset RFG time	0	/	Change at stop
d2-53	0xD235	Stop mode selection of V/f separation	0: Frequency and voltage decline to 0 independently 1: Frequency declines to 0 after voltage declines to 0 2: Coast to stop	0	/	Real time
d2-59	0xD23B	Synchronous motor V/f mode	1： Synchronous motor V/f	1	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
d2-60	0xD23C	Synchronous motor V/f current loop coefficient	0 to 1000	100	%	Real-time
d2-61	0xD23D	Synchronous motor V/f-MTPA coefficient	0 to 1000	0	%	Real-time
d2-62	0xD23E	Synchronous motor V/f oscillation suppression gain coefficient	0 to 500	100	%	Real-time
d2-63	0xD23F	V/f filter time coefficient of synchronous motor	0 to 500	100	%	Real-time
d2-64	0xD240	Synchronous motor V/f energy-saving control mode	0：Fixed linear V/f curve 1：Reactive current fixed to 30% of rated current 2：MTPA control	2	/	Change at stop

10.2.5.4 d3 Speed control parameter of motor 1

Item	Address:	Name	Value Range	Default	Unit	Change:
d3-00	0xD300	FVC speed loop proportional gain	0.0 to 6000.0	8.0	/	Real time
d3-01	0xD301	FVC speed loop integral time	0.000 to 20.000	0.080	s	Real-time
d3-02	0xD302	SVC speed loop Kp	0.0 to 6000.0	5.0	/	Real time
d3-03	0xD303	SVC speed loop Ti	0.000 to 20.000	0.127	s	Real-time
d3-06	0xD306	Zero speed switchover frequency	0.0–d3-09	1.0	%	Real-time
d3-07	0xD307	Zero speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-08	0xD308	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-09	0xD309	Low speed switchover frequency	0.0–d3-12	10.0	%	Real-time
d3-10	0xD30A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-11	0xD30B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-12	0xD30C	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real-time
d3-13	0xD30D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-14	0xD30E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
d3-19	0xD313	Adaptive source of speed loop Kp	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
d3-21	0xD315	Speed loop adaption switchover lower limit	0.0 to 1000.0	40.0	%	Real-time
d3-22	0xD316	Speed loop adaption switchover upper limit	0.0 to 1000.0	100.0	%	Real-time
d3-23	0xD317	Speed loop adaption correction lower limit	0.0 to 1000.0	100.0	%	Real-time
d3-24	0xD318	Speed loop adaption correction upper limit	0.0 to 1000.0	100.0	%	Real-time
d3-27	0xD31B	Droop function	0: Disable 1: Enable	0	/	Real time
d3-28	0xD31C	Droop source	0: Output torque 1: Torque reference 2: Speed adjustment output 3: Speed adjustment integral component	1	/	Change at stop
d3-29	0xD31D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
d3-33	0xD321	Forced integral enable	0: Disable 1: Enable Others: B connector	0	/	Real time
d3-34	0xD322	Integral force source	0: d3-35 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
d3-35	0xD323	Digital setting of integral forced value	-800.0 to 800.0	0.0	%	Real-time
d3-38	0xD326	Acceleration feedforward torque	0: Disable 1: Enable	0	/	Real time
d3-39	0xD327	Acceleration feedforward torque coefficient	0.0 to 6553.0	100.0	%	Real-time
d3-40	0xD328	Feedforward acceleration speed source	0: RFG reference 1: Automatic calculation Others: F connector	0	/	Real time
d3-45	0xD32D	Speed control window width	0.00 to +10.00	0.00	Hz	At stop

Item	Address:	Name	Value Range	Default	Unit	Change:
d3-46	0xD32E	Filter time of the frequency reference	0.0 to 100.0	0.0	ms	At stop:
d3-47	0xD32F	Filter time for feedback frequency	0.0 to 100.0	0.0	ms	At stop:
d3-48	0xD330	Current low-pass filter time for torque setting	0.0 to 100.0	0.0	ms	At stop:
d3-55	0xD337	Load disturbance prevention enable	0: Disable 1: Enable	0	/	Real time
d3-57	0xD339	Anti-load disturbance bandwidth	0.01 to 300.00	1.00	Hz	Real-time
d3-58	0xD33A	Anti-load disturbance coefficient	0.0 to 1000.0	100.0	%	Real-time

10.2.5.5 d4 Current control of motor 1

Item	Address:	Name	Value Range	Default	Unit	Change:
d4-00	0xD400	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
d4-01	0xD401	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time
d4-02	0xD402	Current loop Q-axis Kp coefficient	1 to 1000	100	%	Real-time
d4-03	0xD403	Current loop Q-axis Ki coefficient	1 to 1000	100	%	Real-time

10.2.5.6 d5 Excitation control of motor 1

Item	Address:	Name	Value Range	Default	Unit	Change:
d5-17	0xD511	Demagnetization current Limit	0 to 500	300	%	Real-time
d5-25	0xD519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	/	Real time

10.2.5.7 d7 Motor 1 control optimization

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d7-02	0xD702	FVC switched to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC mode when encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be recovered after stop.)	0	/	Real-time
d7-03	0xD703	Frequency for switching from FVC to SVC	10 to 500	50	%	Real-time
d7-04	0xD704	Hysteresis loop for switching from FVC to SVC	10 to 100	10	%	Real-time

10.2.5.8 d8 Basic control parameters of motor 2

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
d8-00	0xD800	Control mode	0: SVC 1: FVC 2: V/f	2	/	Change at stop
d8-01	0xD801	Motor control method	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
d8-02	0xD802	Start mode	0: Direct start 1: Flying start	0	/	Change at stop
d8-03	0xD803	Mode of speed tracking	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	4	/	Real time
d8-04	0xD804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	/	Real time
d8-05	0xD805	OFF2 (coast to stop) stop mode	0: Coast to stop	0	/	Unchangeable
d8-06	0xD806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	/	Real time
d8-07	0xD807	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	/	Real time
d8-08	0xD808	Stop mode in torque control	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	1	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
d8-09	0xD809	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
d8-10	0xD80A	Zero speed judgment time (actual speed)	0.00 to +10.00	0.10	s	Change at stop
d8-11	0xD80B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
d8-12	0xD80C	Zero speed judgment time of synchronous frequency	0.0 to 655.35	2.00	s	Change at stop
d8-13	0xD80D	Start/Stop frequency following	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
d8-14	0xD80E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	/	Change at stop
d8-16	0xD810	Shut-down time delay	0.0 to 655.35	0.00	s	Change at stop
d8-17	0xD811	Pre-excitation mode	0: Pre-excitation based on time 1: Pre-excitation based on the set current 2: Pre-excitation based on maximum current	1	/	Change at stop
d8-18	0xD812	Pre-excitation time	1 to 30000	1,000	ms	Real-time
d8-19	0xD813	Pre-excitation current	1 to 800	100	%	Real-time
d8-20	0xD814	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
d8-23	0xD817	Startup frequency	0.00 to +10.00	0.00	Hz	Real-time
d8-24	0xD818	Startup frequency hold time	0.0 to 1000.0	0.0	s	Change at stop
d8-25	0xD819	DC braking time at startup	0.0 to 100.0	0.0	s	Change at stop
d8-26	0xD81A	DC braking current at startup	0 to 800	50	%	Change at stop
d8-27	0xD81B	Start frequency of DC braking for stop	0.0 to 600.0	0.0	Hz	Real-time
d8-28	0xD81C	DC braking waiting time for stop	0.0 to 100.0	0.0	s	Real-time
d8-29	0xD81D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
d8-30	0xD81E	F6-13 (DC injection braking 2 level)	0 to 800	50	%	Real-time
d8-31	0xD81F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real-time
d8-32	0xD820	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
d8-35	0xD823	Current Limit during constant current	50.0 to 800.0	100.0	%	Real-time
d8-39	0xD827	Overexcitation selection (vector)	0: Inactive 1: Active	0	/	Real time
d8-40	0xD828	Overexciting current (vector)	0 to 800	100	%	Real-time
d8-41	0xD829	Overexcitation gain (V/f)	0 to 200	90	%	Real-time
d8-61	0xD83D	Star connection	0: Disabled 1: Enabled Others: B connector	0	/	Change at stop
d8-62	0xD83E	Delay time for starting shorting motor stator	0.0 to 5000.0	0.0	ms	Change at stop
d8-63	0xD83F	Holding time of shorting motor stator at stop	0.1 to 3600.0	10.0	s	Change at stop
d8-70	0xD846	Magnetic pole position detection mode when synchronous motor SVC starts	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	/	Change at stop
d8-71	0xD847	Initial position detection method of synchronous motor before start	0: Pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	/	Change at stop
d8-72	0xD848	Auto-tuning configuration before start	Bit0: Reserved bit1: Start fast auto-tuning stator resistance 0: Disable 1: Enable bit2 to bit6 : Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection search 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	Change at stop
d8-75	0xD84B	Initial position detection current of synchronous motor	50 to 180	80	%	Change at stop
d8-76	0xD84C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Item	Address:	Name	Value Range	Default	Unit	Change:
d8-85	0xD855	Low speed handling mode	Ones: Synchronous motor V/f 0: Disable 1: Speed open-loop Tens: Synchronous motor SVC 0: Disable 1: Open loop normal mode of speed 2: Open loop advanced mode of speed Hundreds: Synchronous motor SVC 0: Disable 1: Speed open loop Thousands: Reserved Ten thousands: Reserved	101	/	Change at stop
d8-86	0xD856	Speed open loop current	0 to 800	100	%	Real-time
d8-87	0xD857	Speed open loop switchover frequency	0.0 to 100.0	10.0	%	Real-time
d8-88	0xD858	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
d8-89	0xD859	Speed open loop waiting time in the SVC mode	0.00 to 5.00	0.50	s	Real-time

10.2.5.9 d9 Limit and protection parameters of motor 2

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
d9-00	0xD900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
d9-01	0xD901	Positive speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
d9-02	0xD902	Negative speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
d9-03	0xD903	Digital setting of positive frequency upper limit 1	d9-07 to 800.0	800.0	%	Change at stop
d9-04	0xD904	Digital setting of reverse frequency upper limit 1	-800.0~d9-08	-800.0	%	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
d9-05	0xD905	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d9-06	0xD906	Source of reverse frequency upper limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d9-07	0xD907	Digital setting of forward frequency lower limit 1	0.0-d9-03	0.0	%	Change at stop
d9-08	0xD908	Digital setting of reverse frequency lower limit 1	d9-04 to 0.0	0.0	%	Change at stop
d9-09	0xD909	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
d9-10	0xD90A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
d9-11	0xD90B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d9-12	0xD90C	Source of torque lower limit 2	0: -800% 1: Inverted value of upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d9-13	0xD90D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
d9-14	0xD90E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
d9-15	0xD90F	Generating power limit selection	0: Disabled 1: Enabled in the whole process 2: Enabled at constant speed 3: Enabled during deceleration	0	-	Real-time
d9-17	0xD911	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time
d9-33	0xD921	Motor protection	Bit 0: Reserved Bit 1: Current control error detection Bit 2: Motor step loss detection Bit 3: Reserved Bit 4: Permanent magnet synchronous motor demagnetization protection Bit 5: Runaway protection Bit 6: Speed reversal protection Bit7: Reserved Bit 8: Motor parameter error check Bit 9: Output single-phase loss detection Bit 10: Demagnetization protection for reluctance motor with field strengthening Bit 11 to Bit 15: Reserved Bit value 0: Disable Bit value 1: Enable	0x0687	-	Real-time
d9-35	0xD923	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
d9-36	0xD924	Overspeed protection time	0.0 to 60.0	0.5	s	Real-time
d9-37	0xD925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
d9-38	0xD926	Excessive speed deviation protection	0: Disable 1: Enable	1	-	Real-time
d9-39	0xD927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
d9-40	0xD928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
d9-41	0xD929	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
d9-45	0xD92D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
d9-46	0xD92E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
d9-47	0xD92F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
d9-50	0xD932	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
d9-54	0xD936	Overvoltage suppression	Bit 0: VF overvoltage suppression enable 0: Disable 1: Enable bit 1: Vector overvoltage suppression 0: Disable 1: Enable Bit 2 to Bit 15: reserved	0x0001	-	Real-time
d9-55	0xD937	Overvoltage suppression action voltage	600.0 to A3-57	770.0	V	Real-time
d9-56	0xD938	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	770.0	V	Unchangeable
d9-57	0xD939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d9-58	0xD93A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d9-63	0xD93F	Undervoltage action selection	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real-time
d9-64	0xD940	Undervoltage suppression action voltage	A3-55 to 500.0	430.0	V	Real-time
d9-65	0xD941	Effective voltage threshold of undervoltage suppression	A4-35 to 500.0	430.0	V	Unchangeable
d9-66	0xD942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d9-67	0xD943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d9-68	0xD944	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
d9-69	0xD945	Time for decelerating to stop during undervoltage	0.0 to 300.0	20.0	s	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
d9-70	0xD946	Recovery voltage hysteresis upon undervoltage	1 to 100	30	V	Real-time
d9-71	0xD947	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	Change at stop
d9-72	0xD948	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d9-73	0xD949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d9-77	0xD94D	Stall detection	0: Disable 1: Enable	0	-	Real-time
d9-78	0xD94E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
d9-79	0xD94F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
d9-80	0xD950	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
d9-81	0xD951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
d9-82	0xD952	Current threshold of output three-phase loss	0.0 to 100.0	10.0	%	Real-time
d9-83	0xD953	Motor stall detection time	0.0 to 10.0	0.5	s	Real-time
d9-84	0xD954	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
d9-87	0xD957	Current control exception detection time	0.00 to 1.00	0.05	s	Real-time
d9-88	0xD958	Current control exception detection threshold	0.0 to 200.0	25.0	%	Real-time
d9-89	0xD959	Output single-phase loss detection time	0.05 to 650.00	0.20	s	Real-time
d9-91	0xD95B	Asynchronous motor runaway protection time in SVC	0.05 to 0.50	0.10	s	Real-time
d9-92	0xD95C	Asynchronous motor runaway protection threshold in SVC	10.0 to 50.0	15.0	%	Real-time

10.2.5.10 Motor 1-V/f control

Item	Address:	Name	Value Range	Default	Unit	Change:
DA-00	0xDA00	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: V/f separation	0	/	Change at stop
DA-01	0xDA01	Multi-point curve source	0: Three-point curve	0	/	Real time
DA-02	0xDA02	Frequency point 1 on a multi-point V/f curve	0.0 to -03	0.0	Hz	Real-time
DA-03	0xDA03	Frequency point 2 on a multi-point V/f curve	DA-02 to dA-04	0.0	Hz	Real-time
DA-04	0xDA04	Frequency point 3 on a multi-point V/f curve	-03-600.0	0.0	Hz	Real-time
DA-08	0xDA08	Voltage point 1 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
DA-09	0xDA09	Voltage point 2 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
DA-10	0xDA0A	Voltage point 3 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
DA-14	0xDA0E	Manual torque boost amount	0.0 to 100.0	3.0	%	Real-time
DA-15	0xDA0F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real-time
DA-16	0xDA10	Torque boost mode	0：Manual 1：Automatic 2：Manual+Automatic	2	/	Real time
DA-17	0xDA11	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
DA-18	0xDA12	Automatic torque boost gain	80 to 150	100	/	Real time
DA-22	0xDA16	V/f oscillation suppression	0: Disable 1: Enable	1	/	Real time
DA-23	0xDA17	V/f oscillation suppression gain	0 to 400	100	%	Real-time
DA-24	0xDA18	Cut-off frequency of V/f oscillation suppression filter	1.0 to 50.0	8.0	Hz	Real-time
DA-25	0xDA19	Cut-off frequency for active V/F oscillation suppression	0.0 to 600.0	400.0	%	Real-time
DA-26	0xDA1A	Overcurrent suppression	0: Disable 1: Enable	1	/	Change at stop
DA-27	0xDA1B	Overcurrent suppression threshold	80 to 300	200	%	Change at stop
DA-28	0xDA1C	Overvoltage suppression Kp adjustment	1 to 500	100	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
DA-29	0xDA1D	Overvoltage suppression Ki adjustment	10 to 1000	100	%	Change at stop
DA-30	0xDA1E	Frequency threshold for overcurrent suppression field weakening	60 to 500	100	%	Real-time
DA-31	0xDA1F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real-time
DA-32	0xDA20	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real-time
DA-35	0xDA23	Energy-saving in V/f control mode	0: Invalid 1: Valid	0	/	Real time
DA-36	0xDA24	Cut-off frequency of V/f energy-saving control	20 to 100	30	%	Real-time
DA-37	0xDA25	Voltage drop gain in V/f energy-saving control	10 to 500	100	%	Real-time
DA-38	0xDA26	Boost gain in V/f energy-saving control	10 to 500	100	%	Real-time
DA-41	0xDA29	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	/	Change at stop
DA-42	0xDA2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
DA-43	0xDA2B	Slip compensation filter time	0.1 to 10.0	0.5	s	Change at stop
DA-47	0xDA2F	Upper limit of V/f separation voltage	50.0 to 200.0	100.0	%	Change at stop
DA-48	0xDA30	Voltage source of V/f separation	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
DA-49	0xDA31	Digital setting of V/f separation voltage	0-C7-03	0	V	Real-time
DA-50	0xDA32	Voltage acceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
DA-51	0xDA33	Voltage deceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
DA-52	0xDA34	Frequency RFG time of V/f separation	0: RFG time forced to 0 1: Preset RFG time	0	/	Change at stop
DA-53	0xDA35	Stop mode selection of V/f separation	0: Frequency and voltage decline to 0 independently 1: Frequency declines to 0 after voltage declines to 0 2: Coast to stop	0	/	Real time
DA-59	0xDA3B	Synchronous motor V/f mode	0: Synchronous motor V/f1 1: Synchronous motor V/f2	1	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
DA-60	0xDA3C	Synchronous motor V/f current loop coefficient	0 to 1000	100	%	Real-time
DA-61	0xDA3D	Synchronous motor V/f-MTPA coefficient	0 to 1000	0	%	Real-time
DA-62	0xDA3E	Synchronous motor V/f oscillation suppression gain coefficient	0 to 500	100	%	Real-time
DA-63	0xDA3F	V/f filter time coefficient of synchronous motor	0 to 500	100	%	Real-time
DA-64	0xDA40	Synchronous motor V/f energy-saving control mode	0：Fixed linear V/f curve 1：Reactive current fixed to 30% of rated current 2：MTPA control	2	/	Change at stop

10.2.5.11 db Speed control parameters of motor 2

Item	Address:	Name	Value Range	Default	Unit	Change:
Db-00	0xDB00	FVC speed loop proportional gain	0.0 to 6000.0	8.0	/	Real time
Db-01	0xDB01	FVC speed loop integral time	0.000 to 20.000	0.080	s	Real-time
Db-02	0xDB02	SVC speed loop Kp	0.0 to 6000.0	5.0	/	Real time
Db-03	0xDB03	SVC speed loop Ti	0.000 to 20.000	0.127	s	Real-time
Db-06	0xDB06	Zero speed switchover frequency	0.0 to -09	1.0	%	Real-time
Db-07	0xDB07	Zero speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Db-08	0xDB08	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
Db-09	0xDB09	Low speed switchover frequency	0.0 to -12	10.0	%	Real-time
Db-10	0xDB0A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Db-11	0xDB0B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
Db-12	0xDB0C	High speed switchover frequency	-09-400.0	100.0	%	Real-time
Db-13	0xDB0D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Db-14	0xDB0E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
Db-19	0xDB13	Adaptive source of speed loop Kp	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
Db-21	0xDB15	Speed loop adaption switchover lower limit	0.0 to 1000.0	40.0	%	Real-time
Db-22	0xDB16	Speed loop adaption switchover upper limit	0.0 to 1000.0	100.0	%	Real-time
Db-23	0xDB17	Speed loop adaption correction lower limit	0.0 to 1000.0	100.0	%	Real-time
Db-24	0xDB18	Speed loop adaption correction upper limit	0.0 to 1000.0	100.0	%	Real-time
Db-27	0xDB1B	Droop function	0: Disable 1: Enable	0	/	Real time
Db-28	0xDB1C	Droop source	0: Output torque 1: Torque reference 2: Speed adjustment output 3: Speed adjustment integral component	1	/	Change at stop
Db-29	0xDB1D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
Db-33	0xDB21	Forced integral enable	0: Disable 1: Enable Others: B connector	0	/	Real time
Db-34	0xDB22	Integral force source	0: b5-35 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
Db-35	0xDB23	Digital setting of integral forced value	-800.0 to 800.0	0.0	%	Real-time
Db-38	0xDB26	Acceleration feedforward torque	0: Disable 1: Enable	0	/	Real time
Db-39	0xDB27	Acceleration feedforward torque coefficient	0.0 to 6553.0	100.0	%	Real-time
Db-40	0xDB28	Feedforward acceleration speed source	0: RFG reference 1: Automatic calculation Others: F connector	0	/	Real time
Db-45	0xDB2D	Speed control window width	0.00 to +10.00	0.00	Hz	At stop
Db-46	0xDB2E	Indicates the filter time of the frequency reference.	0.0 to 100.0	0.0	ms	Change at stop
Db-47	0xDB2F	Filter time for feedback frequency	0.0 to 100.0	0.0	ms	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
Db-48	0xDB30	Current filter time for torque reference	0.0 to 100.0	0.0	ms	Change at stop
Db-55	0xDB37	Load disturbance prevention enable	0: Disable 1: Enable	0	/	Real time
Db-57	0xDB39	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
Db-58	0xDB3A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.2.5.12 dC Current control parameters of motor 2

Item	Address:	Name	Value Range	Default	Unit	Change:
DC-00	0xDC00	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
DC-01	0xDC01	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time
DC-02	0xDC02	Current loop q-axis Kp adjustment	1 to 1000	100	%	Real-time
DC-03	0xDC03	Current loop q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.2.5.13 Dd Excitation control parameters of motor 2

Item	Address:	Name	Value Range	Default	Unit	Change:
dd-17	0xDD11	Demagnetization current Limit	0 to 500	300	%	Real-time
dd-25	0xDD19	Energy-saving control	0: Disable 1: Enable	0	/	Real time

10.2.5.14 dF Control optimization parametrs of motor 2

Item	Address:	Name	Value Range	Default	Unit	Change:
DF-02	0xDF02	FVC switched to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC mode when encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be recovered after stop.)	0	/	Real-time
DF-03	0xDF03	Frequency for switching from FVC to SVC	10 to 500	50	%	Real-time
DF-04	0xDF04	Hysteresis loop for switching from FVC to SVC	10 to 100	10	%	Real-time

10.2.6 Group y Control Parameters of Motor 1/2

10.2.6.1 y0 Basic control parameters of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
y0-00	0x4000	Control mode	0: SVC 1: FVC 2: V/f	2	/	Change at stop
y0-01	0x4001	Motor control method	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
y0-02	0x4002	Start mode	0: Direct start 1: Flying start	0	/	Change at stop
y0-03	0x4003	Mode of speed tracking	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	4	/	Real time
y0-04	0x4004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	/	Real time
y0-05	0x4005	OFF2 (coast to stop) stop mode	0: Coast to stop	0	/	Unchangeable
y0-06	0x4006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	/	Real time
y0-07	0x4007	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
y0-08	0x4008	Stop mode in torque control	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	1	/	Change at stop
y0-09	0x4009	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
y0-10	0x400A	Zero speed judgment time (actual speed)	0.00 to +10.00	0.10	s	Change at stop
y0-11	0x400B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
y0-12	0x400C	Zero speed judgment time of synchronous frequency	0.0 to 655.35	2.00	s	Change at stop
y0-13	0x400D	Start/Stop frequency following	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
y0-14	0x400E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	/	Change at stop
y0-16	0x4010	Shut-down time delay	0.0 to 655.35	0.00	s	Change at stop
y0-17	0x4011	Pre-excitation mode	0: Pre-excitation based on time 1: Pre-excitation based on the set current 2: Pre-excitation based on maximum current	1	/	Change at stop
y0-18	0x4012	Pre-excitation time	1 to 30000	1,000	ms	Real-time
y0-19	0x4013	Pre-excitation current	1 to 800	100	%	Real-time
y0-20	0x4014	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
y0-23	0x4017	Startup frequency	0.00 to +10.00	0.00	Hz	Real-time
y0-24	0x4018	Startup frequency hold time	0.0 to 1000.0	0.0	s	Change at stop
y0-25	0x4019	DC braking time at startup	0.0 to 100.0	0.0	s	Change at stop
y0-26	0x401A	DC braking current at startup	0 to 800	50	%	Change at stop
y0-27	0x401B	Start frequency of DC braking for stop	0.0 to 600.0	0.0	Hz	Real-time
y0-28	0x401C	DC braking waiting time for stop	0.0 to 100.0	0.0	s	Real-time
y0-29	0x401D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
y0-30	0x401E	F6-13 (DC injection braking 2 level)	0 to 800	50	%	Real-time
y0-31	0x401F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
y0-32	0x4020	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
y0-35	0x4023	Current Limit during constant current	50.0 to 800.0	100.0	%	Real-time
y0-39	0x4027	Overexcitation selection (vector)	0: Inactive 1: Active	0	/	Real time
y0-40	0x4028	Overexciting current (vector)	0 to 800	100	%	Real-time
y0-41	0x4029	Overexcitation gain (V/f)	0 to 200	90	%	Real-time
y0-61	0x403D	Star connection	0: Disabled 1: Enabled Others: B connector	0	/	Change at stop
y0-62	0x403E	Delay time for starting shorting motor stator	0.0 to 5000.0	0.0	ms	Change at stop
y0-63	0x403F	Holding time of shorting motor stator at stop	0.1 to 3600.0	10.0	s	Change at stop
y0-70	0x4046	Magnetic pole position detection mode when synchronous motor SVC starts	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	/	Change at stop
y0-71	0x4047	Initial position detection method of synchronous motor before start	0: Pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	/	Change at stop
y0-72	0x4048	Auto-tuning configuration before start	Bit0: Reserved bit1: Start fast auto-tuning stator resistance 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection search 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	Change at stop
y0-75	0x404B	Initial position detection current of synchronous motor	50 to 180	80	%	Change at stop
y0-76	0x404C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Item	Address:	Name	Value Range	Default	Unit	Change:
y0-85	0x4055	Low speed handling mode	Ones: Synchronous motor V/f 0: Disable 1: Speed open-loop Tens: Synchronous motor SVC 0: Disable 1: Open loop normal mode of speed 2: Open loop advanced mode of speed Hundreds: Synchronous motor SVC 0: Disable 1: Speed open loop Thousands: Reserved Ten thousands: Reserved	101	/	Change at stop
y0-86	0x4056	Speed open loop current	0 to 800	100	%	Real-time
y0-87	0x4057	Speed open loop switchover frequency	0.0 to 100.0	10.0	%	Real-time
y0-88	0x4058	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
y0-89	0x4059	Speed open loop waiting time in the SVC mode	0.00 to 5.00	0.50	s	Real-time

10.2.6.2 y1 Limit and protection parameters of motor 3

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y1-00	0x4100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
y1-01	0x4101	Positive speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
y1-02	0x4102	Negative speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
y1-03	0x4103	Digital setting of positive frequency upper limit 1	y1-07 to 800.0	800.0	%	Change at stop
y1-04	0x4104	Digital setting of reverse frequency upper limit 1	-800.0–y1-08	-800.0	%	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y1-05	0x4105	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y1-06	0x4106	Source of reverse frequency upper limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y1-07	0x4107	Digital setting of forward frequency lower limit 1	0.0–y1-03	0.0	%	Change at stop
y1-08	0x4108	Digital setting of reverse frequency lower limit 1	y1-04 to 0.0	0.0	%	Change at stop
y1-09	0x4109	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
y1-10	0x410A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
y1-11	0x410B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y1-12	0x410C	Source of torque lower limit 2	0: -800% 1: Inverted value of upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y1-13	0x410D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y1-14	0x410E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
y1-15	0x410F	Generating power limit selection	0: Disabled 1: Enabled in the whole process 2: Enabled at constant speed 3: Enabled during deceleration	0	-	Real-time
y1-17	0x4111	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time
y1-33	0x4121	Motor protection	Bit 0: Reserved Bit 1: Current control error detection Bit 2: Motor step loss detection Bit 3: Reserved Bit 4: Permanent magnet synchronous motor demagnetization protection Bit 5: Runaway protection Bit 6: Speed reversal protection Bit7: Reserved Bit 8: Motor parameter error checkBit 9: Output single-phase loss detection Bit 10: Demagnetization protection for reluctance motor with field strengthening Bit 11 to Bit 15: Reserved Bit value 0: Disable Bit value 1: Enable	0x0687	-	Real-time
y1-35	0x4123	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
y1-36	0x4124	Overspeed protection time	0.0 to 60.0	0.5	s	Real-time
y1-37	0x4125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
y1-38	0x4126	Excessive speed deviation protection	0: Disable 1: Enable	1	-	Real-time
y1-39	0x4127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
y1-40	0x4128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
y1-41	0x4129	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
y1-45	0x412D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
y1-46	0x412E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
y1-47	0x412F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y1-50	0x4132	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
y1-54	0x4136	Overvoltage suppression	Bit 0: VF overvoltage suppression enable 0: Disable 1: Enable bit 1: Vector overvoltage suppression 0: Disable 1: Enable Bit 2 to Bit 15: reserved	0x0001	-	Real-time
y1-55	0x4137	Overvoltage suppression action voltage	600.0 to A3-57	770.0	V	Real-time
y1-56	0x4138	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	770.0	V	Unchangeable
y1-57	0x4139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y1-58	0x413A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y1-63	0x413F	Undervoltage action selection	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real-time
y1-64	0x4140	Undervoltage suppression action voltage	A3-55 to 500.0	430.0	V	Real-time
y1-65	0x4141	Effective voltage threshold of undervoltage suppression	A4-35 to 500.0	430.0	V	Unchangeable
y1-66	0x4142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y1-67	0x4143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y1-68	0x4144	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
y1-69	0x4145	Time for decelerating to stop during undervoltage	0.0 to 300.0	20.0	s	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y1-70	0x4146	Recovery voltage hysteresis upon undervoltage	1 to 100	30	V	Real-time
y1-71	0x4147	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	Change at stop
y1-72	0x4148	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y1-73	0x4149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y1-77	0x414D	Stall detection	0: Disable 1: Enable	0	-	Real-time
y1-78	0x414E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
y1-79	0x414F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
y1-80	0x4150	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
y1-81	0x4151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
y1-82	0x4152	Current threshold of output three-phase loss	0.0 to 100.0	10.0	%	Real-time
y1-83	0x4153	Motor stall detection time	0.0 to 10.0	0.5	s	Real-time
y1-84	0x4154	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
y1-87	0x4157	Current control exception detection time	0.00 to 1.00	0.05	s	Real-time
y1-88	0x4158	Current control exception detection threshold	0.0 to 200.0	25.0	%	Real-time
y1-89	0x4159	Output single-phase loss detection time	0.05 to 650.00	0.20	s	Real-time
y1-91	0x415B	Asynchronous motor runaway protection time in SVC	0.05 to 0.50	0.10	s	Real-time
y1-92	0x415C	Asynchronous motor runaway protection threshold in SVC	10.0 to 50.0	15.0	%	Real-time

10.2.6.3 y2 Control parameters of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
y2-00	0x4200	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: V/f separation	0	/	Change at stop
y2-01	0x4201	Multi-point curve source	0: Three-point curve	0	/	Real time
y2-02	0x4202	Frequency point 1 on a multi-point V/f curve	0.0–y2-03	0.0	Hz	Real-time
y2-03	0x4203	Frequency point 2 on a multi-point V/f curve	y2-02 to y2-04	0.0	Hz	Real-time
y2-04	0x4204	Frequency point 3 on a multi-point V/f curve	y2-03 to 600.0	0.0	Hz	Real-time
y2-08	0x4208	Voltage point 1 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
y2-09	0x4209	Voltage point 2 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
y2-10	0x420A	Voltage point 3 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
y2-14	0x420E	Manual torque boost amount	0.0 to 100.0	3.0	%	Real-time
y2-15	0x420F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real-time
y2-16	0x4210	Torque boost mode	0：Manual 1：Automatic 2：Manual+Automatic	2	/	Real time
y2-17	0x4211	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
y2-18	0x4212	Automatic torque boost gain	80 to 150	100	/	Real time
y2-22	0x4216	V/f oscillation suppression	0: Disable 1: Enable	1	/	Real time
y2-23	0x4217	V/f oscillation suppression gain	0 to 400	100	%	Real-time
y2-24	0x4218	Cut-off frequency of V/f oscillation suppression filter	1.0 to 50.0	8.0	Hz	Real-time
y2-25	0x4219	Cut-off frequency for active V/F oscillation suppression	0.0 to 600.0	400.0	%	Real-time
y2-26	0x421A	Overcurrent suppression	0: Disable 1: Enable	1	/	Change at stop
y2-27	0x421B	Overcurrent suppression threshold	80 to 300	200	%	Change at stop
y2-28	0x421C	Overvoltage suppression Kp adjustment	1 to 500	100	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
y2-29	0x421D	Overvoltage suppression Ki adjustment	10 to 1000	100	%	Change at stop
y2-30	0x421E	Frequency threshold for overcurrent suppression field weakening	60 to 500	100	%	Real-time
y2-31	0x421F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real-time
y2-32	0x4220	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real-time
y2-35	0x4223	Energy-saving in V/f control mode	0: Invalid 1: Valid	0	/	Real time
y2-36	0x4224	Cut-off frequency of V/f energy-saving control	20 to 100	30	%	Real-time
y2-37	0x4225	Voltage drop gain in V/f energy-saving control	10 to 500	100	%	Real-time
y2-38	0x4226	Boost gain in V/f energy-saving control	10 to 500	100	%	Real-time
y2-41	0x4229	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	/	Change at stop
y2-42	0x422A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
y2-43	0x422B	Slip compensation filter time	0.1 to 10.0	0.5	s	Change at stop
y2-47	0x422F	Upper limit of V/f separation voltage	50.0 to 200.0	100.0	%	Change at stop
y2-48	0x4230	Voltage source of V/f separation	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
y2-49	0x4231	Digital setting of V/f separation voltage	0-CA-03	0	V	Real-time
y2-50	0x4232	Voltage acceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
y2-51	0x4233	Voltage deceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
y2-52	0x4234	Frequency RFG time of V/f separation	0: RFG time forced to 0 1: Preset RFG time	0	/	Change at stop
y2-53	0x4235	Stop mode selection of V/f separation	0: Frequency and voltage decline to 0 independently 1: Frequency declines to 0 after voltage declines to 0 2: Coast to stop	0	/	Real time
y2-59	0x423B	Synchronous motor V/f mode	0: Synchronous motor V/f1 1: Synchronous motor V/f2	1	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
y2-60	0x423C	Synchronous motor V/f current loop coefficient	0 to 1000	100	%	Real-time
y2-61	0x423D	Synchronous motor V/f-MTPA coefficient	0 to 1000	0	%	Real-time
y2-62	0x423E	Synchronous motor V/f oscillation suppression gain coefficient	0 to 500	100	%	Real-time
y2-63	0x423F	V/f filter time coefficient of synchronous motor	0 to 500	100	%	Real-time
y2-64	0x4240	Synchronous motor V/f energy-saving control mode	0：Fixed linear V/f curve 1：Reactive current fixed to 30% of rated current 2：MTPA control	2	/	Change at stop

10.2.6.4 y3 Speed control parameter of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
y3-00	0x4300	FVC speed loop proportional gain	0.0 to 6000.0	8.0	/	Real time
y3-01	0x4301	FVC speed loop integral time	0.000 to 20.000	0.080	s	Real-time
y3-02	0x4302	SVC speed loop Kp	0.0 to 6000.0	5.0	/	Real time
y3-03	0x4303	SVC speed loop Ti	0.000 to 20.000	0.127	s	Real-time
y3-06	0x4306	Zero speed switchover frequency	0.0–y3-09	1.0	%	Real-time
y3-07	0x4307	Zero speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-08	0x4308	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-09	0x4309	Low speed switchover frequency	0.0–y3-12	10.0	%	Real-time
y3-10	0x430A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-11	0x430B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-12	0x430C	High speed switchover frequency	y3-09 to 400.0	100.0	%	Real-time
y3-13	0x430D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-14	0x430E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
y3-19	0x4313	Adaptive source of speed loop Kp	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
y3-21	0x4315	Speed loop adaption switchover lower limit	0.0 to 1000.0	40.0	%	Real-time
y3-22	0x4316	Speed loop adaption switchover upper limit	0.0 to 1000.0	100.0	%	Real-time
y3-23	0x4317	Speed loop adaption correction lower limit	0.0 to 1000.0	100.0	%	Real-time
y3-24	0x4318	Speed loop adaption correction upper limit	0.0 to 1000.0	100.0	%	Real-time
y3-27	0x431B	Droop function	0: Disable 1: Enable	0	/	Real time
y3-28	0x431C	Droop source	0: Output torque 1: Torque reference 2: Speed adjustment output 3: Speed adjustment integral component	1	/	Change at stop
y3-29	0x431D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
y3-33	0x4321	Forced integral enable	0: Disable 1: Enable Others: B connector	0	/	Real time
y3-34	0x4322	Integral force source	0: y3-35 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
y3-35	0x4323	Digital setting of integral forced value	-800.0 to 800.0	0.0	%	Real-time
y3-38	0x4326	Acceleration feedforward torque	0: Disable 1: Enable	0	/	Real time
y3-39	0x4327	Acceleration feedforward torque coefficient	0.0 to 6553.0	100.0	%	Real-time
y3-40	0x4328	Feedforward acceleration speed source	0: RFG reference 1: Automatic calculation Others: F connector	0	/	Real time
y3-45	0x432D	Speed control window width	0.00 to +10.00	0.00	Hz	At stop
y3-46	0x432E	Indicates the filter time of the frequency reference.	0.0 to 100.0	0.0	ms	Change at stop
y3-47	0x432F	Filter time for feedback frequency	0.0 to 100.0	0.0	ms	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
y3-48	0x4330	Current filter time for torque reference	0.0 to 100.0	0.0	ms	Change at stop
y3-55	0x4337	Load disturbance prevention enable	0: Disable 1: Enable	0	/	Real time
y3-57	0x4339	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
y3-58	0x433A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.2.6.5 y4 Current control of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
y4-00	0x4400	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
y4-01	0x4401	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time
y4-02	0x4402	Current loop q-axis Kp adjustment	1 to 1000	100	%	Real-time
y4-03	0x4403	Current loop q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.2.6.6 y5 Excitation control of motor 3

Item	Address:	Name	Value Range	Default	Unit	Change:
y5-17	0x4511	Demagnetization current Limit	0 to 500	300	%	Real-time
y5-25	0x4519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	/	Real time

10.2.6.7 y7 Motor 3 control optimization

Param.	Address	Name	Value Range	Default	Unit	Change Mode
y7-02	0x4702	FVC switched to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC mode when encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be recovered after stop.)	0	/	Real-time
y7-03	0x4703	Frequency for switching from FVC to SVC	10 to 500	50	%	Real-time
y7-04	0x4704	Hysteresis loop for switching from FVC to SVC	10 to 100	10	%	Real-time

10.2.6.8 y8 Basic control parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
y8-00	0x4800	Control mode	0: SVC 1: FVC 2: V/f	2	/	Change at stop
y8-01	0x4801	Motor control method	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
y8-02	0x4802	Start mode	0: Direct start 1: Flying start	0	/	Change at stop
y8-03	0x4803	Mode of speed tracking	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	4	/	Real time
y8-04	0x4804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	/	Real time
y8-05	0x4805	OFF2 (coast to stop) stop mode	0: Coast to stop	0	/	Unchangeable
y8-06	0x4806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	/	Real time
y8-07	0x4807	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	/	Real time
y8-08	0x4808	Stop mode in torque control	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	1	/	Change at stop
y8-09	0x4809	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
y8-10	0x480A	Zero speed judgment time (actual speed)	0.00 to +10.00	0.10	s	Change at stop
y8-11	0x480B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
y8-12	0x480C	Zero speed judgment time of synchronous frequency	0.0 to 655.35	2.00	s	Change at stop
y8-13	0x480D	Start/Stop frequency following	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
y8-14	0x480E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	/	Change at stop
y8-16	0x4810	Shut-down time delay	0.0 to 655.35	0.00	s	Change at stop
y8-17	0x4811	Pre-excitation mode	0: Pre-excitation based on time 1: Pre-excitation based on the set current 2: Pre-excitation based on maximum current	1	/	Change at stop
y8-18	0x4812	Pre-excitation time	1 to 30000	1,000	ms	Real-time
y8-19	0x4813	Pre-excitation current	1 to 800	100	%	Real-time
y8-20	0x4814	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
y8-23	0x4817	Startup frequency	0.00 to +10.00	0.00	Hz	Real-time
y8-24	0x4818	Startup frequency hold time	0.0 to 1000.0	0.0	s	Change at stop
y8-25	0x4819	DC braking time at startup	0.0 to 100.0	0.0	s	Change at stop
y8-26	0x481A	DC braking current at startup	0 to 800	50	%	Change at stop
y8-27	0x481B	Start frequency of DC braking for stop	0.0 to 600.0	0.0	Hz	Real-time
y8-28	0x481C	DC braking waiting time for stop	0.0 to 100.0	0.0	s	Real-time
y8-29	0x481D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
y8-30	0x481E	F6-13 (DC injection braking 2 level)	0 to 800	50	%	Real-time
y8-31	0x481F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real-time
y8-32	0x4820	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
y8-35	0x4823	Current Limit during constant current	50.0 to 800.0	100.0	%	Real-time
y8-39	0x4827	Overexcitation selection (vector)	0: Inactive 1: Active	0	/	Real time
y8-40	0x4828	Overexciting current (vector)	0 to 800	100	%	Real-time
y8-41	0x4829	Overexcitation gain (V/f)	0 to 200	90	%	Real-time
y8-61	0x483D	Star connection	0: Disabled 1: Enabled Others: B connector	0	/	Change at stop
y8-62	0x483E	Delay time for starting shorting motor stator	0.0 to 5000.0	0.0	ms	Change at stop
y8-63	0x483F	Holding time of shorting motor stator at stop	0.1 to 3600.0	10.0	s	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
y8-70	0x4846	Magnetic pole position detection mode when synchronous motor SVC starts	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	/	Change at stop
y8-71	0x4847	Initial position detection method of synchronous motor before start	0: Pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	/	Change at stop
y8-72	0x4848	Auto-tuning configuration before start	Bit0: Reserved bit1: Start fast auto-tuning stator resistance 0: Disable 1: Enable bit2 to bit6 : Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection search 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	Change at stop
y8-75	0x484B	Initial position detection current of synchronous motor	50 to 180	80	%	Change at stop
y8-76	0x484C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop
y8-85	0x4855	Low speed handling mode	Ones: Synchronous motor V/f 0: Disable 1: Speed open-loop Tens: Synchronous motor SVC 0: Disable 1: Open loop normal mode of speed 2: Open loop advanced mode of speed Hundreds: Synchronous motor SVC 0: Disable 1: Speed open loop Thousands: Reserved Ten thousands: Reserved	101	/	Change at stop
y8-86	0x4856	Speed open loop current	0 to 800	100	%	Real-time
y8-87	0x4857	Speed open loop switchover frequency	0.0 to 100.0	10.0	%	Real-time
y8-88	0x4858	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
y8-89	0x4859	Speed open loop waiting time in the SVC mode	0.00 to 5.00	0.50	s	Real-time

10.2.6.9 y9 Limit and protection parameters of motor 4

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y9-00	0x4900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
y9-01	0x4901	Positive speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
y9-02	0x4902	Negative speed permission	0: Prohibited 1: Allowed 3: DI1 4: DI2 5 to 9: DI3 to DI7 (MD630S) Others: B connector	1	-	Real-time
y9-03	0x4903	Digital setting of positive frequency upper limit 1	y9-07 to 800.0	800.0	%	Change at stop
y9-04	0x4904	Digital setting of reverse frequency upper limit 1	-800.0–y9-08	-800.0	%	Change at stop
y9-05	0x4905	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y9-06	0x4906	Source of reverse frequency upper limit 2	0: -800% 1: Inverted value of positive frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y9-07	0x4907	Digital setting of forward frequency lower limit 1	0.0–y9-03	0.0	%	Change at stop
y9-08	0x4908	Digital setting of reverse frequency lower limit 1	y9-04 to 0.0	0.0	%	Change at stop
y9-09	0x4909	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
y9-10	0x490A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y9-11	0x490B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y9-12	0x490C	Source of torque lower limit 2	0: -800% 1: Inverted value of upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y9-13	0x490D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time
y9-14	0x490E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
y9-15	0x490F	Generating power limit selection	0: Disabled 1: Enabled in the whole process 2: Enabled at constant speed 3: Enabled during deceleration	0	-	Real-time
y9-17	0x4911	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time
y9-33	0x4921	Motor protection	Bit 0: Reserved Bit 1: Current control error detection Bit 2: Motor step loss detection Bit 3: Reserved Bit 4: Permanent magnet synchronous motor demagnetization protection Bit 5: Runaway protection Bit 6: Speed reversal protection Bit7: Reserved Bit 8: Motor parameter error check Bit 9: Output single-phase loss detectionBit 10: Demagnetization protection for reluctance motor with field strengthening Bit 11 to Bit 15: Reserved Bit value 0: Disable Bit value 1: Enable	0x0687	-	Real-time
y9-35	0x4923	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
y9-36	0x4924	Overspeed protection time	0.0 to 60.0	0.5	s	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y9-37	0x4925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
y9-38	0x4926	Excessive speed deviation protection	0: Disable 1: Enable	1	-	Real-time
y9-39	0x4927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
y9-40	0x4928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
y9-41	0x4929	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
y9-45	0x492D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
y9-46	0x492E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
y9-47	0x492F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real-time
y9-50	0x4932	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
y9-54	0x4936	Overvoltage suppression	Bit 0: VF overvoltage suppression enable 0: Disable 1: Enable bit 1: Vector overvoltage suppression 0: Disable 1: Enable Bit 2 to Bit 15: reserved	0x0001	-	Real-time
y9-55	0x4937	Overvoltage suppression action voltage	600.0 to A3-57	770.0	V	Real-time
y9-56	0x4938	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	770.0	V	Unchangeable
y9-57	0x4939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y9-58	0x493A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y9-63	0x493F	Undervoltage action selection	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y9-64	0x4940	Undervoltage suppression action voltage	A3-55 to 500.0	430.0	V	Real-time
y9-65	0x4941	Effective voltage threshold of undervoltage suppression	A4-35 to 500.0	430.0	V	Unchangeable
y9-66	0x4942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y9-67	0x4943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y9-68	0x4944	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
y9-69	0x4945	Time for decelerating to stop during undervoltage	0.0 to 300.0	20.0	s	Real-time
y9-70	0x4946	Recovery voltage hysteresis upon undervoltage	1 to 100	30	V	Real-time
y9-71	0x4947	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	Change at stop
y9-72	0x4948	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y9-73	0x4949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y9-77	0x494D	Stall detection	0: Disable 1: Enable	0	-	Real-time
y9-78	0x494E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
y9-79	0x494F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
y9-80	0x4950	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
y9-81	0x4951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
y9-82	0x4952	Current threshold of output three-phase loss	0.0 to 100.0	10.0	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
y9-83	0x4953	Motor stall detection time	0.0 to 10.0	0.5	s	Real-time
y9-84	0x4954	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
y9-87	0x4957	Current control exception detection time	0.00 to 1.00	0.05	s	Real-time
y9-88	0x4958	Current control exception detection threshold	0.0 to 200.0	25.0	%	Real-time
y9-89	0x4959	Output single-phase loss detection time	0.05 to 650.00	0.20	s	Real-time
y9-91	0x495B	Asynchronous motor runaway protection time in SVC	0.05 to 0.50	0.10	s	Real-time
y9-92	0x495C	Asynchronous motor runaway protection threshold in SVC	10.0 to 50.0	15.0	%	Real-time

10.2.6.10 yb Speed control parameters of motor 4

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
YA-00	0x4A00	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: V/f separation	0	/	Change at stop
YA-01	0x4A01	Multi-point curve source	0: Three-point curve	0	/	Real time
YA-02	0x4A02	Frequency point 1 on a multi-point V/f curve	0.0 to -03	0.0	Hz	Real-time
YA-03	0x4A03	Frequency point 2 on a multi-point V/f curve	YA-02 to yA-04	0.0	Hz	Real-time
YA-04	0x4A04	Frequency point 3 on a multi-point V/f curve	-03-600.0	0.0	Hz	Real-time
YA-08	0x4A08	Voltage point 1 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
YA-09	0x4A09	Voltage point 2 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
YA-10	0x4A0A	Voltage point 3 on a multi-point V/f curve.	0.0 to 1000.0	0.0	V	Real-time
YA-14	0x4A0E	Manual torque boost amount	0.0 to 100.0	3.0	%	Real-time
YA-15	0x4A0F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real-time
YA-16	0x4A10	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
YA-17	0x4A11	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
YA-18	0x4A12	Automatic torque boost gain	80 to 150	100	/	Real time
YA-22	0x4A16	V/f oscillation suppression	0: Disable 1: Enable	1	/	Real time
YA-23	0x4A17	V/f oscillation suppression gain	0 to 400	100	%	Real-time
YA-24	0x4A18	Cut-off frequency of V/f oscillation suppression filter	1.0 to 50.0	8.0	Hz	Real-time
YA-25	0x4A19	Cut-off frequency for active V/F oscillation suppression	0.0 to 600.0	400.0	%	Real-time
YA-26	0x4A1A	Overcurrent suppression	0: Disable 1: Enable	1	/	Change at stop
YA-27	0x4A1B	Overcurrent suppression threshold	80 to 300	200	%	Change at stop
YA-28	0x4A1C	Overvoltage suppression Kp adjustment	1 to 500	100	%	Real-time
YA-29	0x4A1D	Overvoltage suppression Ki adjustment	10 to 1000	100	%	Change at stop
YA-30	0x4A1E	Frequency threshold for overcurrent suppression field weakening	60 to 500	100	%	Real-time
YA-31	0x4A1F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real-time
YA-32	0x4A20	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real-time
YA-35	0x4A23	Energy-saving in V/f control mode	0: Invalid 1: Valid	0	/	Real time
YA-36	0x4A24	Cut-off frequency of V/f energy-saving control	20 to 100	30	%	Real-time
YA-37	0x4A25	Voltage drop gain in V/f energy-saving control	10 to 500	100	%	Real-time
YA-38	0x4A26	Boost gain in V/f energy-saving control	10 to 500	100	%	Real-time
YA-41	0x4A29	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
YA-42	0x4A2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
YA-43	0x4A2B	Slip compensation filter time	0.1 to 10.0	0.5	s	Change at stop
YA-47	0x4A2F	Upper limit of V/f separation voltage	50.0 to 200.0	100.0	%	Change at stop
YA-48	0x4A30	Voltage source of V/f separation	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
YA-49	0x4A31	Digital setting of V/f separation voltage	0--03	0	V	Real-time
YA-50	0x4A32	Voltage acceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
YA-51	0x4A33	Voltage deceleration time of V/f separation	0.0 to 1000.0	0.0	s	Real-time
YA-52	0x4A34	Frequency RFG time of V/f separation	0: RFG time forced to 0 1: Preset RFG time	0	/	Change at stop
YA-53	0x4A35	Stop mode selection of V/f separation	0: Frequency and voltage decline to 0 independently 1: Frequency declines to 0 after voltage declines to 0 2: Coast to stop	0	/	Real time
YA-59	0x4A3B	Synchronous motor V/f mode	0: Synchronous motor V/f1 1: Synchronous motor V/f2	1	/	Change at stop
YA-60	0x4A3C	Synchronous motor V/f current loop coefficient	0 to 1000	100	%	Real-time
YA-61	0x4A3D	Synchronous motor V/f-MTPA coefficient	0 to 1000	0	%	Real-time
YA-62	0x4A3E	Synchronous motor V/f oscillation suppression gain coefficient	0 to 500	100	%	Real-time
YA-63	0x4A3F	V/f filter time coefficient of synchronous motor	0 to 500	100	%	Real-time
YA-64	0x4A40	Synchronous motor V/f energy-saving control mode	0：Fixed linear V/f curve 1：Reactive current fixed to 30% of rated current 2：MTPA control	2	/	Change at stop

10.2.6.11 yb Speed control parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
Yb-00	0x4B00	FVC speed loop proportional gain	0.0 to 6000.0	8.0	/	Real time
Yb-01	0x4B01	FVC speed loop integral time	0.000 to 20.000	0.080	s	Real-time
Yb-02	0x4B02	SVC speed loop Kp	0.0 to 6000.0	5.0	/	Real time
Yb-03	0x4B03	SVC speed loop Ti	0.000 to 20.000	0.127	s	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
Yb-06	0x4B06	Zero speed switchover frequency	0.0 to -09	1.0	%	Real-time
Yb-07	0x4B07	Zero speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-08	0x4B08	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-09	0x4B09	Low speed switchover frequency	0.0 to -12	10.0	%	Real-time
Yb-10	0x4B0A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-11	0x4B0B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-12	0x4B0C	High speed switchover frequency	-09-400.0	100.0	%	Real-time
Yb-13	0x4B0D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-14	0x4B0E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
Yb-19	0x4B13	Adaptive source of speed loop Kp	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
Yb-21	0x4B15	Speed loop adaption switchover lower limit	0.0 to 1000.0	40.0	%	Real-time
Yb-22	0x4B16	Speed loop adaption switchover upper limit	0.0 to 1000.0	100.0	%	Real-time
Yb-23	0x4B17	Speed loop adaption correction lower limit	0.0 to 1000.0	100.0	%	Real-time
Yb-24	0x4B18	Speed loop adaption correction upper limit	0.0 to 1000.0	100.0	%	Real-time
Yb-27	0x4B1B	Droop function	0: Disable 1: Enable	0	/	Real time
Yb-28	0x4B1C	Droop source	0: Output torque 1: Torque reference 2: Speed adjustment output 3: Speed adjustment integral component	1	/	Change at stop
Yb-29	0x4B1D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
Yb-33	0x4B21	Forced integral enable	0: Disable 1: Enable Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
Yb-34	0x4B22	Integral force source	0: b5-35 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
Yb-35	0x4B23	Digital setting of integral forced value	-800.0 to 800.0	0.0	%	Real-time
Yb-38	0x4B26	Acceleration feedforward torque	0: Disable 1: Enable	0	/	Real time
Yb-39	0x4B27	Acceleration feedforward torque coefficient	0.0 to 6553.0	100.0	%	Real-time
Yb-40	0x4B28	Feedforward acceleration speed source	0: RFG reference 1: Automatic calculation Others: F connector	0	/	Real time
Yb-45	0x4B2D	Speed control window width	0.00 to +10.00	0.00	Hz	At stop
Yb-46	0x4B2E	Indicates the filter time of the frequency reference.	0.0 to 100.0	0.0	ms	Change at stop
Yb-47	0x4B2F	Filter time for feedback frequency	0.0 to 100.0	0.0	ms	Change at stop
Yb-48	0x4B30	Current filter time for torque reference	0.0 to 100.0	0.0	ms	Change at stop
Yb-55	0x4B37	Load disturbance prevention enable	0: Disable 1: Enable	0	/	Real time
Yb-57	0x4B39	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
Yb-58	0x4B3A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.2.6.12 yC Current control parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
YC-00	0x4C00	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
YC-01	0x4C01	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time
YC-02	0x4C02	Current loop q-axis Kp adjustment	1 to 1000	100	%	Real-time
YC-03	0x4C03	Current loop q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.2.6.13 yd：Excitation control parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
Yd-17	0x4D11	Demagnetization current Limit	0 to 500	300	%	Real-time
Yd-25	0x4D19	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	/	Real time

10.2.6.14 yF Control optimization parameters of motor 4

Item	Address:	Name	Value Range	Default	Unit	Change:
YF-02	0x4F02	FVC switched to SVC	0：Not switched 1：Switched actively 2：Switched passively (Switch to SVC mode when encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be recovered after stop.)	0	/	Real time
YF-03	0x4F03	Frequency for switching from FVC to SVC	10 to 500	50	%	Real-time
YF-04	0x4F04	Hysteresis loop for switching from FVC to SVC	10 to 100	10	%	Real-time

10.2.7 Group E Input/Output

10.2.7.1 E0 DI

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E0-00	0xE000	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: NO input of external fault 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/Deceleration selection terminal 1 17: Acceleration/Deceleration selection terminal 2 19: Clear the adjustment set by UP/DOWN keys on the operating panel or by terminals functioning as the UP/DOWN keys 21: Acceleration/Deceleration inhibition 22: PID pause 23: Simple PLC state reset 24: Wobble frequency pause 29: Torque control inhibition 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enable 35: PID action direction reversal 36: External stop terminal 1 38: PID integral pause 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Switchover between speed control and torque control 47: Emergency stop 49: Decelerate to DC braking 50: Current operating time clear 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 (to be continued)	1	-	At stop:

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E0-00	0xE000	DI1 function selection	(Continued) 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced to local control 67: Forced to terminal control 68: Forced to communication control 69: Forced to customized control 70: Control channel selection 71: Setting channel selection 72: Terminal module A/B selection 76: Motor selection terminal 2 77: Operation enable (all modes) 78: Forward run allowed 79: Reverse run allowed 80: RFG input clear	1	-	At stop
E0-01	0xE001	DI2 function selection	Same as E0-00	4	-	At stop
E0-02	0xE002	DI3 function selection	Same as E0-00	9	-	At stop
E0-03	0xE003	DI4 function selection	Same as E0-00	12	-	At stop
E0-04	0xE004	DI5 function selection	Same as E0-00	13	-	At stop
E0-05	0xE005	DI6 function selection	Same as E0-00	0	-	At stop
E0-06	0xE006	DI7 function selection	Same as E0-00	0	-	At stop
E0-10	0xE00A	VDI1 function selection	Same as E0-00	0	-	At stop
E0-11	0xE00B	VDI2 function selection	Same as E0-00	0	-	At stop
E0-12	0xE00C	VDI3 function selection	Same as E0-00	0	-	At stop
E0-13	0xE00D	VDI4 function selection	Same as E0-00	0	-	At stop
E0-14	0xE00E	VDI5 function selection	Same as E0-00	0	-	At stop
E0-15	0xE00F	VDI6 function selection	Same as E0-00	0	-	At stop
E0-16	0xE010	DI input filter time 1	0.000 to 1.000	0.010	s	Real time
E0-17	0xE011	DI input filter time 2	0.000 to 1.000	0.010	s	Real time
E0-18	0xE012	DI input filter time selection	Bit 0: DI1 filter time 0: Filter time 1 1: Filter time 2 Bit 1: DI2 filter time 0: Filter time 1 1: Filter time 2 Bit 2 to bit 6: DI3 filter time to DI7 filter time (valid only for MD630S) 0: Filter time 1 1: Filter time 2 Bit 7 to bit 15: Reserved	0x0	/	Real time
E0-19	0xE013	Step value of the terminal functioning as UP/DOWN keys	0.001 to 65.535	1.000	Hz/s	Real time

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E0-20	0xE014	DI1 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-21	0xE015	DI1 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-22	0xE016	DI2 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-23	0xE017	DI2 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-24	0xE018	DI3 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-25	0xE019	DI3 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-26	0xE01A	DI4 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-27	0xE01B	DI4 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-28	0xE01C	DI5 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-29	0xE01D	DI5 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-30	0xE01E	DI6 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-31	0xE01F	DI6 switch-off delay time	0.0 to 3600.0	0.0	s	At stop
E0-32	0xE020	DI7 switch-on delay time	0.0 to 3600.0	0.0	s	At stop
E0-33	0xE021	DI7 switch-off delay time	0.0 to 3600.0	0.0	s	At stop

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E0-50	0xE032	VDI1 source	1: Forced value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 (valid only for MD630S) 14: DI4 (valid for MD630S only) 15: DI5 (valid for MD630S only) 16: DI6 (valid for MD630S only) 17: DI7/HDI (valid only for MD630S) 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: I/O card 1-DI1 28: I/O card 1-DI2 29: I/O card 1-DI3 30: I/O card 2-DI1 31: I/O card 2-DI2 32: I/O card 2-DI3 51: RO1 55: DO1 59: FMR (valid for MD630S only) 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6	1	-	At stop
E0-51	0xE033	VDI2 source	The values exclude "22: VDI2" and include "21: VDI1". Except the previous descriptions, other values of this parameter are the same as those of E0-50.	1	-	At stop
E0-52	0xE034	VDI3 source	The values exclude "23: VDI3" and include "21: VDI1". Except the previous descriptions, other values of this parameter are the same as those of E0-50.	1	-	At stop
E0-53	0xE035	VDI4 source	The values exclude "24: VDI4" and include "21: VDI1". Except the previous descriptions, other values of this parameter are the same as those of E0-50.	1	-	At stop
E0-54	0xE036	VDI5 source	The values exclude "25: VDI5" and include "21: VDI1". Except the previous descriptions, other values of this parameter are the same as those of E0-50.	1	-	At stop
E0-55	0xE037	VDI6 source	The values exclude "26: VDI6" and include "21: VDI1". Except the previous descriptions, other values of this parameter are the same as those of E0-50.	1	-	At stop

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E0-56	0xE038	DI forcibly enable	Bit 0 to bit 6: DI1 to DI7 0: Hardware 1: Forced value Bit 7 to bit 15: Reserved	0x0	/	At stop
E0-57	0xE039	DI forced data	Bit 0: DI1 setting Bit 1: DI2 setting Bit 2 to Bit 5: DI3 to DI6 setting (valid only for MD630S) Bit 6: DI7/HDI setting (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10 to bit 15: VDI1 to VDI6 setting Bit value: 0: Low level 1: High level	0x0	/	Real time
E0-58	0xE03A	DI active mode selection	Bit 0: DI1 active mode Bit 1: DI2 active mode Bit 2 to Bit 6: DI3 to DI7 active mode (valid only for MD630S) Bit 7 to bit 9 : Reserved Bit 10 to bit 15: VDI1 to VDI6 active mode Bit value: 0: Active high 1: Active low	0x0	/	Real time

10.2.7.2 E1 DORO

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E1-00	0xE100	RO1 output function selection	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Cumulative running time reach 13: Wobble frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication (address: 0x7312) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 42: STO output 43: Output upon minor fault or warning 44: AI2 input limit exceeded 46: Component service life warning Others: B connector	2	-	Real time
E1-04	0xE104	DO1 output function selection	Same as E1-00	0	-	Real time
E1-08	0xE108	FMR (HDO) output function selection	Same as E1-00	0	-	Real time
E1-10	0xE10A	VDO1 output function selection	Same as E1-00	0	-	Real time

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E1-11	0xE10B	VDO2 output function selection	Same as E1-00	0	-	Real time
E1-12	0xE10C	VDO3 output function selection	Same as E1-00	0	-	Real time
E1-13	0xE10D	VDO4 output function selection	Same as E1-00	0	-	Real time
E1-14	0xE10E	VDO5 output function selection	Same as E1-00	0	-	Real time
E1-15	0xE10F	VDO6 output function selection	Same as E1-00	0	-	Real time
E1-16	0xE110	RO1 switch-on delay time	0.0 to 3600.0	0.0	s	Real time
E1-17	0xE111	RO1 switch-off delay time	0.0 to 3600.0	0.0	s	Real time
E1-24	0xE118	DO1 output switch-on delay time	0.0 to 3600.0	0.0	s	Real time
E1-25	0xE119	DO1 output switch-off delay time	0.0 to 3600.0	0.0	s	Real time
E1-32	0xE120	FMR switch-on delay time	0.0 to 3600.0	0.0	s	Real time
E1-33	0xE121	FMR switch-off delay time	0.0 to 3600.0	0.0	s	Real time
E1-36	0xE124	DO/RO/VDO output source	Bit 0 RO output source Bit 1 to bit 3: Reserved Bit4: DO output source Bit 5 to bit 7: Reserved Bit 8: FMR output source (valid only for MD630S) Bit 9: Reserved Bit 10 to bit 15: VDO1 to VDO6 output source Bit value: 0: Output function setting 1: Forced value	0x0	/	Real time

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
E1-37	0xE125	DO/RO/VDO forced data	Bit 0 RO setting Bit 1 to bit 3: Reserved Bit 4: DO setting Bit 5 to bit 7: Reserved Bit 8: FMR output source (only valid for MD630S) Bit 9: Reserved Bit 10: VDO1 setting Bit 11: VDO2 setting Bit 12: VDO3 setting Bit 13: VDO4 setting Bit 14: VDO5 setting Bit 15: VDO6 setting Bit value: 0: Low level 1: High level	0x0	/	Real time
E1-38	0xE126	DO/RO/VDO output terminal polarity selection	Bit 0: RO Bit 1 to bit 3 Reserved Bit4: DO Bit 5 to bit 7: Reserved Bit 8: FMR output source (valid only for MD630S) Bit 9: Reserved Bit 10: VDO1 Bit 11: VDO2 Bit12: VDO3 Bit 13: VDO4Bit14: VDO5 Bit 15: VDO6 Bit value: 0: Positive logic 1: Negative logic	0x0	/	Real time

10.2.7.3 E2 AI

Item	Address	Name	Value Range	Default	Unit	Change Mode
E2-07	0xE207	AI1 gain	-10.00 to +10.00	1.00	/	Real-time
E2-08	0xE208	AI1 offset	-10.00 to +10.00	0.00	V	Real-time
E2-09	0xE209	AI1 denoising threshold	0.0 to 100.0	0.0	%	Real-time
E2-10	0xE20A	AI1 fitter time	0.00 to +10.00	0.10	s	Real-time
E2-11	0xE20B	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
E2-12	0xE20C	AI1 jump point	-800.0 to 800.0	0.0	%	Real-time
E2-13	0xE20D	AI1 jump amplitude	0.0 to 100.0	0.1	%	Real-time
E2-14	0xE20E	Upper limit of AI1 input protection	E2-15 to 10.00	8.00	V	Real-time
E2-15	0xE20F	Lower limit of AI1 input protection	0.00 to E2-14	2.00	V	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
E2-16	0xE210	AI2 gain	-10.00 to +10.00	1.00	/	Real-time
E2-17	0xE211	AI2 offset	-10.00 to +10.00	0.00	V	Real-time
E2-18	0xE212	AI2 denoising threshold	0.0 to 100.0	0.0	%	Real-time
E2-19	0xE213	AI2 filter time	0.00 to +10.00	0.10	s	Real-time
E2-20	0xE214	AI2 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
E2-21	0xE215	AI2 jump point	-800.0 to 800.0	0.0	%	Real-time
E2-22	0xE216	AI2 jump amplitude	0.0 to 100.0	0.1	%	Real-time
E2-23	0xE217	Upper limit of AI2 input protection	E2-24 to 10.00	8.00	V	Real-time
E2-24	0xE218	Lower limit of AI2 input protection	0.00 to E2-23	2.00	V	Real-time
E2-34	0xE222	AI input protection time	0.00 to 1.00	0.01	s	Real-time
E2-35	0xE223	High level judgment threshold when AI uses as DI	5.5 to 9.0	7.0	V	Real-time
E2-36	0xE224	Low level judgment threshold when AI uses as DI	1.0 to 4.5	3.0	V	Real-time
E2-37	0xE225	AI curve absolute value inverted	Ones place: AI1 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens place: AI2 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Hundreds place: Reserved Thousands place: Reserved Ten thousands place: Reserved	0	/	Real-time
E2-38	0xE226	AI curve	Ones place: AI1 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Tens place: AI2 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Hundreds place: Reserved Thousands place: Reserved	0x21	-	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
E2-39	0xE227	Selection when AI value < minimum input value	Ones place: Selection when AI1 value lower than minimum input value 0: Corresponding to the minimum input setting 1: 0.0% Tens place: Selection when AI2 value lower than minimum input value 0: Corresponding to the minimum input setting 1: 0.0% Hundreds place: Reserved Thousands place: Reserved	0x0	-	Real-time
E2-40	0xE228	Minimum input of AI curve 1	-10.00–E2-42	0.00	V	Real-time
E2-41	0xE229	Percentage corresponding to minimum input of AI curve 1	-800.0 to 800.0	0.0	%	Real-time
E2-42	0xE22A	Maximum input of AI curve 1	E2-40 to 10.00	10.00	V	Real-time
E2-43	0xE22B	Percentage corresponding to the maximum input of AI curve 1	-800.0 to 800.0	100.0	%	Real-time
E2-44	0xE22C	Minimum input of AI curve 2	-10.00–E2-46	0.00	V	Real-time
E2-45	0xE22D	Percentage corresponding to the minimum input of AI curve 2	-800.0 to 800.0	0.0	%	Real-time
E2-46	0xE22E	Maximum input of AI curve 2	E2-44 to 10.00	10.00	V	Real-time
E2-47	0xE22F	Percentage corresponding to the maximum input of AI curve 2	-800.0 to 800.0	100.0	%	Real-time
E2-48	0xE230	Minimum input of AI curve 3	-10.00–E2-50	0.00	V	Real-time
E2-49	0xE231	Percentage corresponding to minimum input of AI curve 3	-800.0 to 800.0	0.0	%	Real-time
E2-50	0xE232	Maximum input of AI curve 3	E2-48 to 10.00	10.00	V	Real-time
E2-51	0xE233	Percentage corresponding to the maximum input of AI curve 3	-800.0 to 800.0	100.0	%	Real-time
E2-52	0xE234	Minimum input of AI curve 4	-10.00–E2-54	0.00	V	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
E2-53	0xE235	Percentage corresponding to minimum input of AI curve 4	-800.0 to 800.0	0.0	%	Real-time
E2-54	0xE236	Inflection point 1 input of AI curve 4	E2-52 to E2-56	3.00	V	Real-time
E2-55	0xE237	Percentage corresponding to inflection point 1 input of AI curve 4	-800.0 to 800.0	30.0	%	Real-time
E2-56	0xE238	Inflection point 2 input of AI curve 4	E2-54 to E2-58	6.00	V	Real-time
E2-57	0xE239	Percentage corresponding to inflection 2 input of AI curve 4	-800.0 to 800.0	60.0	%	Real-time
E2-58	0xE23A	Maximum input of AI curve 4	E2-56 to 10.00	10.00	V	Real-time
E2-59	0xE23B	Percentage corresponding to maximum input of AI curve 4	-800.0 to 800.0	100.0	%	Real-time
E2-60	0xE23C	Minimum input of AI curve 5	-10.00–E2-62	-10.00	V	Real-time
E2-61	0xE23D	Percentage corresponding to minimum input of AI curve 5	-800.0 to 800.0	-100.0	%	Real-time
E2-62	0xE23E	Inflection point 1 input of AI curve 5	E2-60 to E2-64	-3.00	V	Real-time
E2-63	0xE23F	Percentage corresponding to inflection point 1 input of AI curve 5	-800.0 to 800.0	-30.0	%	Real-time
E2-64	0xE240	Inflection point 2 input of AI curve 5	E2-62 to E2-66	3.00	V	Real-time
E2-65	0xE241	Percentage corresponding to inflection 2 input of AI curve 5	-800.0 to 800.0	30.0	%	Real-time
E2-66	0xE242	Maximum input of AI curve 5	E2-64 to 10.00	10.00	V	Real-time
E2-67	0xE243	Percentage corresponding to the maximum input of AI curve 5	-800.0 to 800.0	100.0	%	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
E2-73	0xE249	AI2 temperature mode - motor temperature sensor type	0: No temperature sensor (AI channel used as analog input) 1: PT100 2: PT1000 3: KTY84-130 4: PTC130	0	/	Real-time
E2-74	0xE24A	AI2 temperature mode - Motor temperature reach	0 to 100	75	°C	Real-time
E2-75	0xE24B	AI2 temperature mode - Motor overtemperature alarm threshold	0–E2-76	110	°C	Real-time
E2-76	0xE24C	AI2 temperature mode - motor overheat protection threshold	E2-75 to 200	130	°C	Real-time
E2-81	0xE251	AI hardware source selection	Ones place: AI1 source 0: Hardware sampling 1: Forced setpoint Tens place: AI2 source 0: Hardware sampling 1: Forced setpoint Hundreds place: Reserved Thousands place: Reserved Ten thousands place: Reserved	0	/	Change at stop
E2-82	0xE252	AI1 forced value	-10.00 to +10.00	0.00	V	Real-time
E2-83	0xE253	AI1 setpoint	-10.00 to +10.00	0.00	V	Real-time
E2-96	0xE260	Action upon AI hardware sampling power-off	0: Sampling continued at power-off 1: Sampling stopped at power-off	0	/	Real-time
E2-97	0xE261	Bus voltage threshold upon AI hardware sampling power-off	40.0 to 70.0	60.0	%	Real-time
E2-98	0xE262	AI hardware sampling state	0: Normal sampling 1: Stop sampling	0	/	Unchangeable

10.2.7.4 E3 AO

Item	Address:	Name	Value Range	Default	Unit	Change:
E3-00	0xE300	AO1 function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (Address: 0x7313) 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 V) 16: Output torque (actual value)19: Taper output20: Roll diameter output21: Tension outputOthers: F connector	0	/	Real time
E3-03	0xE303	AO polarity selection	Ones: AO source 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E3-04	0xE304	AO curve	Ones: AO1 curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E3-05	0xE305	Minimum input of AO curve	-800.0–E3-07	0.0	%	Real-time
E3-06	0xE306	Percentage corresponding to minimum input of AO curve	0.00 to +10.00	0.00	V	Real-time
E3-07	0xE307	Maximum input of AO curve	E3-05 to 800.0	100.0	%	Real-time
E3-08	0xE308	Percentage corresponding to the maximum input of AO curve	0.00 to +10.00	10.00	V	Real-time
E3-17	0xE311	AO1 zero offset coefficient	-100.0 to 100.0	0.0	%	Real-time
E3-18	0xE312	AO1 gain	-10.00 to +10.00	1.00	/	Real time
E3-23	0xE317	AO1 output offset	-10.00 to +10.00	0.00	V	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
E3-26	0xE31A	AO hardware source selection	Ones: AO1 source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E3-27	0xE31B	AI1 setpoint	0.00 to +10.00	0.00	V	Real-time

10.2.7.5 E4 HDI (DI7)

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E4-00	0xE400	HDI terminal type selection	0: HDI 1: DI	1	/	Change at stop
E4-01	0xE401	HDI input	0: Disable 1: Enable Others: B connector	0	/	Unchangeable
E4-02	0xE402	HDI hardware source	0: Hardware sampling 1: Forced value	0	/	Real time
E4-03	0xE403	HDI force setpoint	0.00 to 20.00	1.00	kHz	Real-time
E4-07	0xE407	HDI curve setting	Ones position: HDI curve selection 0: Two-point curve 1: Four-point curve Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E4-08	0xE408	Minimum input of two-point HDI curve	0.00 to E4-10	0.00	kHz	Real-time
E4-09	0xE409	Percentage corresponding to minimum input of two-point HDI curve	-800.0 to 800.0	0.0	%	Real-time
E4-10	0xE40A	Maximum input of two-point HDI curve	E4-08 to 20.00	20.00	kHz	Real-time
E4-11	0xE40B	Percentage corresponding to maximum input of two-point HDI curve	-800.0 to 800.0	100.0	%	Real-time
E4-12	0xE40C	Minimum input of four-point HDI curve	0.00 to E4-14	0.00	kHz	Real-time
E4-13	0xE40D	Percentage corresponding to minimum input of four-point HDI curve	-800.0 to 800.0	-100.0	%	Real-time
E4-14	0xE40E	Inflection 1 input of HDI four-point curve	E4-12 to E4-16	5.00	kHz	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E4-15	0xE40F	Percentage corresponding to inflection point 1 input of four-point HDI curve	-800.0 to 800.0	-30.0	%	Real-time
E4-16	0xE410	Inflection 2 input of HDI four-point curve	E4-14 to E4-18	10.00	kHz	Real-time
E4-17	0xE411	Percentage corresponding to inflection point 2 input of four-point HDI curve	-800.0 to 800.0	30.0	%	Real-time
E4-18	0xE412	Maximum input of four-point HDI curve	E4-16 to 20.00	20.00	kHz	Real-time
E4-19	0xE413	Percentage corresponding to maximum input of four-point HDI curve	-800.0 to 800.0	100.0	%	Real-time
E4-32	0xE420	HDI filter time	0.00 to +10.00	0.10	s	Real time
E4-33	0xE421	HDI curve absolute value inverted	Ones: HDI 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E4-34	0xE422	HDI denoising threshold	0.0 to 10.0	0.0	%	Real-time
E4-35	0xE423	HDI curve upper and lower limit selection	Ones: HDI 0: Limited 1: Not limited Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E4-36	0xE424	HDI impulse noise	0 to 1000	0	ms	Real-time

10.2.7.6 E5: HDO (FM)

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E5-00	0xE500	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Digital output (FMR)	0	/	Real time
E5-01	0xE501	HDO output function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (Address: 0x7315) 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 V) 16: Output torque (actual value) 19: Taper output 20: Roll diameter output 21: Tension output Others: F connector	0	/	Real time
E5-03	0xE503	Minimum input of HDO curve	-100.0 to E5-05	0.0	%	Real-time
E5-04	0xE504	Percentage corresponding to minimum input of HDO curve	0.00 to 100.00	0.00	%	Real-time
E5-05	0xE505	Maximum input of HDO curve	E5-03 to 100.0	100.0	%	Real-time
E5-06	0xE506	Percentage corresponding to the maximum input of HDO curve	0.00 to 100.00	100.00	%	Real-time
E5-11	0xE50B	HDO output polarity selection	Ones position: HDO source 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E5-12	0xE50C	HDO hardware source	Ones: HDO source 0: Output function setting 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real time
E5-13	0xE50D	HDO forced value	0.00 to 100.00	0.00	%	Real-time
E5-15	0xE50F	Maximum frequency of HDO output	0.01 to 100.00	50.00	kHz	Real-time

10.2.7.7 EA Parameters of I/O Expansion Card 1

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-00	0xEA00	DI forced function enable	Bit 0 DI1 0: Hardware 1: Forced value Bit 1: DI1 0: Hardware 1: Forced value Bit 2 to Bit 15: Reserved	0x0	-	Change at stop
EA-01	0xEA01	DI forced data	Bit 0: DI1 setting 0: Low level 1: High level Bit 1: DI2 setting 0: Low level 1: High level Bit 2 to Bit 15: Reserved	0x0	-	Real-time
EA-02	0xEA02	DI1 switch-on delay time	0.0 to 3600.0	0.0	s	Change at stop
EA-03	0xEA03	DI1 switch-off delay time	0.0 to 3600.0	0.0	s	Change at stop
EA-04	0xEA04	DI2 switch-on delay time	0.0 to 3600.0	0.0	s	Change at stop
EA-05	0xEA05	DI2 switch-off delay time	0.0 to 3600.0	0.0	s	Change at stop
EA-08	0xEA08	DI input filter time selection	Bit 0 DI1 filter time 0: Filter time 1 1: Filter time 2 Bit 1: DI2 filter time 0: Filter time 1 1: Filter time 2	0x0	-	Real-time
EA-09	0xEA09	DI input filter time 1	0.000 to 1.000	0.010	s	Real-time
EA-10	0xEA0A	DI input filter time 2	0.000 to 1.000	0.010	s	Real-time

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-16	0xEA10	DO1 output function selection	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload alarm 7: AC drive overload alarm 11: Simple PLC cycle completed 12: Cumulative running time reach 13: Wobble frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication (7322) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or alarm 40: Current running time reach 41: Output upon fault (excluding undervoltage) 42: STO output 43: Output upon minor fault or alarm 44: AI2 input limit exceeded 46: Component service life alarm Others: B connector	0	-	Real-time
EA-17	0xEA11	RO1 function selection	Same as EA-16	0	-	Real-time
EA-18	0xEA12	DO/RO output source	Bit 0: DO source 0: Output function setting 1: Forced value Bit 1: RO1 source 0: Output function setting 1: Forced value Bit 12 to Bit 15: Reserved	0x0	-	Real-time

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-19	0xEA13	Forced DO/RO data	Bit 0: DO setting 0: Low level 1: High level Bit 1: RO setting 0: Low level 1: High level Bit 2 to Bit 15: Reserved	0x0	-	Real-time
EA-20	0xEA14	DO/RO polarity selection	Bit 0: DO output source 0: Positive logic 1: Negative logic Bit 1: RO output source 0: Positive logic 1: Negative logic Bit 2 to Bit 15: Reserved	0x0	-	Real-time
EA-21	0xEA15	DO1 switch-on delay time	0.0 to 3600.0	0.0	s	Real-time
EA-22	0xEA16	DO1 switch-off delay time	0.0 to 3600.0	0.0	s	Real-time
EA-23	0xEA17	RO1 switch-on delay time	0.0 to 3600.0	0.0	s	Real-time
EA-24	0xEA18	RO1 switch-off delay time	0.0 to 3600.0	0.0	s	Real-time
EA-25	0xEA19	Forced output state of DO/RO upon communication disconnection	Bit 0: Forced output upon DO disconnection 0: Low level 1: High level Bit 1: Forced output upon RO disconnection 0: Low level 1: High level Bit 2 to Bit 15: Reserved	0x0	-	Real-time
EA-31	0xEA1F	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Change at stop
EA-32	0xEA20	AI1 forced value	-10.00 to 10.00	0.00	V	Real-time
EA-36	0xEA24	AI1 gain	-10.00 to 10.00	1.00	-	Real-time
EA-37	0xEA25	AI1 offset	-10.00 to 10.00	0.00	V	Real-time
EA-38	0xEA26	AI1 denoising threshold	0.0 to 100.0	0.0	%	Real-time
EA-39	0xEA27	AI1 fitter time	0.00 to 10.00	0.10	s	Real-time
EA-40	0xEA28	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
EA-41	0xEA29	AI1 jump point	-800.0 to 800.0	0.0	%	Real-time
EA-42	0xEA2A	AI1 jump amplitude	0.0 to 100.0	0.1	%	Real-time

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-43	0xEA2B	Upper limit of AI1 input protection	EA-44 to 10.00	8.00	V	Real-time
EA-44	0xEA2C	Lower limit of AI1 input protection	0.00 to EA-43	2.00	V	Real-time
EA-45	0xEA2D	AI input protection time	0.00 to 1.00	0.01	s	Real-time
EA-46	0xEA2E	High level judgment threshold when AI used as DI	5.5 to 9.0	7.0	V	Real-time
EA-47	0xEA2F	Low level judgment threshold when AI used as DI	1.0 to 4.5	3.0	V	Real-time
EA-48	0xEA30	AI polarity selection	Ones: AI1 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-49	0xEA31	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, EA-51 to EA-54) 2: Curve 2 (2 points, EA-55 to EA-58) Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0001	-	Real-time
EA-50	0xEA32	AI lower limit selection	Ones: Selection when AI1 value lower than minimum input value 0: Corresponding to the minimum input setting 1: 0.0% Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0	-	Real-time
EA-51	0xEA33	AI curve 1 minimum input	-10.00 to EA-53	0.00	V	Real-time
EA-52	0xEA34	Percentage corresponding to minimum input of AI curve 1	-800.0 to 800.0	0.0	%	Real-time
EA-53	0xEA35	AI curve 1 maximum input	EA-51 to 10.00	10.00	V	Real-time
EA-54	0xEA36	Percentage corresponding to the maximum input of AI curve 1	-800.0 to 800.0	100.0	%	Real-time
EA-55	0xEA37	AI curve 2 minimum input	-10.00 to EA-57	0.00	V	Real-time

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-56	0xEA38	Percentage corresponding to minimum input of AI curve 2	-800.0 to 800.0	0.0	%	Real-time
EA-57	0xEA39	AI curve 2 maximum input	EA-55 to 10.00	10.00	V	Real-time
EA-58	0xEA3A	Percentage corresponding to the maximum input of AI curve 2	-800.0 to 800.0	100.0	%	Real-time
EA-59	0xEA3B	AI temperature mode - motor temperature sensor type	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 Single-core 5: PTC130 three-core	0	-	Real-time
EA-60	0xEA3C	AI temperature mode - motor overtemperature protection threshold	EA-61 to 200	130	°C	Real time
EA-61	0xEA3D	AI temperature mode - motor overtemperature alarm threshold	0 to EA-60	110	°C	Real time
EA-62	0xEA3E	AI temperature mode - motor temperature reach	0 to 100	75	°C	Real time
EA-71	0xEA47	AO1 output function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7323) 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 A) 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time

Param.	Comm. address	Name	Value Range	Default	Unit	Change Mode
EA-72	0xEA48	AO polarity selection	Ones: AO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-73	0xEA49	AO curve selection	Ones: AO curve 0: Two-point curve 1: Gain + offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-74	0xEA4A	Minimum input of AO curve	-800.0 to EA-76	0.0	%	Real-time
EA-75	0xEA4B	Percentage corresponding to minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
EA-76	0xEA4C	Maximum input of AO curve	EA-74 to 800.0	100.0	%	Real-time
EA-77	0xEA4D	Percentage corresponding to the maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time
EA-78	0xEA4E	AO1 zero offset coefficient	-100.0 to 100.0	0.0	%	Real-time
EA-79	0xEA4F	AO1 gain	-10.00 to 10.00	1.00	-	Real-time
EA-80	0xEA50	AO1 output offset	-10.00 to 10.00	0.00	V	Real-time
EA-81	0xEA51	AO hardware source selection	Ones: AO source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-82	0xEA52	AO1 forced value	0.00 to 10.00	0.00	V	Real-time

10.2.7.8 Eb Parameters of I/O Expansion Card 2

Param.	Address	Name	Value range	Default	Unit	Change
Eb-00	0xEB00	DI enabled forcibly	bit0: DI1 0: Hardware 1: Forced value bit1: DI2 0: Hardware 1: Forced value bit2 to bit15: Reserved	0x0	-	At stop
Eb-01	0xEB01	DI forced data	bit0: DI1 setting 0: Low level 1: High level bit1: DI2 setting 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-02	0xEB02	DI1 switch-on delay	0.0 to 3600.0	0.0	s	At stop
Eb-03	0xEB03	DI1 switch-off delay	0.0 to 3600.0	0.0	s	At stop
Eb-04	0xEB04	DI2 switch-on delay	0.0 to 3600.0	0.0	s	At stop
Eb-05	0xEB05	DI2 switch-off delay	0.0 to 3600.0	0.0	s	At stop
Eb-08	0xEB08	DI input filter time selection	bit0: DI1 filter time 0: Filter time 1 1: Filter time 2 bit1: DI2 filter time 0: Filter time 1 1: Filter time 2 bit2 to bit15: Reserved	0x0	-	Real-time
Eb-09	0xEB09	DI input filter time 1	0.000 to 1.000	0.010	s	Real time
Eb-10	0xEB0A	DI input filter time 2	0.000 to 1.000	0.010	s	Real time

Param.	Address	Name	Value range	Default	Unit	Change
Eb-16	0xEB10	DO1 output function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency level detection FDT1 4: Frequency reached 5: Operating at zero speed (no output at stop) 6: Motor overload pre-alarm 7: Drive overload pre-alarm 11: Simple PLC cycle completed 12: Cumulative operating time reached 13: Wobble frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage output 20: Communication (7322) 23: Operating at zero speed 2 (output at stop) 24: Cumulative power-on time reached 25: Frequency level detection FDT2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (output at stop) 38: Error output (fault/minor fault/alarm) 40: Current operating time reached 41: Fault (excluding undervoltage) 43: Minor fault or alarm 44: AI2 input limit exceeded 46: Component service lifetime pre-alarm Others: B connector	0	-	Real time
Eb-17	0xEB11	RO1 output function selection	Same as Eb-16	0	/	Real time
Eb-18	0xEB12	DO/RO output source	bit 0: DO source 0: Output function setting 1: Forced value bit1: RO output source 0: Output function setting 1: Forced value bit2 to bit15: Reserved	0x0	-	Real-time

Param.	Address	Name	Value range	Default	Unit	Change
Eb-19	0xEB13	Forced DO/RO data	bit0: DO setting 0: Low level 1: High level bit1: RO setting 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-20	0xEB14	DO/RO polarity selection	bit0: DO output source 0: Positive logic 1: Negative logic bit1: bit0: RO output source 0: Positive logic 1: Negative logic bit2 to bit15: Reserved	0x0	-	Real-time
Eb-21	0xEB15	DO1 switch-on delay	0.0 to 3600.0	0.0	s	Real time
Eb-22	0xEB16	DO1 switch-off delay	0.0 to 3600.0	0.0	s	Real time
Eb-23	0xEB17	RO1 switch-on delay	0.0 to 3600.0	0.0	s	Real time
Eb-24	0xEB18	RO1 switch-off delay	0.0 to 3600.0	0.0	s	Real time
Eb-25	0xEB19	Forced output state of DO/RO upon communication disconnection	bit0: Forced output upon DO disconnection 0: Low level 1: High-level bit1: Forced output upon RO disconnection 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-31	0xEB1F	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
Eb-32	0xEB20	Forced value of AI1	-10.00 to +10.00	0.00	V	Real-time
Eb-36	0xEB24	AI1 gain	-10.00 to +10.00	1.00	-	Real time
Eb-37	0xEB25	AI1 offset	-10.00 to +10.00	0.00	V	Real-time
Eb-38	0xEB26	AI1 de-noising threshold	0.0 to 100.0	0.0	%	Real-time
Eb-39	0xEB27	AI1 filter time	0.00 to 10.00	0.10	s	Real time
Eb-40	0xEB28	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
Eb-41	0xEB29	Jump point of AI1 setting	-800.0 to +800.0	0.0	%	Real-time
Eb-42	0xEB2A	Jump amplitude of AI1 setting	0.0 to 100.0	0.1	%	Real-time

Param.	Address	Name	Value range	Default	Unit	Change
Eb-43	0xEB2B	Upper limit of AI1 input protection	Eb-44 to 10.00	8.00	V	Real-time
Eb-44	0xEB2C	Lower limit of AI1 input protection	0.00 to Eb-43	2.00	V	Real-time
Eb-45	0xEB2D	AI input protection time	0.00 to 1.00	0.01	s	Real time
Eb-46	0xEB2E	High level threshold when AI used as DI	5.5 to 9.0	7.0	V	Real-time
Eb-47	0xEB2F	Low level threshold when AI used as DI	1.0 to 4.5	3.0	V	Real-time
Eb-48	0xEB30	AI polarity selection	Ones: AI1 selection 0: Normal value 1: Absolute value 2: Inverted 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
Eb-49	0xEB31	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, EB-51 to EB-54) 2: Curve 2 (2 points, EB-55 to EB-58) Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0001	-	Real-time
Eb-50	0xEB32	Selection when AI value lower than the minimum input value	Ones: Selection when AI1 value lower than minimum input value 0: Corresponding to the minimum input setting 1: 0.0% Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0	-	Real-time
Eb-51	0xEB33	Minimum input of AI curve 1	-10.00 to Eb-53	0.00	V	Real-time
Eb-52	0xEB34	Percentage corresponding to minimum input of AI curve 1	-800.0 to +800.0	0.0	%	Real-time
Eb-53	0xEB35	Maximum input of AI curve 1	Eb-51 to 10.00	10.00	V	Real-time
Eb-54	0xEB36	Percentage corresponding to the maximum input of AI curve 1	-800.0 to +800.0	100.0	%	Real-time
Eb-55	0xEB37	Minimum input of AI curve 2	-10.00 to Eb-57	0.00	V	Real-time

Param.	Address	Name	Value range	Default	Unit	Change
Eb-56	0xEB38	Percentage corresponding to the minimum input of AI curve 2	-800.0 to +800.0	0.0	%	Real-time
Eb-57	0xEB39	Maximum input of AI curve 2	Eb-55 to 10.00	10.00	V	Real-time
Eb-58	0xEB3A	Percentage corresponding to the maximum input of AI curve 2	-800.0 to +800.0	100.0	%	Real-time
Eb-59	0xEB3B	AI temperature mode - motor temperature sensor type	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 single-core 5: PTC130 three-core	0	-	Real time
Eb-60	0xEB3C	AI temperature mode - motor overtemperature protection threshold	Eb-61 to 200	130	°C	Real time
Eb-61	0xEB3D	AI temperature mode - motor overtemperature pre-alarm threshold	0 to Eb-60	110	°C	Real time
Eb-62	0xEB3E	AI temperature mode - motor temperature reached	0 to 100	75	°C	Real time
Eb-71	0xEB47	AO1 function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication (address: 0x7324) 13: Motor speed 14: Output current (The value 100.0% corresponds to 1000.0 A) 15: Bus voltage (The value 100% corresponding to 1000.0 V) 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real time

Param.	Address	Name	Value range	Default	Unit	Change
Eb-72	0xEB48	AO polarity selection	Ones: AO selection 0: Normal 1: Absolute value 2: Inverted 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
Eb-73	0xEB49	AO curve	Ones: AO curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
Eb-74	0xEB4A	Minimum input of AO curve	-800.0 to Eb-76	0.0	%	Real-time
Eb-75	0xEB4B	Percentage corresponding to minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
Eb-76	0xEB4C	Maximum input of AO curve	Eb-74 to 800.0	100.0	%	Real-time
Eb-77	0xEB4D	Percentage corresponding to the maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time
Eb-78	0xEB4E	AO1 zero offset coefficient	-100.0 to +100.0	0.0	%	Real-time
Eb-79	0xEB4F	AO1 gain	-10.00 to +10.00	1.00	-	Real time
Eb-80	0xEB50	AO1 output offset	-10.00 to +10.00	0.00	V	Real-time
Eb-81	0xEB51	AO hardware source selection	Ones: AO source 0: Output function setting 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
Eb-82	0xEB52	AO1 forced value	0.00 to 10.00	0.00	V	Real-time

10.2.7.9 EE Input and output correction parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
EE-00	0xEE00	AI1 measured voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-01	0xEE01	AI1 displayed voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-02	0xEE02	AI1 measured voltage 2	-10.000 to 10.000	8.000	V	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
EE-03	0xEE03	Displayed voltage 2 over AI1	-10.000 to 10.000	8.000	V	Change at stop
EE-04	0xEE04	AI2 measured voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-05	0xEE05	AI2 displayed voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-06	0xEE06	AI2 measured voltage 2	-10.000 to 10.000	8.000	V	Change at stop
EE-07	0xEE07	Displayed voltage 2 over AI2	-10.000 to 10.000	8.000	V	Change at stop
EE-12	0xEE0C	AO1 target voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-13	0xEE0D	AO1 measured voltage 1	-10.000 to 10.000	2.000	V	Change at stop
EE-14	0xEE0E	AO1 target voltage 2	-10.000 to 10.000	8.000	V	Change at stop
EE-15	0xEE0F	AO1 measured voltage 2	-10.000 to 10.000	8.000	V	Change at stop

10.2.8 Group H Protection and Auxiliary

10.2.8.1 H1 Fault Level Settings

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-00	0x8100	Protection action selection 0 upon fault	Ones: Overcurrent (E002) 0: Coast to stop Tens: Overvoltage (E005) 0: Coast to stop Hundreds: Buffer fault (E008) 0: Coast to stop Thousands: Undervoltage (E009) 0: Coast to stop	0x0	-	Unchangeable
H1-01	0x8101	Protection action selection 1 upon fault	Ones: Inverter overload (E010) 0: Coast to stop Tens: Motor overload (E011) 0: Coast to stop Hundreds: Input phase loss (E012) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Thousands: Output phase loss (E013) 0: Coast to stop	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-02	0x8102	Protection action selection 2 upon fault	Ones: Module overtemperature (E014) 0: Coast to stop Tens: External fault (E015) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	0x0	-	Real-time
H1-03	0x8103	Protection action selection 3 upon fault	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop at max. capacity 2: Quick stop 3: Decelerate to stop F: Ignore	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-04	0x8104	Protection action selection 4 upon fault	Ones: Output short-circuited to ground (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Accumulative running time reached (E026) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: User-defined fault (E027) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-05	0x8105	Protection action selection 5 upon fault	Ones: User-defined alarm (E028) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: Cumulative power-on time reached fault (E029) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: Three-phase loss fault (E030) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: PID fault feedback loss (E031) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x00DD	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-06	0x8106	Protection action selection 6 upon fault	Ones: Parameter reset improperly (E023) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Too large speed deviation (E042) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Thousands: Motor speed exception (E043) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore	0x0D0D	-	Real-time
H1-07	0x8107	Protection action selection 7 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Auto-tuned pole position error (E051) 0: Coast to stop	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-08	0x8108	Protection action selection 8 upon fault	Ones: Reserved 0: Coast to stop Tens: Self-test fault 1 (E056) 0: Coast to stop Hundreds: Self-test fault 2 (E057) 0: Coast to stop Thousands: Self-test fault 3 (E058) 0: Coast to stop	0x0	-	Unchangeable
H1-09	0x8109	Protection action selection 9 upon fault	Ones: Self-test fault 4 (E059) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time
H1-10	0x810A	Protection action selection 10 upon fault	Ones: Fan failure (E080) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-11	0x810B	Protection action selection 11 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Sequence fault (E085) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: Motor control error 1 (E093) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x0F00	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-12	0x810C	Protection action selection 12 upon fault	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: AC drive pre-overload (E110) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: Motor pre-overload (E111) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: Module pre-overtemperature (E114) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0xDDDD	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-13	0x810D	Protection action selection 13 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time
H1-14	0x810E	Protection action selection 14 upon fault	Ones: AI/HDI disconnection fault (E154) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: Expansion IO card communication timeout 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: Reserved Coast to stop Thousands: Fault automatic reset failed (E159) 0: Coast to stop	0x00DF	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-15	0x810F	Protection action selection 15 upon fault	Ones: Ones: Modbus communication timeout (E160) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: CANopen fault (E161) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: CANlink fault (E162) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: Modbus TCP communication timeout (E169) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x0333	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-16	0x8110	Protection action selection 16 upon fault	Ones: EtherNet/IP failure (MD630N valid) (E165) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: PROFINET fault (MD630N valid) (E166) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: EtherCAT fault 1 (MD630N valid) (E167 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: EtherCAT fault 2 (MD630N valid) (E168) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-17	0x8111	Protection action selection 17 upon fault	Ones: Inobus extension protocol (E170) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: Reserved 0: Coast to stop Hundreds: Speed tracking fault (E192) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: Undervoltage suppression limit reached (E193) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-18	0x8112	Protection action selection 18 upon fault	Ones: Component lifetime alarm (E179) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Tens: Junction temperature parameter fault (E187)0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Hundreds: Power EEPROM power off parameter failure (Err188) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: No detection Thousands: junction temperature fault (E191) 0: Coast to stop	0x000D	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-19	0x8113	Protection action selection 19 upon fault	Ones: External flash data read/write fault of black box 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run with speed limited A: Run with power limited B: Run with current limited C: Run with torque limited D: Alarm displayed E: Prompt F: Ignore Tens: Fire mode active D: Alarm displayed E: Prompt F: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x00DD	-	Real-time
H1-30	0x811E	Setting for the 1st group of fault codes	0.0 to 255.9	0.0	-	Change at stop
H1-31	0x811F	Settings of fault level for fault codes of group 1	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-32	0x8120	Settings of fault codes of group 2	0.0 to 255.9	0.0	-	Change at stop
H1-33	0x8121	Settings of fault level for fault codes of group 2	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-34	0x8122	Settings of fault codes of group 3	0.0 to 255.9	0.0	-	Change at stop
H1-35	0x8123	Handling of exceptions in group 3	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-36	0x8124	Settings of fault codes of group 4	0.0 to 255.9	0.0	-	Change at stop
H1-37	0x8125	Settings of fault level for fault codes of group 4	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-38	0x8126	Settings of fault codes of group 5	0.0 to 255.9	0.0	-	Change at stop
H1-39	0x8127	Settings of fault level for fault codes of group 5	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-40	0x8128	Settings of fault codes of group 6	0.0 to 255.9	0.0	-	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-41	0x8129	Settings of fault level for fault codes of group 6	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-42	0x812A	Settings of fault codes of group 7	0.0 to 255.9	0.0	-	Change at stop
H1-43	0x812B	Settings of fault level for fault codes of group 7	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-44	0x812C	Settings of fault codes of group 8	0.0 to 255.9	0.0	-	Change at stop
H1-45	0x812D	Settings of fault level for fault codes of group 8	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-46	0x812E	Settings of fault codes of group 9	0.0 to 255.9	0.0	-	Change at stop

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-47	0x812F	Settings of fault level for fault codes of group 9	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-48	0x8130	Settings of fault codes of group 10	0.0 to 255.9	0.0	-	Change at stop
H1-49	0x8131	Settings of fault level for fault codes of group 10	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: No detection	0x000F	-	Change at stop
H1-60	0x813C	Operation at limited speed	0: Run at limited frequency 1: Run at operating frequency upon fault 2: Run at specified safety frequency 3: Run at frequency reference 4: Run at frequency upper limit in the current direction 5: Run at frequency lower limit in the current direction	1	-	Real-time
H1-61	0x813D	Designated safe operation frequency	0.0 to 800.0	0.0	%	Real-time
H1-62	0x813E	Maximum positive frequency in limited operation mode	0.0 to 800.0	100.0	%	Real-time
H1-63	0x813F	Maximum negative frequency in limited operation mode	0.0 to 800.0	100.0	%	Real-time
H1-64	0x8140	Maximum motoring power in limited operation mode	0.0 to 400.0	50.0	%	Real-time
H1-65	0x8141	Maximum regenerative power in limited operation mode	0.0 to 400.0	50.0	%	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
H1-66	0x8142	Maximum positive torque in limited operation mode	0.0 to 400.0	50.0	%	Real-time
H1-67	0x8143	Maximum negative torque in limited operation mode	0.0 to 400.0	50.0	%	Real-time
H1-68	0x8144	Maximum current in limited operation mode	0.0 to 400.0	50.0	%	Real-time

10.2.8.2 H2: User-Defined Fault

Item	Address:	Name	Value Range	Default	Unit	Change:
H2-00	0x8200	Source of external fault 1 (NO)	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-01	0x8201	Source of external fault 2 (NC)	0: Inactive 1: Active Others: B connector	1	/	Real time
H2-02	0x8202	Source of user-defined fault 1	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-03	0x8203	Source of user-defined fault 2	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-04	0x8204	Source of user-defined fault 3	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-05	0x8205	Source of user-defined fault 4	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-06	0x8206	Source of user-defined fault 5	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-07	0x8207	Source of user-defined fault 6	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-08	0x8208	Source of user-defined fault 7	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-09	0x8209	Source of user-defined fault 8	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-10	0x820A	Source of user-defined alarm 1	0: Inactive 1: Active Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
H2-11	0x820B	Source of user-defined alarm 2	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-12	0x820C	Source of user-defined alarm 3	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-13	0x820D	Source of user-defined alarm 4	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-14	0x820E	Source of user-defined alarm 5	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-15	0x820F	Source of user-defined alarm 6	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-16	0x8210	Source of user-defined alarm 7	0: Inactive 1: Active Others: B connector	0	/	Real time
H2-17	0x8211	Source of user-defined alarm 8	0: Inactive 1: Active Others: B connector	0	/	Real time

10.2.8.3 H3: Automatic Fault Reset/Restart

Item	Address:	Name	Value Range	Default	Unit	Change:
H3-00	0x8300	Automatic fault reset	0: Disable 1: Enable	1	/	Real time
H3-01	0x8301	Number of automatic fault reset times	0 to 100	0	/	Real time
H3-02	0x8302	Time interval between automatic fault reset	0.1 to 600.0	1.0	s	Real-time
H3-03	0x8303	Auto reset terminated upon manual reset	0: Yes 1: No	1	/	Real time
H3-04	0x8304	Time to restore the number of automatic fault reset times	0 to 6000	10	min	Real-time
H3-05	0x8305	Active fault reset attempt count	0 to 65535	0	/	Unchangeable
H3-06	0x8306	Clearing upon fault reset count reach	0: Cleared 1: Not cleared	0	/	Real time
H3-07	0x8307	Fault output selection	0: No output during automatic fault reset 1: Output during automatic fault reset	0	/	Real time
H3-13	0x830D	Fault code 1 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
H3-14	0x830E	Fault code 2 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-15	0x830F	Fault code 3 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-16	0x8310	Fault code 4 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-17	0x8311	Fault code 5 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-18	0x8312	Fault code 6 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-19	0x8313	Fault code 7 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-20	0x8314	Fault code 8 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-21	0x8315	Fault code 9 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-22	0x8316	Fault code 10 that is inhibited from automatic fault reset	0.0 to 255.9	0.0	/	Real time
H3-28	0x831C	Restart after automatic fault reset	0: Disable 1: Enable	0	/	Real time
H3-29	0x831D	Restart interval upon automatic fault reset	0.0 to 600.0	0.5	s	Real-time
H3-30	0x831E	Adopt flying start after automatic fault reset	0: No 1: Yes	0	/	Real time
H3-31	0x831F	List that allows restart after automatic fault reset	0: Whitelist 1: Blacklist	1	/	Real time
H3-34	0x8322	Designated fault code 1	0.0 to 255.9	0.0	/	Real time
H3-35	0x8323	Designated fault code 2	0.0 to 255.9	0.0	/	Real time
H3-36	0x8324	Designated fault code 3	0.0 to 255.9	0.0	/	Real time
H3-37	0x8325	Designated fault code 4	0.0 to 255.9	0.0	/	Real time
H3-38	0x8326	Designated fault code 5	0.0 to 255.9	0.0	/	Real time
H3-39	0x8327	Designated fault code 6	0.0 to 255.9	0.0	/	Real time

10.2.8.4 H6 Historical Fault Record 1

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-00	0x8600	Fault code 1 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-06	0x8606	Fault code 2 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-12	0x860C	Fault code 3 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-18	0x8612	Fault code 4 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-24	0x8618	Fault code 5 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-30	0x861E	Fault code 6 of the latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-36	0x8624	Frequency upon the latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H6-37	0x8625	Current upon the latest fault	0.00 to 655.35	0.00	A	Unchangeable
H6-38	0x8626	Bus voltage upon the latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H6-39	0x8627	Input terminal status upon the latest fault	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 status (valid only for MD630S) Bit 4: DI5 status (valid only for MD630S) Bit 5: DI6 status (valid only for MD630S) Bit 6: DI7/HDI status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-40	0x8628	Output terminal status upon the latest fault	Bit 0: RO status (Bit 1): FMR status (valid only for MD630S) Bit 2: DO status Bit 3 to Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
H6-41	0x8629	Drive state upon the latest fault	0 to 65535	0	-	Unchangeable
H6-42	0x862A	Power-on time upon the latest fault	0 to 65535	0	min	Unchangeable
H6-43	0x862B	Running time upon the latest fault	0.0 to 6553.5	0.0	min	Unchangeable
H6-44	0x862C	Status word 1 upon the latest fault	Bit 0: Ready to switch on Bit 1: Ready to run Bit 2: Running Bit 3: Fault Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) stop Bit 6: Switch-on blocked Bit 7: Alarm/limit operation Bit 8: No speed deviation Bit 9: Local/Remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Positive speed Bit 13: Negative speed Bit 14: Running (pulsing) Bit 15: User setting state 0 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-45	0x862D	Status word 2 upon the latest fault	Bit 0: Self-check Bit 1: Parameter auto-tuning Bit 2: Minor fault state Bit 3: Alarm state Bit 4: Speed mode Bit 5: Torque mode Bit 6: reserved Bit 7: RFG enable Bit 8: RFG operation Bit 9: Stop at fault Bit 10: Non-jogging Bit 11: Jogging Bit 12: Decelerate to stop Bit 13: Brake closed Bit 14: Terminal control Bit 15: User setting state 1 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-46	0x862E	Command word upon the latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal; 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal; 1: RFG pause Bit 6: RFG input forced to 0 0: Normal; 1: RFG input forced to 0 Bit 7: Fault reset 0: Invalid; 1: Valid Bit 8: Jog 1 0: Invalid; 1: Valid Bit 9: Jog 2 0: Invalid; 1: Valid Bit 10: Remote control reserved 0: Invalid; 1: Valid Bit 11: Opposite to the speed 0: Not reversed; 1: Reversed Bit 12: Start signal 0: Invalid; 1: Valid Bit 13: Internal start command 0: Invalid; 1: Valid Bit 14 to bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-47	0x862F	RFG status word upon the latest fault	Bit 0 to Bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 2 to Bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to Bit 7: Reserved Bit 8 to Bit 9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 10 to Bit 11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12 to Bit 15: Reserved	0x0	-	Unchangeable

10.2.8.5 H7 Historical Fault Record 2

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-00	0x8700	Fault code 1 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-06	0x8706	Fault code 2 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-12	0x870C	Fault code 3 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-18	0x8712	Fault code 4 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-24	0x8718	Fault code 5 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-30	0x871E	Fault code 6 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-36	0x8724	Frequency upon the 2nd latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H7-37	0x8725	Current upon the 2nd latest fault	0.00 to 655.35	0.00	A	Unchangeable
H7-38	0x8726	Bus voltage upon the 2nd latest fault	0.0 to 6553.5	0.0	V	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-39	0x8727	Input terminal status upon the 2nd latest fault	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 status (valid only for MD630S) Bit 4: DI5 status (valid only for MD630S) Bit 5: DI6 status (valid only for MD630S) Bit 6: DI7/HDI status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
H7-40	0x8728	Output terminal status upon the 2nd latest fault	Bit 0: RO status (Bit 1): FMR status (valid only for MD630S) Bit 2: DO status Bit 3 to Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
H7-41	0x8729	Drive state upon the 2nd latest fault	0 to 65535	0	-	Unchangeable
H7-42	0x872A	Power-on time upon the 2nd latest fault	0 to 65535	0	min	Unchangeable
H7-43	0x872B	Running time upon the 2nd latest fault	0.0 to 6553.5	0.0	min	Unchangeable
H7-44	0x872C	Status word 1 upon the 2nd latest fault	Bit 0: Ready to switch on Bit 1: Ready to run Bit 2: Running Bit 3: Fault Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) stop Bit 6: Switch-on blocked Bit 7: Alarm/limit operation Bit 8: No speed deviation Bit 9: Local/Remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Positive speed Bit 13: Negative speed Bit 14: Running (pulsing) Bit 15: User setting state 0 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-45	0x872D	Status word 2 upon the 2nd latest fault	Bit 0: Self-check Bit 1: Parameter auto-tuning Bit 2: Minor fault state Bit 3: Alarm state Bit 4: Speed mode Bit 5: Torque mode Bit 6: reserved Bit 7: RFG enable Bit 8: RFG operation Bit 9: Stop at fault Bit 10: Non-jogging Bit 11: Jogging Bit 12: Decelerate to stop Bit 13: Brake closed Bit 14: Terminal control Bit 15: User setting state 1 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable
H7-46	0x872E	Command word upon the 2nd latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Invalid 1: Valid Bit 8: Jog 1 0: Invalid 1: Valid Bit 9: Jog 2 0: Invalid 1: Valid Bit 10: Remote control reserved 0: Invalid 1: Valid Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved.	0x0	-	Unchangeable
H7-47	0x872F	RFG status word upon the 2nd latest fault	Bit 0 to Bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 2 to Bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to Bit 7: Reserved Bit 8 to Bit 9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 10 to Bit 11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12 to Bit 15: Reserved	0x0	-	Unchangeable

10.2.8.6 H8 Historical Fault Record 3

Parameter code	Communication Address	Parameter name	Range	Default Value	Unit	Change mode
H8-00	0x8800	Fault code 1 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-06	0x8806	Fault code 2 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-12	0x880C	Fault code 3 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-18	0x8812	Fault code 4 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-24	0x8818	Fault code 5 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable

Parameter code	Communication Address	Parameter name	Range	Default Value	Unit	Change mode
H8-30	0x881E	Fault code 6 of the 3rd latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-36	0x8824	Frequency upon the 3rd latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H8-37	0x8825	Current upon the 3rd latest fault	0.0 to 655.35	0.00	A	Unchangeable
H8-38	0x8826	Bus voltage upon the 3rd latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H8-39	0x8827	Input terminal status upon the 3rd latest fault	Bit 0: DI1 state Bit 1: DI2 state Bit 2: DI3 state (valid only for MD630S) Bit 3: DI4 state (valid only for MD630S) Bit 4: DI5 state (valid only for MD630S) Bit 5: DI6 state (valid only for MD630S) Bit 6: DI7 state (valid only for MD630S) Bit 7 to bit 9: Reserved Bit 10: VDI1 state Bit 11: VDI2 state Bit 12: VDI3 state Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Bit value: 0: Low level 1: High level	0x0	/	Unchangeable
H8-40	0x8828	Output terminal status upon the 3rd latest fault	Bit 0 RO state Bit 1: FMR state (valid only for MD630S) Bit 2: DO state Bit 3 to bit 9: Reserved Bit 10: VDO1 state Bit 11: VDO2 state Bit 12: VDO3 state Bit 13: VDO4 state Bit 14: VDO5 state Bit 15: VDO6 state Bit value: 0: Low level 1: High level	0x0	/	Unchangeable
H8-41	0x8829	Drive state upon the 3rd latest fault	0 to 65535	0	-	Unchangeable
H8-42	0x882A	Power-on time upon the 3rd latest fault	0 to 65535	0	min	Unchangeable
H8-43	0x882B	Running time upon the 3rd latest fault	0.0 to 6553.5	0.0	min	Unchangeable

Parameter code	Communication Address	Parameter name	Range	Default Value	Unit	Change mode
H8-44	0x882C	Status word 1 upon the 3rd latest fault	Bit 0: Ready to switch-on Bit 1: Ready to run Bit 2: Operating Bit 3: Fault Bit 4: OFF2 stop (coast to stop) Bit 5: OFF3 stop (quick stop) Bit 6: Switch-on blocked Bit 7: Alarm/limit operation Bit 8: No speed deviation Bit 9: Local/Remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Positive speed Bit 13: Negative speed Bit 14: Operating (pulsing) Bit 15: User-set state 0 Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable
H8-45	0x882D	Status word 2 upon the 3rd latest fault	Bit 0: Self-test Bit 1: Parameter auto-tuning Bit 2: Minor fault status Bit 3: Warning status Bit 4: Speed mode Bit 5: Torque mode Bit 6: Reserved Bit 7: RFG enabled Bit 8: RFG running Bit 9: Fault stop Bit 10: Non-jogging operation Bit 11: Jog operation Bit 12: Decelerate to stop Bit 13: Reserved Bit 14: Terminal control Bit 15: User-defined status 1 Bit value: 1: Invalid 0: Invalid	0x0	/	Unchangeable

Parameter code	Communication Address	Parameter name	Range	Default Value	Unit	Change mode
H8-46	0x882E	Command word upon the 3rd latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 stop (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control (reserved) 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	/	Unchangeable

Parameter code	Communication Address	Parameter name	Range	Default Value	Unit	Change mode
H8-47	0x882F	RFG status word upon the 3rd latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 10 to bit 11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12 to bit 15: Reserved	0x0	/	Unchangeable

10.2.8.7 H9 Historical Fault Record 4

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-00	0x8900	Fault code 1 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-06	0x8906	Fault code 2 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-12	0x890C	Fault code 3 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-18	0x8912	Fault code 4 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-24	0x8918	Fault code 5 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-30	0x891E	Fault code 6 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-36	0x8924	Frequency upon the 4th latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H9-37	0x8925	Current upon the 4th latest fault	0.00 to 655.35	0.00	A	Unchangeable
H9-38	0x8926	Bus voltage upon the fourth latest fault	0.0 to 6553.5	0.0	V	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-39	0x8927	Input terminal status upon the 4th latest fault	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 status (valid only for MD630S) Bit 4: DI5 status (valid only for MD630S) Bit 5: DI6 status (valid only for MD630S) Bit 6: DI7/HDI status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
H9-40	0x8928	Output terminal status upon the fourth latest fault	Bit 0: RO status (Bit 1): FMR status (valid only for MD630S) Bit 2: DO status Bit 3 to Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
H9-41	0x8929	Drive state upon the fourth latest fault	0 to 65535	0	-	Unchangeable
H9-42	0x892A	Power-on time upon the fourth latest fault	0 to 65535	0	min	Unchangeable
H9-43	0x892B	Running time upon the 4th latest fault	0.0 to 6553.5	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-44	0x892C	Status word 1 upon the fourth latest fault	Bit 0: Ready to switch on Bit 1: Ready to run Bit 2: Running Bit 3: Fault Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) stop Bit 6: Switch-on blocked Bit 7: Alarm/limit operation Bit 8: No speed deviation Bit 9: Local/Remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Positive speed Bit 13: Negative speed Bit 14: Running (pulsing) Bit 15: User setting state 0 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable
H9-45	0x892D	Status word 2 upon the fourth latest fault	Bit 0: Self-check Bit 1: Parameter auto-tuning Bit 2: Minor fault state Bit 3: Alarm state Bit 4: Speed mode Bit 5: Torque mode Bit 6: reserved Bit 7: RFG enable Bit 8: RFG operation Bit 9: Stop at fault Bit 10: Non-jogging Bit 11: Jogging Bit 12: Decelerate to stop Bit 13: Brake closed Bit 14: Terminal control Bit 15: User setting state 1 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-46	0x892E	Command word upon the fourth latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Invalid 1: Valid Bit 8: Jog 1 0: Invalid 1: Valid Bit 9: Jog 2 0: Invalid 1: Valid Bit 10: Remote control reserved 0: Invalid 1: Valid Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved to bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-47	0x892F	RFG status word upon the fourth latest fault	Bit 0 to Bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 2 to Bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to Bit 7: Reserved Bit 8 to Bit 9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 10 to Bit 11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12 to Bit 15: Reserved	0x0	-	Unchangeable

10.2.8.8 HA Historical Fault Record 5

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-00	0x8A00	Fault code 1 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-06	0x8A06	Fault code 2 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-12	0x8A0C	Fault code 3 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-18	0x8A12	Fault code 4 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-24	0x8A18	Fault code 5 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-30	0x8A1E	Fault code 6 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-36	0x8A24	Frequency upon the 5th latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
HA-37	0x8A25	Current upon the 5th latest fault	0.00 to 655.35	0.00	A	Unchangeable
HA-38	0x8A26	Bus voltage upon the 5th latest fault	0.0 to 6553.5	0.0	V	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-39	0x8A27	Input terminal status upon the 5th latest fault	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 status (valid only for MD630S) Bit 4: DI5 status (valid only for MD630S) Bit 5: DI6 status (valid only for MD630S) Bit 6: DI7/HDI status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
HA-40	0x8A28	Output terminal status upon the fifth latest fault	Bit 0: RO status (Bit 1): FMR status (valid only for MD630S) Bit 2: DO status Bit 3 to Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status Value of bit: 0: Low level 1: High level	0x0	-	Unchangeable
HA-41	0x8A29	Drive state upon the fifth latest fault	0 to 65535	0	-	Unchangeable
HA-42	0x8A2A	Power-on time upon the fifth latest fault	0 to 65535	0	min	Unchangeable
HA-43	0x8A2B	Running time upon the fifth latest fault	0.0 to 6553.5	0.0	min	Unchangeable
HA-44	0x8A2C	Status word 1 upon the fifth latest fault	Bit 0: Ready to switch on Bit 1: Ready to run Bit 2: Running Bit 3: Fault Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) stop Bit 6: Switch-on blocked Bit 7: Alarm/limit operation Bit 8: No speed deviation Bit 9: Local/Remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Positive speed Bit 13: Negative speed Bit 14: Running (pulsing) Bit 15: User setting state 0 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-45	0x8A2D	Status word 2 upon the fifth latest fault	Bit 0: Self-check Bit 1: Parameter auto-tuning Bit 2: Minor fault state Bit 3: Alarm state Bit 4: Speed mode Bit 5: Torque mode Bit 6: reserved Bit 7: RFG enable Bit 8: RFG operation Bit 9: Stop at fault Bit 10: Non-jogging Bit 11: Jogging Bit 12: Decelerate to stop Bit 13: Brake closed Bit 14: Terminal control Bit 15: User setting state 1 Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable
HA-46	0x8A2E	Command word upon the fifth latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Invalid 1: Valid Bit 8: Jog 1 0: Invalid 1: Valid Bit 9: Jog 2 0: Invalid 1: Valid Bit 10: Remote control reserved 0: Invalid 1: Valid Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved.	0x0	-	Unchangeable
HA-47	0x8A2F	RFG status word upon the fifth latest fault	Bit 0 to Bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 2 to Bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to Bit 7: Reserved Bit 8 to Bit 9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate Bit 10 to Bit 11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12 to Bit 15: Reserved	0x0	-	Unchangeable

10.2.8.9 Hb: Historical Fault Record 6

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-00	0x8B00	Sixth latest fault 1	0.0 to 6553.5	0.0	-	Unchangeable
Hb-06	0x8B06	Sixth latest fault 2	0.0 to 6553.5	0.0	-	Unchangeable
Hb-12	0x8B0C	Sixth latest fault 3	0.0 to 6553.5	0.0	-	Unchangeable
Hb-18	0x8B12	Sixth latest fault 4	0.0 to 6553.5	0.0	-	Unchangeable
Hb-24	0x8B18	Sixth latest fault 5	0.0 to 6553.5	0.0	-	Unchangeable
Hb-30	0x8B1E	Sixth latest fault 6	0.0 to 6553.5	0.0	-	Unchangeable
Hb-36	0x8B24	Frequency upon the sixth latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
Hb-37	0x8B25	Current upon the sixth latest fault	0.00 to 655.35	0.00	A	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-38	0x8B26	Bus voltage upon the sixth latest fault	0.0 to 6553.5	0.0	V	Unchangeable
Hb-39	0x8B27	Input terminal status upon the sixth latest fault	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 state (valid only for MD630S) Bit 4: DI5 state (valid only for MD630S) Bit 5: DI6 state (valid only for MD630S) Bit 6: DI7/HDI status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status The bit value is: 0: Low level 1: High level	0x0	-	Unchangeable
Hb-40	0x8B28	Output terminal status upon the sixth latest fault	Bit 0: RO status Bit 1: FMR status (valid only for MD630S) Bit 2: DO states Bit 3 to Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status The bit value is: 0: Low level 1: High level	0x0	-	Unchangeable
Hb-41	0x8B29	Drive state upon the sixth latest fault	0 to 65535	0	-	Unchangeable
Hb-42	0x8B2A	Power-on time upon the sixth latest fault	0 to 65535	0	min	Unchangeable
Hb-43	0x8B2B	Running time upon the sixth latest fault	0.0 to 6553.5	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-44	0x8B2C	Status word 1 upon the sixth latest fault	Bit 0: Ready to start Bit 1: Ready to run Bit 2: Running Bit 3: Faulty Bit 4: OFF2 (coast to stop) Bit 5: OFF3 (quick stop) Bit 6: Power-on blocked Bit 7: Alarm/running with restriction Bit 8: No speed deviation Bit 9: Local/remote Bit 10: Target speed reached Bit 11: Torque limit Bit 12: Forward speed Bit 13: Negative speed Bit 14: Running (pulse output) Bit 15: User-defined status 0 The bit value is: 0: Invalid 1: Valid	0x0	-	Unchangeable
Hb-45	0x8B2D	Status word 2 upon the sixth latest fault	Bit 0: Self-check Bit 1: Parameter auto-tuning Bit 2: Minor fault state Bit 3: Warning state Bit 4: Speed mode Bit 5: Torque mode Bit 6: Position mode Bit 7: RFG enable Bit 8: RFG running Bit 9: Stop at fault Bit 10: Non-jog running Bit 11: Jog running Bit 12: Decelerate to stop Bit 13: Reserved Bit 14: Terminal control Bit 15: User-defined status 0 The bit value is: 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-46	0x8B2E	Command word upon the sixth latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG paused Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 0: Disable 1: Enable Bit 9:Jog 2 0: Disable 1: Enable Bit 10: Remote control 0: Disable 1: Enable Bit 11: Speed inversion 0: Disable 1: Enable Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-47	0x8B2F	RFG status word upon the sixth latest fault	Bit 0 to Bit 1: Acceleration/deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to Bit 3: Acceleration/deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit4 to Bit7: Reserved Bit8 to Bit9: Last acceleration/deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 to Bit 11: Last arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit12 to Bit15: Reserved	0x0	-	Unchangeable

10.2.9 Group J Industry-specific processes

10.2.9.1 J6 Fire Mode

Param.	Address	Name	Range	Default	Unit	Change Mode
J6-00	0x3600	Fire mode password	0 to 65535	0	-	Real-time
J6-01	0x3601	Status of the fire function	0: Fire function is invalid 1: The fire function is valid.	0	-	Unchangeable
J6-02	0x3602	Fire mode enable	0: Disable 1: Enable 2: Fire mode test	0	-	Real-time
J6-03	0x3603	Operating source in fire mode	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
J6-06	0x3606	Operating direction in fire mode	0: Default direction 1: Opposite to the default direction	0	-	Real-time
J6-07	0x3607	Acceleration time in fire mode	0.0 to 6500.0	20.0	s	Real-time

Param.	Address	Name	Range	Default	Unit	Change Mode
J6-08	0x3608	Deceleration time in fire mode	0.0 to 6500.0	20.0	s	Real-time
J6-11	0x360B	Fire mode frequency source	0: Frequency set by digital setting 1: Operating frequency filter value before the fire 2: AI1 3: AI2 8: PID 9: Communication	0	-	Change at stop
J6-12	0x360C	Fire mode backup frequency source	0: Frequency set by digital setting 1: Operating frequency filter value before the fire 2: Maximum running frequency	0	-	Change at stop
J6-13	0x360D	Frequency set by digital setting	0.00 to A2-17	50.00	Hz	Real-time
J6-16	0x3610	Operating frequency filter time before the fire	0.0 to 300.0	1.0	s	Real-time
J6-17	0x3611	Time for determining effective operating frequency before the fire	0.0 to 6000.0	30.0	s	Real-time
J6-20	0x3614	Number of automatic fault reset times in fire mode	0 to 100	80	-	Real-time
J6-21	0x3615	Delay for automatic fault reset in fire mode	0.0 to 300.0	1.0	-	Real-time
J6-22	0x3616	Waiting time for fault waiting to be reset 1	0 to J6-23	10	s	Real-time
J6-23	0x3617	Waiting time for fault waiting to be reset 2	J6-22 to 3600	30	s	Real-time
J6-24	0x3618	Waiting time for fault waiting to be reset 3	0 to 65535	0	-	Real-time
J6-27	0x361B	Enable bypass function in fire mode	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
J6-28	0x361C	Fire bypass delay	0.0 to 300.0	5.0	-	Real-time
J6-31	0x361F	Total number of fires	0 to 65535	0	-	Unchangeable
J6-33	0x3621	Total number of fire bypass triggered times	0 to 65535	0	-	Unchangeable

10.2.10 n Communication Configuration

10.2.10.1 n0 Communication General Configuration

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
n0-09	0x2009	Active communication mode	0: Invalid 1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	0	-	Unchangeable
n0-10	0x200A	Communication type	1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	1	-	Change at stop
n0-11	0x200B	Communication status	0 to 65535	0	-	Unchangeable
n0-12	0x200C	Compatible with old communication address	0: Not compatible 1: Compatible	1	-	Change at stop
n0-13	0x200D	1000 H setting selection	0: Percentage (corresponds to the rated frequency/ one decimal place) 1: Percentage (corresponds to the rated frequency/two decimal places) 2: Percentage (corresponds to the maximum frequency/two decimal places)	2	-	Change at stop
n0-14	0x200E	7310H setting selection	0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the rated frequency/ signed 16-bit/two decimal places)	1	-	Change at stop
n0-15	0x200F	Save parameters written through communication (group AE)	0: Invalid 1: Valid	0	-	Real-time
n0-16	0x2010	Communication fault automatic reset	0: Disable 1: Enable	1	-	Real-time
n0-17	0x2011	Current resolution (U0-04) read through communication	0: 0.01 A 1: 0.1 A	0	-	Real-time
n0-20	0x2014	Main device type	0x0 to 0xFFFF	0x0102	-	Unchangeable
n0-32	0x2020	Bus hardware (auxiliary integrated circuit) version	0 to 65535	1	-	Unchangeable
n0-56	0x2038	Process data address mapping clear	0: No operation 1: Clear	0	-	Change at stop
n0-60	0x203C	MAC1 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x0070	-	Unchangeable

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
n0-61	0x203D	MAC2 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00CA	-	Unchangeable
n0-62	0x203E	MAC3 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x004D	-	Unchangeable
n0-63	0x203F	MAC4 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
n0-64	0x2040	MAC5 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
n0-65	0x2041	MAC6 (EtherNet/IP, PROFINET, Modbus TCP)	0x0 to 0xFFFF	0x00AA	-	Unchangeable

10.2.10.2 n1: Commissioning Communication

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
n1-00	0x2100	Commissioning baud rate	9: 115200 bps 12: 500 kbps 16: 1 Mbps	9	/	Change at stop
n1-02	0x2102	Commissioning address	1 to 127	1	/	Change at stop

10.2.10.3 n2 Modbus Communication

Param.	Address	Name	Value Range	Default	Unit	Change Mode
n2-00	0x2200	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	Change at stop
n2-01	0x2201	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	0	-	Real-time
n2-02	0x2202	Modbus local address	1 to 247	1	-	Change at stop
n2-03	0x2203	Modbus response delay	0 to 20	2	ms	Real-time
n2-04	0x2204	Modbus communication timeout time	0.0 to 6000.0	0.0	s	Real-time
n2-20	0x2214	Modbus communication enable	0: Not supported by the current device 1: Effective	0	-	Unchangeable
n2-51	0x2233	Highest order byte of Modbus TCP IP address	0 to 255	0	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
n2-52	0x2234	Second highest order byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-53	0x2235	Third highest order byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-54	0x2236	Lowest order byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-55	0x2237	Highest order byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-56	0x2238	Second highest order byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-57	0x2239	Third highest order byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-58	0x223A	Lowest order byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-59	0x223B	Highest order byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-60	0x223C	Second highest order byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-61	0x223D	Third highest order byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-62	0x223E	Lowest order byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-69	0x2245	Modbus TCP communication timeout time	0.0 to 6000.0	0.0	s	Real-time
n2-77	0x224D	PHY error frame statistics of Modbus TCP	0: Disable 1: Enable	0	-	Real-time
n2-78	0x224E	Modbus TCP port 0 - linkdown counts	0 to 65535	0	-	Unchangeable
n2-79	0x224F	Modbus TCP port 1 - linkdown counts	0 to 65535	0	-	Unchangeable
n2-80	0x2250	EtherCAT TCP port 0 - number of faults received	0 to 65535	0	-	Unchangeable
n2-81	0x2251	EtherCAT TCP port 1 - number of faults received	0 to 65535	0	-	Unchangeable
n2-82	0x2252	Number of Modbus TCP communication timeout	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
n2-83	0x2253	Modbus TCP port 0 - number of faults sent	0 to 65535	0	-	Unchangeable
n2-84	0x2254	Modbus TCP port 1 - number of faults sent	0 to 65535	0	-	Unchangeable

10.2.10.4 n3: CAN Communication

Item	Address:	Name	Value Range	Default	Unit	Change:
n3-00	0x2300	CAN communication enable	0: Not supported by the current device 1: Effective	0	/	This is not modifiable.
n3-01	0x2301	CAN communication protocol selection	1: CANopen 2: CANlink	2	/	Real time
n3-02	0x2302	CANopen baud rate	0: 20kbps 1: 50kbps 2: 100kbps 3: 125kbps 4: 250kbps 5: 500kbps 6: 1Mbps	5	/	Change at stop
n3-03	0x2303	CANopen station number	1 to 127	1	/	Change at stop
n3-06	0x2306	CANlink baud rate	0: 20kbps 1: 50kbps 2: 100kbps 3: 125kbps 4: 250kbps 5: 500kbps 6: 1Mbps	5	/	Change at stop
n3-07	0x2307	CANlink station number	1 to 63	1	/	Change at stop
n3-09	0x2309	Number of CAN frames received per unit time	0 to 65535	0	/	This is not modifiable.
n3-10	0x230A	Maximum CAN reception error count	0 to 65535	0	/	This is not modifiable.
n3-11	0x230B	Maximum CAN transmission error count	0 to 65535	0	/	This is not modifiable.
n3-12	0x230C	Number of CAN bus disconnections per unit time	0 to 65535	0	/	This is not modifiable.
n3-14	0x230E	CAN communication disconnection coefficient.	1 to 15	3	/	Change at stop
n3-25	0x2319	CANopen mode	0: Default mode 1: Expert mode	0	/	Change at stop
n3-26	0x231A	CANopen prohibition time	0 to 65535	0	/	Change at stop
n3-27	0x231B	CANopen event time	0 to 65535	0	/	Change at stop

Item	Address:	Name	Value Range	Default	Unit	Change:
n3-32	0x2320	CANopen NMT length error count	0 to 65535	0	/	This is not modifiable.
n3-33	0x2321	CANopen NMT command error count	0 to 65535	0	/	This is not modifiable.
n3-34	0x2322	CANopen heartbeat frame length error count	0 to 65535	0	/	This is not modifiable.

10.2.10.5 n4 EtherCAT parameters

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
n4-05	0x2405	Number of allowable sync interrupts	0 to 65535	20	-	Real-time
n4-06	0x2406	Enhanced link function switch	0: Disable 1: Enable	0	-	Real-time
n4-10	0x240A	Phy-related configuration	0 to 65535	0	-	Real-time
n4-16	0x2410	Station name	0 to 65535	0	-	Unchangeable
n4-17	0x2411	Station alias	0 to 65535	0	-	Real-time
n4-18	0x2412	Station alias backup	0 to 65535	0	-	Unchangeable
n4-25	0x2419	Number of errors received by port 0	0 to 65535	0	-	Unchangeable
n4-26	0x241A	Number of errors received by port 1	0 to 65535	0	-	Unchangeable
n4-27	0x241B	Transfer error count	0 to 65535	0	-	Unchangeable
n4-28	0x241C	Number of processing unit errors of EtherCAT	0 to 65535	0	-	Unchangeable
n4-29	0x241D	Connection loss count	0 to 65535	0	-	Unchangeable
n4-30	0x241E	Sync loss counter value	0 to 65535	0	-	Unchangeable
n4-31	0x241F	Application layer status error code	0 to 65535	0	-	Unchangeable
n4-32	0x2420	ESC register port control and status	0 to 65535	0	-	Unchangeable
n4-33	0x2421	XML file version	0 to 65535	0	-	Unchangeable
n4-34	0x2422	Device synchronization mode	0 to 65535	0	-	Unchangeable
n4-35	0x2423	Synchronization cycle	0 to 65535	0	-	Unchangeable
n4-41	0x2429	EtherCAT reset XML	0: Invalid 1: Valid	0	-	Real-time

10.2.10.6 n5 EtherNet/IP Parameters

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
n5-00	0x2500	DHCP function	0: Disable 1: Enable	0	-	Change at stop
n5-01	0x2501	Highest order byte of the IP address	0 to 255	0	-	Change at stop
n5-02	0x2502	Second highest order byte of the IP address	0 to 255	0	-	Change at stop
n5-03	0x2503	Third highest order byte of the IP address	0 to 255	0	-	Change at stop
n5-04	0x2504	Lowest order byte of the IP address	0 to 255	0	-	Change at stop
n5-05	0x2505	Highest order byte of the subnet mask	0-255	0	-	Change at stop
n5-06	0x2506	Second highest order byte of the subnet mask	0-255	0	-	Change at stop
n5-07	0x2507	Third highest order byte of the subnet mask	0-255	0	-	Change at stop
n5-08	0x2508	Lowest order byte of the subnet mask	0-255	0	-	Change at stop
n5-09	0x2509	Highest order byte of the gateway IP address	0-255	0	-	Change at stop
n5-10	0x250A	Second highest order byte of the gateway IP address	0-255	0	-	Change at stop
n5-11	0x250B	Third highest order byte of the gateway IP address	0-255	0	-	Change at stop
n5-12	0x250C	Lowest order byte of the gateway IP address	0-255	0	-	Change at stop
n5-21	0x2515	Packet loss count value	0-65535	0	-	Unchangeable
n5-22	0x2516	Port 0-linkdown counts	0-65535	0	-	Unchangeable
n5-23	0x2517	Port 1-linkdown counts	0-65535	0	-	Unchangeable
n5-24	0x2518	Port 0-Number of errors received	0-65535	0	-	Unchangeable
n5-25	0x2519	Port 1-Number of errors received	0-65535	0	-	Unchangeable
n5-26	0x251A	Number of communication timeout events	0-65535	0	-	Unchangeable
n5-27	0x251B	Port 0 - Number of transmission errors	0-65535	0	-	Unchangeable
n5-28	0x251C	Port 1 - Number of transmission errors	0-65535	0	-	Unchangeable

10.2.10.7 n6 PROFINET parameter

Item	Address:	Name	Value Range	Default	Unit	Change:
n6-01	0x2601	Highest order byte of the IP address	0 to 65535	0	/	Unchangeable
n6-02	0x2602	Second highest order byte of the IP address	0 to 65535	0	/	Unchangeable
n6-03	0x2603	Third highest order byte of the IP address	0 to 65535	0	/	Unchangeable
n6-04	0x2604	Lowest order byte of the IP address	0 to 65535	0	/	Unchangeable
n6-05	0x2605	Highest order byte of the subnet mask	0 to 65535	0	/	Unchangeable
n6-06	0x2606	Second highest order byte of the subnet mask	0 to 65535	0	/	Unchangeable
n6-07	0x2607	Third highest order byte of the subnet mask	0 to 65535	0	/	Unchangeable
n6-08	0x2608	Lowest order byte of the subnet mask	0 to 65535	0	/	Unchangeable
n6-09	0x2609	Highest order byte of the gateway IP address	0 to 65535	0	/	Unchangeable
n6-10	0x260A	Second highest order byte of the gateway IP address	0 to 65535	0	/	Unchangeable
n6-11	0x260B	Third highest order byte of the gateway IP address	0 to 65535	0	/	Unchangeable
n6-12	0x260C	Lowest order byte of the gateway IP address	0 to 65535	0	/	Unchangeable
n6-20	0x2614	Message number	0 to 65535	0	/	Unchangeable
n6-21	0x2615	Control word for station searching	0 to 65535	0	/	Unchangeable

10.2.10.8 nd CIA402 parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
nd-00	0x2D00	CIA402 enable	0: Disable 1: Enable	0	/	Change at stop
nd-01	0x2D01	CIA 402 parameter-write storage	0: Disable 1: Enable	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
nd-02	0x2D02	Speed reference type of CIA402	0: Frequency 1: Speed	0	/	Change at stop
nd-03	0x2D03	CIA402 acceleration/ deceleration time selection	One place: Acceleration/Deceleration time selection 0: System acceleration/deceleration time 1: CIA402 acceleration/deceleration time Tens place: Frequency upper/lower limit selection 0: Not writing frequency upper/lower limit to CIA402 1: Writing frequency upper/lower limit to CIA402 Hundreds place: Reserved Thousands place: Reserved Ten thousands place: Reserved	0	/	Change at stop

10.2.10.9 nE: Process Data Address Mapping

Param.	Address	Name	Value Range	Default	Unit	Change Mode
nE-00	0x2E00	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-01	0x2E01	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-02	0x2E02	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-03	0x2E03	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-04	0x2E04	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-05	0x2E05	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-06	0x2E06	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-07	0x2E07	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-08	0x2E08	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-09	0x2E09	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-10	0x2E0A	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-11	0x2E0B	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-12	0x2E0C	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-13	0x2E0D	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-14	0x2E0E	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-15	0x2E0F	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-16	0x2E10	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-17	0x2E11	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-18	0x2E12	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-19	0x2E13	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-20	0x2E14	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-21	0x2E15	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-22	0x2E16	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-23	0x2E17	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-24	0x2E18	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-25	0x2E19	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-26	0x2E1A	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-27	0x2E1B	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
nE-28	0x2E1C	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-29	0x2E1D	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-30	0x2E1E	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-31	0x2E1F	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-32	0x2E20	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-33	0x2E21	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-34	0x2E22	TPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-35	0x2E23	TPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-36	0x2E24	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-37	0x2E25	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-38	0x2E26	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-39	0x2E27	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-40	0x2E28	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-41	0x2E29	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-42	0x2E2A	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-43	0x2E2B	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-44	0x2E2C	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-45	0x2E2D	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-46	0x2E2E	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-47	0x2E2F	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-48	0x2E30	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-49	0x2E31	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-50	0x2E32	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-51	0x2E33	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-52	0x2E34	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-53	0x2E35	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-54	0x2E36	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-55	0x2E37	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-56	0x2E38	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-57	0x2E39	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-58	0x2E3A	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-59	0x2E3B	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-60	0x2E3C	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-61	0x2E3D	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-62	0x2E3E	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-63	0x2E3F	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-66	0x2E42	Number of valid RPDOs	0x0 to 0xFFFF	0x0	-	Unchangeable
nE-67	0x2E43	Number of valid TPDOs	0x0 to 0xFFFF	0x0	-	Unchangeable

10.2.11 Group o Free Function Block

10.2.11.1 o1 Constant setpoint

Item	Address:	Name	Value Range	Default	Unit	Change:
o1-00	0x5100	Constant value setting 1 (per-unit value)	-300.00 to 300.00	0.00	%	Real-time
o1-01	0x5101	Constant value setting 2 (per-unit value)	-300.00 to 300.00	100.00	%	Real-time
o1-02	0x5102	Constant value setting 3 (per-unit value)	-300.00 to 300.00	-100.00	%	Real-time
o1-03	0x5103	Constant value setting 4 (per-unit value)	-300.00 to 300.00	0.00	%	Real-time
o1-04	0x5104	Constant value setting 5 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-05	0x5105	Constant value setting 6 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-06	0x5106	Constant value setting 7 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-07	0x5107	Constant value setting 8 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-08	0x5108	Constant value setting 1 (single word)	-32768 to 32767	0	/	Real time
o1-09	0x5109	Constant value setting 2 (single word)	-32768 to 32767	0	/	Real time
o1-10	0x510A	Constant value setting 3 (single word)	-32768 to 32767	0	/	Real time
o1-11	0x510B	Constant value setting 4 (single word)	-32768 to 32767	0	/	Real time
o1-12	0x510C	Constant value setting 5 (single word)	-32768 to 32767	0	/	Real time
o1-13	0x510D	Constant value setting 6 (single word)	-32768 to 32767	0	/	Real time
o1-14	0x510E	Constant value setting 7 (single word)	-32768 to 32767	0	/	Real time
o1-15	0x510F	Constant value setting 8 (single word)	-32768 to 32767	0	/	Real time

10.2.11.2 o2: Multi-point Curve Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o2-00	0x5200	Input of multi-point curve module A	0: Disabled Others: F connector	0	/	Real time
o2-01	0x5201	Setpoint X1 of polyline module A	-600.0 to 600.0	0.0	%	Real-time
o2-02	0x5202	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-03	0x5203	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-04	0x5204	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-05	0x5205	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-06	0x5206	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-07	0x5207	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-08	0x5208	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-09	0x5209	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-10	0x520A	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-11	0x520B	Setpoint Y1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-12	0x520C	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-13	0x520D	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-14	0x520E	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-15	0x520F	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-16	0x5210	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-17	0x5211	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-18	0x5212	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-19	0x5213	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-20	0x5214	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o2-21	0x5215	Input of multi-point curve module B	0: Disabled Others: F connector	0	/	Real time
o2-22	0x5216	Setpoint X1 of polyline module B	-600.0 to 600.0	0.0	%	Real-time
o2-23	0x5217	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-24	0x5218	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-25	0x5219	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-26	0x521A	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-27	0x521B	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-28	0x521C	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-29	0x521D	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-30	0x521E	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-31	0x521F	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-32	0x5220	Setpoint Y1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-33	0x5221	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-34	0x5222	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-35	0x5223	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-36	0x5224	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-37	0x5225	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-38	0x5226	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-39	0x5227	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-40	0x5228	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-41	0x5229	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time

10.2.11.3 o3 Word-to-bit Conversion Module

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-00	0x5300	Input of word-to-bit function A	0: Invalid Others: K connector	0	-	Real-time
o3-01	0x5301	Input of word-to-bit function B	0: Invalid Others: K connector	0	-	Real-time
o3-02	0x5302	Input of word-to-bit function C	0: Invalid Others: K connector	0	-	Real-time
o3-03	0x5303	Input of word-to-bit function D	0: Invalid Others: K connector	0	-	Real-time
o3-04	0x5304	Positive and negative logic of word-to-bit function A	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-05	0x5305	Positive and negative logic of word-to-bit function B.	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-06	0x5306	Positive and negative logic of word-to-bit function C	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-07	0x5307	Positive and negative logic of word-to-bit function D	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-08	0x5308	Bit-to-word module A	0: Disable 1: Enable	0	-	Real-time
o3-09	0x5309	Positive and negative logic selection for bit-to-word module A	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-10	0x530A	Bit 00 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-11	0x530B	Bit 01 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-12	0x530C	Bit 02 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-13	0x530D	Bit 03 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-14	0x530E	Bit 04 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-15	0x530F	Bit 05 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-16	0x5310	Bit 06 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-17	0x5311	Bit 07 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-18	0x5312	Bit 08 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-19	0x5313	Bit 09 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-20	0x5314	Bit 10 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-21	0x5315	Bit 11 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-22	0x5316	Bit 12 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-23	0x5317	Bit 13 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-24	0x5318	Bit 14 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-25	0x5319	Bit 15 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-26	0x531A	B2W module B enable	0: Disable 1: Enable	0	-	Real-time
o3-27	0x531B	Positive and negative logic selection for bit-to-word module B	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-28	0x531C	Bit-to-word module B - Bit00 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-29	0x531D	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-30	0x531E	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-31	0x531F	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-32	0x5320	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-33	0x5321	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-34	0x5322	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-35	0x5323	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-36	0x5324	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-37	0x5325	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-38	0x5326	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-39	0x5327	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-40	0x5328	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-41	0x5329	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-42	0x532A	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-43	0x532B	B2W module B - Bit00	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-44	0x532C	Bit-to-word module C	0: Disable 1: Enable	0	-	Real-time
o3-45	0x532D	Positive and negative logic selection for bit-to-word module C	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time
o3-46	0x532E	Bit-to-word module C - Bit00 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-47	0x532F	Bit-to-word module C - Bit01 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-48	0x5330	Bit-to-word module C - Bit02 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-49	0x5331	Bit-to-word module C - Bit03 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-50	0x5332	Bit-to-word module C - Bit04 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-51	0x5333	Bit-to-word module C - Bit05 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-52	0x5334	Bit-to-word module C - Bit06 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-53	0x5335	Bit-to-word module C - Bit07 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-54	0x5336	Bit-to-word module C - Bit08 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-55	0x5337	Bit-to-word module C - Bit09 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-56	0x5338	Bit-to-word module C - Bit10 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-57	0x5339	Bit-to-word module C - Bit11 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-58	0x533A	Bit-to-word module C - Bit12 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-59	0x533B	Bit-to-word module C - Bit13 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-60	0x533C	Bit-to-word module C - Bit14 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-61	0x533D	Bit-to-word module C - Bit15 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-62	0x533E	Bit-to-word module D	0: Disable 1: Enable	0	-	Real-time
o3-63	0x533F	Positive and negative logic selection for bit-to-word module D	bit 0 to bit 15: Bit00 to Bit15 bit value 0: No inversion bit value 1: Invert	0x0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-64	0x5340	Bit-to-word module D - Bit00 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-65	0x5341	Bit-to-word module D - Bit01 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-66	0x5342	Bit-to-word module D - Bit02 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-67	0x5343	Bit-to-word module D - Bit03 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-68	0x5344	Bit-to-word module D - Bit04 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-69	0x5345	Bit-to-word module D - Bit05 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-70	0x5346	Bit-to-word module D - Bit06 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-71	0x5347	Bit-to-word module D - Bit07 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

Param.	Address	Name	Value Range	Default Value	Unit	Change Mode
o3-72	0x5348	Bit-to-word module D - Bit08 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-73	0x5349	Bit-to-word module D - Bit09 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-74	0x534A	Bit-to-word module D - Bit10 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-75	0x534B	Bit-to-word module D - Bit11 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-76	0x534C	Bit-to-word module D - Bit12 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-77	0x534D	Bit-to-word module D - Bit13 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-78	0x534E	Bit-to-word module D - Bit14 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time
o3-79	0x534F	Bit-to-word module D - Bit15 selection	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (MD630S) to DI7 (MD630S) Others: B connector	0	-	Real-time

10.2.11.4 o5 data conversion module

Item	Address	Name	Value Range	Default	Unit	Change Mode
o5-00	0x5500	[W2DW] Low word	0: 0 Others: K connector	0	/	Real time
o5-01	0x5501	[W2DW] High word	0: Disabled Others: K connector	0	/	Real time
o5-02	0x5502	Low-order bits of base value of W-DW conversion A	0 to 65535	0	/	Real time
o5-03	0x5503	High-order bits of base value of W-DW conversion A	0 to 65535	0	/	Real time
o5-04	0x5504	[W2DW] Low word	0: 0 Others: K connector	0	/	Real time
o5-05	0x5505	[W2DW] High word	0: Disabled Others: K connector	0	/	Real time
o5-06	0x5506	Low-order bits of base value of W-DW conversion B	0 to 65535	0	/	Real time
o5-07	0x5507	High-order bits of base value of W-DW conversion B	0 to 65535	0	/	Real time
o5-08	0x5508	[W2DW] Low word	0: 0 Others: K connector	0	/	Real time
o5-09	0x5509	[W2DW] High word	0: Disabled Others: K connector	0	/	Real time
o5-10	0x550A	Low-order bits of base value of W-DW conversion C	0 to 65535	0	/	Real time
o5-11	0x550B	High-order bits of base value of W-DW conversion C	0 to 65535	0	/	Real time
o5-12	0x550C	[W2DW] Low word	0: 0 Others: K connector	0	/	Real time
o5-13	0x550D	[W2DW] High word	0: Disabled Others: K connector	0	/	Real time
o5-14	0x550E	Low-order bits of base value of W-DW conversion D	0 to 65535	0	/	Real time
o5-15	0x550F	High-order bits of base value of W-DW conversion D	0 to 65535	0	/	Real time
o5-32	0x5520	[DW2W] Selection	0: Disabled Others: K connector	0	/	Real time
o5-33	0x5521	Low-order bits of base value of DW-W conversion A	0 to 65535	0	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
o5-34	0x5522	High-order bits of base value of DW-W conversion A	0 to 65535	0	/	Real time
o5-35	0x5523	[DW2W] Selection	0: Disabled Others: K connector	0	/	Real time
o5-36	0x5524	Low-order bits of base value of DW-W conversion B	0 to 65535	0	/	Real time
o5-37	0x5525	High-order bits of base value of DW-W conversion B	0 to 65535	0	/	Real time
o5-38	0x5526	[DW2W] Selection	0: Disabled Others: K connector	0	/	Real time
o5-39	0x5527	Low-order bits of base value of DW-W conversion C	0 to 65535	0	/	Real time
o5-40	0x5528	High-order bits of base value of DW-W conversion C	0 to 65535	0	/	Real time
o5-41	0x5529	[DW2W] Selection	0: Disabled Others: K connector	0	/	Real time
o5-42	0x552A	Low-order bits of base value of DW-W conversion D	0 to 65535	0	/	Real time
o5-43	0x552B	High-order bits of base value of DW-W conversion D	0 to 65535	0	/	Real time
o5-60	0x553C	Floating-point concatenator-to-monitoring parameter module A input	0: Disabled Others: F connector	0	/	Real time
o5-61	0x553D	Number of decimal places of floating-point concatenator-to-monitoring parameter module A	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-62	0x553E	Floating-point connector-to-monitoring parameter module A coefficient (multiply)	0 to 65535	1	/	Real time
o5-63	0x553F	Floating-point concatenator-to-monitoring parameter module A coefficient (divide)	1 to 65535	1	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
o5-64	0x5540	Floating-point concatenator-to-monitoring parameter module B input	0: Disabled Others: F connector	0	/	Real time
o5-65	0x5541	Number of decimal places for floating-point concatenator-to-monitoring parameter module B	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-66	0x5542	Floating-point connector-to-monitoring parameter module B coefficient (multiply)	0 to 65535	1	/	Real time
o5-67	0x5543	Floating-point connector-to-monitoring parameter module B coefficient (divide)	1 to 65535	1	/	Real time
o5-68	0x5544	Floating-point concatenator-to-monitoring parameter module C input	0: Disabled Others: F connector	0	/	Real time
o5-69	0x5545	Number of decimal places for floating-point connector-to-monitoring parameter module C	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-70	0x5546	Floating-point concatenator-to-monitoring parameter module C coefficient (multiply)	0 to 65535	1	/	Real time
o5-71	0x5547	Floating-point concatenator-to-monitoring parameter module C coefficient (divide)	1 to 65535	1	/	Real time
o5-72	0x5548	Floating-point concatenator-to-monitoring parameter module D input	0: Disabled Others: F connector	0	/	Real time
o5-73	0x5549	Number of decimal places for floating-point concatenator-to-monitoring parameter module D	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
o5-74	0x554A	Floating-point concatenator-to-monitoring parameter module D coefficient (multiply)	0 to 65535	1	/	Real time
o5-75	0x554B	Floating-point concatenator-to-monitoring parameter module D coefficient (divide)	1 to 65535	1	/	Real time
o5-76	0x554C	Floating-point concatenator-to-monitoring parameter module E input	0: Disabled Others: F connector	0	/	Real time
o5-77	0x554D	Number of decimal places for floating-point concatenator-to-monitoring parameter module E	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-78	0x554E	Floating-point concatenator-to-monitoring parameter module E coefficient (multiply)	0 to 65535	1	/	Real time
o5-79	0x554F	Floating-point concatenator-to-monitoring parameter module E coefficient (divide)	1 to 65535	1	/	Real time
o5-80	0x5550	Floating-point concatenator-to-monitoring parameter module F input	0: Disabled Others: F connector	0	/	Real time
o5-81	0x5551	Number of decimal places for floating-point concatenator-to-monitoring parameter module F	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-82	0x5552	Floating-point concatenator-to-monitoring parameter module F coefficient (multiply)	0 to 65535	1	/	Real time
o5-83	0x5553	Floating-point concatenator-to-monitoring parameter module F coefficient (divide)	1 to 65535	1	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
o5-84	0x5554	Floating-point concatenator-to-monitoring parameter module G input	0: Disabled Others: F connector	0	/	Real time
o5-85	0x5555	Number of decimal places for floating-point concatenator-to-monitoring parameter module G	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-86	0x5556	Floating-point concatenator-to-monitoring parameter module G coefficient (multiply)	0 to 65535	1	/	Real time
o5-87	0x5557	Floating-point concatenator-to-monitoring parameter module G coefficient (divide)	1 to 65535	1	/	Real time
o5-88	0x5558	Floating-point concatenator-to-monitoring parameter module H input	0: Disabled Others: F connector	0	/	Real time
o5-89	0x5559	Number of decimal places for floating-point concatenator-to-monitoring parameter module H	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	/	Real time
o5-90	0x555A	Floating-point concatenator-to-monitoring parameter module H coefficient (multiply)	0 to 65535	1	/	Real time
o5-91	0x555B	Floating-point concatenator-to-monitoring parameter module H coefficient (divide)	1 to 65535	1	/	Real time

10.2.11.5 o6: Logic Operation 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-00	0x5600	Function selection for logic AND/OR module A	0: Disabled 1: AND 2: OR	0	/	Real time
o6-01	0x5601	Input 1 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-02	0x5602	Input 2 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-03	0x5603	Input 3 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-04	0x5604	Input 4 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-05	0x5605	Function selection for logic AND/OR module B	0: Disabled 1: AND 2: OR	0	/	Real time
o6-06	0x5606	Input 1 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-07	0x5607	Input 2 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-08	0x5608	Input 3 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-09	0x5609	Input 4 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-10	0x560A	Function of logic AND/OR module C	0: Disabled 1: AND 2: OR	0	/	Real time
o6-11	0x560B	Input 1 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-12	0x560C	Input 2 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-13	0x560D	Input 3 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-14	0x560E	Input 4 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-15	0x560F	Function of logic AND/OR module D	0: Disabled 1: AND 2: OR	0	/	Real time
o6-16	0x5610	Input 1 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-17	0x5611	Input 2 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-18	0x5612	Input 3 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-19	0x5613	Input 4 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-20	0x5614	Function of logic AND/OR module E	0: Disabled 1: AND 2: OR	0	/	Real time
o6-21	0x5615	Input 1 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-22	0x5616	Input 2 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-23	0x5617	Input 3 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-24	0x5618	Function selection for logic AND-OR module F	0: Disabled 1: AND 2: OR	0	/	Real time
o6-25	0x5619	Input 1 of logic AND-OR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-26	0x561A	Input 2 of logic AND-OR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-27	0x561B	Input 3 of logic AND-OR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-28	0x561C	Function selection for logic AND-OR module G	0: Disabled 1: AND 2: OR	0	/	Real time
o6-29	0x561D	Input 1 of logic AND-OR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-30	0x561E	Input 2 of logic AND-OR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-31	0x561F	Input 3 of logic AND-OR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-32	0x5620	Function selection for logic AND-OR module H	0: Disabled 1: AND 2: OR	0	/	Real time
o6-33	0x5621	Input 1 of logic AND-OR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-34	0x5622	Input 2 of logic AND-OR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-35	0x5623	Input 3 of logic AND-OR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o6-80	0x5650	Input of logic NOT module A	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-81	0x5651	Input of logic NOT module B	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-82	0x5652	Input of logic NOT module C	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-83	0x5653	Input of logic NOT module D	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-84	0x5654	Input of logic NOT module E	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-85	0x5655	Input of logic NOT module F	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-86	0x5656	Input of logic NOT module G	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
o6-87	0x5657	Input of logic NOT module H	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

10.2.11.6 o7: Logic Operation 2

Item	Address:	Name	Value Range	Default	Unit	Change:
o7-00	0x5700	Function selection for logic XOR/XNOR module A	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-01	0x5701	Input 1 of logic XOR/ XNOR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-02	0x5702	Input 2 of logic XOR/ XNOR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-03	0x5703	Function selection for logic XOR/XNOR module B	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-04	0x5704	Input 1 of logic XOR/ XNOR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-05	0x5705	Input 2 of logic XOR/ XNOR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-06	0x5706	Function selection for logic XOR/XNOR module C	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-07	0x5707	Input 1 of logic XOR/ XNOR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-08	0x5708	Input 2 of logic XOR/ XNOR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
o7-09	0x5709	Function selection for logic XOR/XNOR module D	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-10	0x570A	Input 1 of logic XOR/ XNOR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-11	0x570B	Input 2 of logic XOR/ XNOR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-12	0x570C	Function selection for logic XOR/XNOR module E	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-13	0x570D	Input 1 of logic XOR/ XNOR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-14	0x570E	Input 2 of logic XOR/ XNOR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-15	0x570F	Function selection for logic XOR/XNOR module F	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-16	0x5710	Input 1 of logic XOR/ XNOR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-17	0x5711	Input 2 of logic XOR/ XNOR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-18	0x5712	Function selection for logic XOR/XNOR module G	0: Disabled 1: XOR 2: XNOR	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
o7-19	0x5713	Input 1 of logic XOR/ XNOR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-20	0x5714	Input 2 of logic XOR/ XNOR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-21	0x5715	Function selection for logic XOR/XNOR module H	0: Disabled 1: XOR 2: XNOR	0	/	Real time
o7-22	0x5716	Input 1 of logic XOR/ XNOR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
o7-23	0x5717	Input 2 of logic XOR/ XNOR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

10.2.11.7 o8 Arithmetic operation 1

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-00	0x5800	Input 1 of addition and subtraction module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-01	0x5801	Input 2 of adder and subtractor block A (ADD)	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-02	0x5802	Input 3 of ADD_SUB module A (ADD)	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-03	0x5803	Input 4 of ADD_SUB module A (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-04	0x5804	Input 1 of addition and subtraction module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-05	0x5805	Input 2 of ADD_SUB module B (ADD)	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-06	0x5806	Input 3 of ADD_SUB module B (ADD)	0: Value 02: AI13: AI25: HDI pulse reference (valid only for MD630S)6: Multi-reference 7: Simple PLC8: PID9: CommunicationOthers: F connector	0	/	Real time
o8-07	0x5807	Input 4 of ADD_SUB module B (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-08	0x5808	Input 1 of addition and subtraction module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-09	0x5809	Input 2 of ADD_SUB module C (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-10	0x580A	Input 3 of ADD_SUB module C (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-11	0x580B	Input 4 of ADD_SUB module C (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-12	0x580C	Input 1 of addition and subtraction module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-13	0x580D	Input 2 of ADD_SUB module D (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-14	0x580E	Input 3 of ADD_SUB module D (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-15	0x580F	Input 4 of ADD_SUB module D (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-16	0x5810	Input 1 of addition and subtraction module E	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-17	0x5811	Input 2 of addition and subtraction module E (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-18	0x5812	Input 3 of addition and subtraction module E (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-19	0x5813	Input 4 of addition and subtraction module E (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-20	0x5814	Input 1 of addition and subtraction module F	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-21	0x5815	Input 2 of addition and subtraction module F (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-22	0x5816	Input 3 of addition and subtraction module F (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-23	0x5817	Input 4 of addition and subtraction module F (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-24	0x5818	Input 1 of addition and subtraction module G	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-25	0x5819	Input 2 of addition and subtraction module G (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-26	0x581A	Input 3 of addition and subtraction module G (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-27	0x581B	Input 4 of addition and subtraction module G (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-28	0x581C	Input 1 of addition and subtraction module H	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-29	0x581D	Input 2 of addition and subtraction module H (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-30	0x581E	Input 3 of addition and subtraction module H (ADD)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-31	0x581F	Input 4 of addition and subtraction module H (SUBTRACT)	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-48	0x5830	Input 1 of multiplication and division module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-49	0x5831	Input 2 of MUL_DIV module A (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-50	0x5832	Input 3 of MUL_DIV module A (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-51	0x5833	Input 1 of multiplication and division module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-52	0x5834	Input 2 of MUL_DIV module B (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-53	0x5835	Input 3 of MUL_DIV module B (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-54	0x5836	Input 1 of multiplication and division module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-55	0x5837	Input 2 of MUL_DIV module C (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-56	0x5838	Input 3 of MUL_DIV module C (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-57	0x5839	Input 1 of multiplication and division module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-58	0x583A	Input 2 of MUL_DIV module D (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-59	0x583B	Input 3 of MUL_DIV module D (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-60	0x583C	Input 1 of multiplication and division module E	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-61	0x583D	Input 2 of multiplication and division module E (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-62	0x583E	Input 3 of multiplication and division module E (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-63	0x583F	Input 1 of multiplication and division module F	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-64	0x5840	Input 2 of multiplication and division module F (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-65	0x5841	Input 3 of multiplication and division module F (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-66	0x5842	Input 1 of multiplication and division module G	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o8-67	0x5843	Input 2 of multiplication and division module G (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-68	0x5844	Input 3 of multiplication and division module G (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-69	0x5845	Input 1 of multiplication and division module H	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-70	0x5846	Input 2 of multiplication and division module H (MULTIPLY)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o8-71	0x5847	Input 3 of multiplication and division module H (DIVIDE)	0: Value 1 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

10.2.11.8 o9 Arithmetic operation 2

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-00	0x5900	Input of absolute value module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-01	0x5901	Input of absolute value module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-02	0x5902	Input of absolute value module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-03	0x5903	Input of absolute value module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-04	0x5904	Input of absolute value module E	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-05	0x5905	Input of absolute value module F	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-06	0x5906	Input of absolute value module G	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-07	0x5907	Input of absolute value module H	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-16	0x5910	Function of comparison module A	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-17	0x5911	Input 1 of comparison module A	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-18	0x5912	Input 2 of comparison module A	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-19	0x5913	Hysteresis input of comparison module A	0.00 to 655.35	0.00	%	Real-time
o9-20	0x5914	Function of comparison module B	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-21	0x5915	Input 1 of comparison module B	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-22	0x5916	Input 2 of comparison module B	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-23	0x5917	Hysteresis input of comparison module B	0.00 to 655.35	0.00	%	Real-time
o9-24	0x5918	Function of comparison module C	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-25	0x5919	Input 1 of comparison module C	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-26	0x591A	Input 2 of numeric comparator block C	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-27	0x591B	Hysteresis input of comparison module C	0.00 to 655.35	0.00	%	Real-time
o9-28	0x591C	Function of comparison module D	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-29	0x591D	Input 1 of comparison module D	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-30	0x591E	Input 2 of comparison module D	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-31	0x591F	Hysteresis input of comparison module D	0.00 to 655.35	0.00	%	Real-time
o9-32	0x5920	Function of comparison module E	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-33	0x5921	Input 1 of comparison module E	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-34	0x5922	Input 2 of comparison module E	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-35	0x5923	Hysteresis input of comparison module E	0.00 to 655.35	0.00	%	Real-time
o9-36	0x5924	Function of comparison module F	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-37	0x5925	Input 1 of comparison module F	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-38	0x5926	Input 2 of comparison module F	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-39	0x5927	Hysteresis input of comparison module F	0.00 to 655.35	0.00	%	Real-time
o9-40	0x5928	Function of comparison module G	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-41	0x5929	Input 1 of comparison module G	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-42	0x592A	Input 2 of comparison module G	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o9-43	0x592B	Hysteresis input of comparison module G	0.00 to 655.35	0.00	%	Real-time
o9-44	0x592C	Function of comparison module H	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	/	Real time
o9-45	0x592D	Input 1 of comparison module H	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-46	0x592E	Input 2 of comparison module H	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
o9-47	0x592F	Hysteresis input of comparison module H	0.00 to 655.35	0.00	%	Real-time

10.2.11.9 oA Switch selection function

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-00	0x5A00	Input source of binary selector module A	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-01	0x5A01	Input 1 of binary selector module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-02	0x5A02	Input 2 of binary selector module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-03	0x5A03	Input source of binary selector module B	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-04	0x5A04	Input 1 of binary selector module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-05	0x5A05	Input 2 of binary multiplexer module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-06	0x5A06	Input source of binary selector module C	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-07	0x5A07	Input 1 of binary selector module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-08	0x5A08	Input 2 of binary selector module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-09	0x5A09	Input source of binary selector module D	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-10	0x5A0A	Input 1 of binary selector module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-11	0x5A0B	Input 2 of binary selector module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-12	0x5A0C	Input source of binary selector module E	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-13	0x5A0D	Input 1 of binary selector module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-14	0x5A0E	Input 2 of binary selector module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-15	0x5A0F	Input source of binary selector module F	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-16	0x5A10	Input 1 of binary selector module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-17	0x5A11	Input 2 of binary selector module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-18	0x5A12	Input source of binary selector module G	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-19	0x5A13	Input 1 of binary selector module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-20	0x5A14	Input 2 of binary selector module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-21	0x5A15	Input source of binary selector module H	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-22	0x5A16	Input 1 of binary selector module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-23	0x5A17	Input 2 of binary selector module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
oA-24	0x5A18	Input source of digital selector module A	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-25	0x5A19	Input 1 of digital selector module A	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-26	0x5A1A	Input 2 of digital selector module A	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-27	0x5A1B	Input source of digital selector module B	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-28	0x5A1C	Input 1 of digital selector module B	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-29	0x5A1D	Input 2 of digital selector module B	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-30	0x5A1E	Input source of digital selector module C	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-31	0x5A1F	Input 1 of digital selector module C	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-32	0x5A20	Input 2 of digital selector module C	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-33	0x5A21	Input source of digital selector module D	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-34	0x5A22	Input 1 of digital selector module D	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-35	0x5A23	Input 2 of digital selector module D	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-36	0x5A24	Input source of digital selector module E	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-37	0x5A25	Input 1 of digital selector module E	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-38	0x5A26	Input 2 of digital selector module E	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-39	0x5A27	Input source of digital selector module F	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-40	0x5A28	Input 1 of digital selector module F	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-41	0x5A29	Input 2 of digital selector module F	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-42	0x5A2A	Input source of digital selector module G	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-43	0x5A2B	Input 1 of digital selector module G	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-44	0x5A2C	Input 2 of digital selector module G	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-45	0x5A2D	Input source of digital selector module H	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oA-46	0x5A2E	Input 1 of digital selector module H	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oA-47	0x5A2F	Input 2 of digital selector module H	0: Value 0 2: AI1 3: AI2 5: Pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

10.2.11.10 ob Control function 1

Item	Address:	Name	Value Range	Default	Unit	Change:
B-00	0x5B00	Function selection of filter module A	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
OB-01	0x5B01	Input of filter module A	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
OB-02	0x5B02	Filter time of filter module A	0.000 to 30.000	0.000	s	Real-time
OB-03	0x5B03	Function selection of filter module B	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
OB-04	0x5B04	Input of filter module B	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
OB-05	0x5B05	Filter time of filter module B	0.000 to 30.000	0.000	s	Real-time
OB-06	0x5B06	Function selection of filter module C	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
Ob-07	0x5B07	Input of filter module C	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
OB-08	0x5B08	Filter time of filter module C	0.000 to 30.000	0.000	s	Real-time
OB-09	0x5B09	Function selection of filter module D	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
OB-10	0x5B0A	Input of filter module D	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
B-11	0x5B0B	Filter time of filter module D	0.000 to 30.000	0.000	s	Real-time
B-24	0x5B18	Function of level-pulse conversion module A	0: Disabled 1: Conversion from level to pulse 2: Conversion from pulse to level	0	/	Real time
OB-25	0x5B19	Input of level-pulse conversion module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
OB-26	0x5B1A	Pulse width of level-pulse conversion module A	0.0 to 655.35	0.00	s	Real-time
OB-27	0x5B1B	Function of level-pulse conversion module B	0: Disabled 1: Conversion from level to pulse 2: Conversion from pulse to level	0	/	Real time
B-28	0x5B1C	Input of level-pulse conversion module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
B-29	0x5B1D	Pulse width of level-pulse conversion module B	0.0 to 655.35	0.00	s	Real-time
OB-30	0x5B1E	Function of level-pulse conversion module C	0: Disabled 1: Conversion from level to pulse 2: Conversion from pulse to level	0	/	Real time
OB-31	0x5B1F	Input of level-pulse conversion module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
OB-32	0x5B20	Pulse width of level-pulse conversion module C	0.0 to 655.35	0.00	s	Real-time
B-33	0x5B21	Function of level-pulse conversion module D	0: Disabled 1: Conversion from level to pulse 2: Conversion from pulse to level	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
OB-34	0x5B22	Input of level-pulse conversion module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S)MD630S Others: B connector	0	/	Real time
OB-35	0x5B23	Pulse width of level-pulse conversion module D	0.0 to 655.35	0.00	s	Real-time

10.2.11.11 oC Control function 2

Param.	Address	Name	Value Range	Default	Unit	Change Mode
oC-00	0x5C00	Input of limiting module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time
oC-01	0x5C01	Upper limit of limiting module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-02	0x5C02	Lower limit of limiting module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-03	0x5C03	Input of limiting module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
oC-04	0x5C04	Upper limit of limiting module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-05	0x5C05	Lower limit of limiting module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-06	0x5C06	Input of limiting module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time
oC-07	0x5C07	Upper limit of limiting module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-08	0x5C08	Lower limit of limiting module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
oC-09	0x5C09	Input of limiting module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time
oC-10	0x5C0A	Upper limit of limiting module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-11	0x5C0B	Lower limit of limiting module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
oC-28	0x5C1C	Input of logic delay module A	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-29	0x5C1D	Switch-on delay of logic delay module A	0 to 65535	0	/	Real time
oC-30	0x5C1E	Switch-off delay of logic delay module A	0 to 65535	0	/	Real time
oC-31	0x5C1F	Delay time unit of logic delay module A	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	/	Real time
oC-32	0x5C20	Input of logic delay module B	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
oC-33	0x5C21	Switch-on delay of logic delay module B	0 to 65535	0	/	Real time
oC-34	0x5C22	Switch-off delay of logic delay module B	0 to 65535	0	/	Real time
oC-35	0x5C23	Delay time unit of logic delay module B	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	/	Real time
oC-36	0x5C24	Input of logic delay module C	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-37	0x5C25	Switch-on delay of logic delay module C	0 to 65535	0	/	Real time
oC-38	0x5C26	Switch-off delay of logic delay module C	0 to 65535	0	/	Real time
oC-39	0x5C27	Delay time unit of logic delay module C	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	/	Real time
oC-40	0x5C28	Input of logic delay module D	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-41	0x5C29	Switch-on delay of logic delay module D	0 to 65535	0	/	Real time
oC-42	0x5C2A	Switch-off delay of logic delay module D	0 to 65535	0	/	Real time
oC-43	0x5C2B	Delay time unit of logic delay module D	0: No delay1: 10 ms2: 100 ms3: 1s4: 10s5: 1 min6: 2 min	1	/	Real time
oC-44	0x5C2C	Input of logic delay module E	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-45	0x5C2D	Switch-on delay of logic delay module E	0 to 65535	0	/	Real time
oC-46	0x5C2E	Switch-off delay of logic delay module E	0 to 65535	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
oC-47	0x5C2F	Delay time unit of logic delay module E	0: No delay1: 10 ms2: 100 ms3: 1s4: 10s5: 1 min6: 2 min	1	/	Real time
oC-48	0x5C30	Input of logic delay module F	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-49	0x5C31	Switch-on delay of logic delay module F	0 to 65535	0	/	Real time
oC-50	0x5C32	Switch-off delay of logic delay module F	0 to 65535	0	/	Real time
oC-51	0x5C33	Delay time unit of logic delay module F	0: No delay1: 10 ms2: 100 ms3: 1s4: 10s5: 1 min6: 2 min	1	/	Real time
oC-52	0x5C34	Input of logic delay module G	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-53	0x5C35	Switch-on delay of logic delay module G	0 to 65535	0	/	Real time
oC-54	0x5C36	Switch-off delay of logic delay module G	0 to 65535	0	/	Real time
oC-55	0x5C37	Delay time unit of logic delay module G	0: No delay1: 10 ms2: 100 ms3: 1s4: 10s5: 1 min6: 2 min	1	/	Real time
oC-56	0x5C38	Input of logic delay module H	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
oC-57	0x5C39	Switch-on delay of logic delay module H	0 to 65535	0	/	Real time
oC-58	0x5C3A	Switch-off delay of logic delay module H	0 to 65535	0	/	Real time
oC-59	0x5C3B	Delay time unit of logic delay module H	0: No delay1: 10 ms2: 100 ms3: 1s4: 10s5: 1 min6: 2 min	1	/	Real time

10.2.12 Group P Application Function

10.2.12.1 P0 Auxiliary Functions

Item	Address	Name	Value Range	Default	Unit	Change Mode
P0-06	0x6006	Jump frequency 1	0.0 to 800.0	0.0	Hz	Real-time
P0-07	0x6007	Jump frequency 2	0.0 to 800.0	0.0	Hz	Real-time
P0-08	0x6008	Jump frequency 3	0.0 to 800.0	0.0	Hz	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P0-09	0x6009	Jump frequency 4	0.0 to 800.0	0.0	Hz	Real-time
P0-10	0x600A	Jump frequency amplitude	0.0 to 800.0	0.0	Hz	Real-time
P0-11	0x600B	Operation mode when set frequency < frequency lower limit	0: Operating at frequency lower limit 1: Stop 2: Operating at zero speed 3: Coast to stop	0	/	Real time
P0-12	0x600C	Encoder counter clear	0: Disabled 1: Enabled	0	/	Real time
P0-13	0x600D	Timing function	0: Disable 1: Enable	0	/	Change at stop
P0-14	0x600E	Timing operation duration source	0: P0-15 1: AI1 2: AI2 Others: F connector	0	/	Change at stop
P0-15	0x600F	Digital setting of timing operation duration	0.0 to 6500.0	0.0	min	Change at stop
P0-16	0x6010	Cumulative power-on hours reached	0 to 65535	0	h	Real-time
P0-17	0x6011	Cumulative power-on seconds reached	0 to 3599	0	s	Real-time
P0-18	0x6012	Cumulative running hours reached	0 to 65535	0	h	Real-time
P0-19	0x6013	Running time threshold (second)	0 to 3599	0	s	Real-time
P0-20	0x6014	Current running time threshold	0.0 to 6500.0	0.0	min	Change at stop
P0-21	0x6015	Protection upon start	0: Disable 1: Enable	1	/	Real time
P0-22	0x6016	Wakeup frequency	P0-24 to A2-17	0.00	Hz	Real-time
P0-23	0x6017	Wakeup delay	0.0 to 6500.0	0.0	s	Real-time
P0-24	0x6018	Hibernation frequency	0.00 to P0-22	0.00	Hz	Real-time
P0-25	0x6019	Hibernation delay	0.0 to 6500.0	0.0	s	Real-time
P0-26	0x601A	Dead-zone time of forward/reverse run	0.0 to 3000.0	0.0	s	Real-time
P0-29	0x601D	Automatic reset of STO status	0: Manual reset 1: Auto reset	1	/	Real time
P0-30	0x601E	Detection time for inconsistent STO status	0.020 to 1.000	0.050	s	Real-time
P0-33	0x6021	AC drive overtemperature threshold reached (threshold)	0 to 100	75	℃	Real time
P0-34	0x6022	Frequency detection value (FDT1)	0.00 to A2-17	50.00	Hz	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P0-35	0x6023	Frequency detection hysteresis coefficient (FDT1)	0.0 to 100.0	5.0	%	Real-time
P0-36	0x6024	Detection frequency (FDT2)	0.00 to A2-17	50.00	Hz	Real-time
P0-37	0x6025	Frequency detection hysteresis coefficient (FDT2)	0.0 to 100.0	5.0	%	Real-time
P0-38	0x6026	Measured width when frequency reached	0.0 to 100.0	0.0	%	Real-time
P0-39	0x6027	Frequency detection value 1	0.00 to A2-17	50.00	Hz	Real-time
P0-40	0x6028	Detection frequency amplitude 1	0.1 to 100.0	0.1	%	Real-time
P0-41	0x6029	Detection value 2 of frequency	0.00 to A2-17	50.00	Hz	Real-time
P0-42	0x602A	Frequency reach detection width 2	0.1 to 100.0	0.1	%	Real-time
P0-43	0x602B	Detection level of current 1	0.0 to 300.0	100.0	%	Real-time
P0-44	0x602C	Detection width of current 1	0.0 to 300.0	0.0	%	Real-time
P0-45	0x602D	Detection level of current 2	0.0 to 300.0	100.0	%	Real-time
P0-46	0x602E	Detection width of current 2	0.0 to 300.0	0.0	%	Real-time
P0-47	0x602F	Zero current detection level	0.0 to 300.0	5.0	%	Real-time
P0-48	0x6030	Zero current detection delay	0.01 to 600.00	0.10	s	Real-time
P0-49	0x6031	Output overcurrent threshold	0.0 to 300.0	200.0	%	Real-time
P0-50	0x6032	Delay of output current limit violation detection	0.00 to 600.00	0.00	s	Real-time
P0-51	0x6033	Target speed amplitude	0.0 to 600.0	3.0	%	Real-time
P0-52	0x6034	Detection time when target speed is reached	0.00 to 100.00	3.00	s	Real-time
P0-53	0x6035	Speed comparison threshold 1	0.0 to 600.0	100.0	%	Real-time
P0-54	0x6036	Hysteresis 1 of speed comparison reach	0.0 to 600.0	3.0	%	Real-time
P0-55	0x6037	Speed comparison reach time 1	0.00 to 100.00	3.00	s	Real-time
P0-56	0x6038	Speed comparison threshold 2	0.0 to 600.0	100.0	%	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P0-57	0x6039	Hysteresis 2 of speed comparison reach	0.0 to 600.0	3.0	%	Real-time
P0-58	0x603A	Speed comparison reach time 2	0.00 to 100.00	3.00	s	Real-time
P0-59	0x603B	Bit 15 setting of system status word 1	0: Invalid 1: Set to 1 Others: B connector	0	/	Real time
P0-60	0x603C	Bit 15 setting of system status word 2	0: Invalid 1: Set to 1 Others: B connector	0	/	Real time
P0-66	0x6042	Load monitoring signal selection	0: Disable monitoring 1: Monitor the output current 2: Monitor the output torque 3: Monitor the output power Others: F connector	0	/	Real time
P0-67	0x6043	Load monitoring signal state	0 to 65535	0	/	This is not modifiable.
P0-68	0x6044	Load monitoring overload action	0: No warning/fault 1: Warning 2: Fault 3: Warning/ Fault	0	/	Real time
P0-69	0x6045	Action for load loss in monitored state	0: No warning/fault 1: Warning 2: Fault 3: Warning/ Fault	0	/	Real time
P0-70	0x6046	X-coordinate point 1 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-71	0x6047	X-coordinate point 2 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-72	0x6048	X-coordinate point 3 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-73	0x6049	X-coordinate point 4 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-74	0x604A	X-coordinate point 5 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-75	0x604B	Upper limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-76	0x604C	Upper limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-77	0x604D	Upper limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-78	0x604E	Upper limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-79	0x604F	Upper limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-80	0x6050	Lower limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-81	0x6051	Lower limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-82	0x6052	Lower limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P0-83	0x6053	Lower limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-84	0x6054	Lower limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-85	0x6055	Allowed overload time	0.0 to 6553.5	20.0	s	Real-time
P0-86	0x6056	Allowed load lost time	0.0 to 6553.5	20.0	s	Real-time
P0-87	0x6057	UPDOWN reference during running	0: Running frequency 1: Frequency reference	0	/	Real time
P0-88	0x6058	Retention of frequency adjusted by UP/DOWN key on operating panel or by terminal functioning as UP/ DOWN key upon stop	0: Non-retentive 1: Retentive	0	/	Real time
P0-89	0x6059	UPDOWN retention selection upon power failure	0: Disable 1: Enable	0	/	Real time
P0-92	0x605C	Numerator of load speed display coefficient	1 to 32767	1	/	Real time
P0-93	0x605D	Denominator of load speed display coefficient	1 to 32767	1	/	Real time
P0-94	0x605E	Wobble setting mode	0: Relative to the central frequency 1: Relative to the maximum frequency	0	/	Real time
P0-95	0x605F	Wobble amplitude	0.0 to 100.0	0.0	%	Real-time
P0-96	0x6060	Jump frequency amplitude	0.0 to 50.0	0.0	%	Real-time
P0-97	0x6061	Wobble cycle	0.1 to 3000.0	10.0	s	Real-time
P0-98	0x6062	Triangular wave rising time of wobble frequency	0.1 to 100.0	50.0	%	Real-time

10.2.12.2 P1: Simple PLC

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-00	0x6100	Enabling simple PLC module	0: Disable 1: Enable	0	/	Change at stop
P1-01	0x6101	Simple PLC calculation source	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	36978	/	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-02	0x6102	Simple PLC running mode	0: Keep multi-reference value 0 after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running for one cycle	0	/	Real-time
P1-03	0x6103	Simple PLC function selection	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation configuration 0: Keep the current stage when calculation is invalid and perform recalculation when calculation is valid 1: Keep the current stage when calculation is invalid and continue to run when calculation is valid Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	/	Real-time
P1-04	0x6104	Simple PLC status reset	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Change at stop
P1-05	0x6105	Current STEP of the simple PLC	0 to 65535	0	/	Unchangeable
P1-06	0x6106	Current STEP running time in hours of the simple PLC	0 to 65535	0	/	Unchangeable
P1-07	0x6107	Current STEP running time in seconds of the simple PLC	0.0 to 3599.9	0.0	/	Unchangeable
P1-08	0x6108	Time unit of simple PLC	0: second (s) 1: hour (h)	0	/	Real-time
P1-09	0x6109	Multi-reference 0 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-10	0x610A	Running time of multi-reference 0 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-11	0x610B	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-12	0x610C	Multi-reference 1 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-13	0x610D	Running time of multi-reference 1 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-14	0x610E	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-15	0x610F	Multi-reference 2 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-16	0x6110	Running time of multi-reference 2 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-17	0x6111	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-18	0x6112	Multi-reference 3 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-19	0x6113	Running time of multi-reference 3 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-20	0x6114	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-21	0x6115	Multi-reference 4 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-22	0x6116	Running time of multi-reference 4 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-23	0x6117	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-24	0x6118	Multi-reference 5 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-25	0x6119	Running time of multi-reference 5 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-26	0x611A	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-27	0x611B	Multi-reference 6 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-28	0x611C	Running time of multi-reference 6 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-29	0x611D	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-30	0x611E	Multi-reference 7 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-31	0x611F	Running time of multi-reference 7 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-32	0x6120	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-33	0x6121	Multi-reference 8 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-34	0x6122	Running time of multi-reference 8 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-35	0x6123	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-36	0x6124	Multi-reference 9 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-37	0x6125	Running time of multi-reference 9 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-38	0x6126	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-39	0x6127	Multi-reference 10 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-40	0x6128	Running time of multi-reference 10 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-41	0x6129	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-42	0x612A	Multi-reference 11 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-43	0x612B	Running time of multi-reference 11 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-44	0x612C	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-45	0x612D	Multi-reference 12 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-46	0x612E	Running time of multi-reference 12 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-47	0x612F	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-48	0x6130	Multi-reference 13 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-49	0x6131	Running time of multi-reference 13 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-50	0x6132	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-51	0x6133	Multi-reference 14 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-52	0x6134	Running time of multi-reference 14 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-53	0x6135	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time
P1-54	0x6136	Multi-reference 15 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-55	0x6137	Running time of multi-reference 15 set by simple PLC	0.0 to 6553.5	0.0	/	Real-time
P1-56	0x6138	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0: Acceleration/Deceleration time of ramp 1 (b7-04 [Acceleration time of ramp 1]/b7-05 [Deceleration time of ramp 1]) 1: Acceleration/Deceleration time of ramp 2 (b7-10 [Acceleration time of ramp 2]/b7-11 [Deceleration time of ramp 2]) 2: Acceleration/Deceleration time of ramp 3 (b7-16 [Acceleration time of ramp 3]/b7-17 [Deceleration time of ramp 3]) 3: Acceleration/Deceleration time of ramp 4 (b7-22 [Acceleration time of ramp 4]/b7-23 [Deceleration time of ramp 4])	0	/	Real-time

10.2.12.3 P2 Process PID

Item	Address	Name	Value Range	Default	Unit	Change Mode
P2-00	0x6200	PID enable	0: Disable 1: Enable Others: B connector	0	/	Real time
P2-01	0x6201	PID action direction	0: Forward 1: Reverse Others: B connector	0	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P2-02	0x6202	PID reference source	0: Value 1 1: AI1 2: AI2 4: Pulse reference (valid only for MD630S) 5: Multi-reference 6: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
P2-03	0x6203	PID digital setting	0.0 to 800.0	50.0	%	Real-time
P2-04	0x6204	PID feedback source	0: AI1 1 : AI2 4: HDI setting (valid only for MD630S) 5: Communication setting Other: F connector	0	/	Real time
P2-05	0x6205	PID reference and feedback range	0 to 65535	1,000	/	Real time
P2-06	0x6206	PID reference change time	0.00 to 655.00	0.00	s	Real-time
P2-07	0x6207	PID feedback filter time	0.00 to 60.00	0.00	s	Real-time
P2-08	0x6208	PID output filter time	0.00 to 60.00	0.00	s	Real-time
P2-09	0x6209	PID reverse cut-off frequency	0.00 to A2-17	2.00	Hz	Real-time
P2-11	0x620B	PID parameter switchover condition	0: No switchover, default PID parameter 1 1: Switchover via DI terminal 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency 4: Automatic adjustment mode 1 based on roll diameter (effective only when the closed-loop speed mode and closed-loop torque mode of tension process are enabled) 5: Automatic adjustment mode 2 based on roll diameter (effective only when closed-loop speed mode and closed-loop torque mode of tension process are enabled)	0	/	Real time
P2-12	0x620C	PID deviation 1 for auto switchover	0.0-P2-13	20.0	%	Real-time
P2-13	0x620D	PID parameter switchover deviation 2	P2-12 to 800.0	80.0	%	Real-time
P2-14	0x620E	PID parameter 1 proportional gain Kp1	0.0 to 1000.0	20.0	/	Real time
P2-15	0x620F	PID parameter 1 integral time Ti1	0.01 to +10.00	2.00	s	Real-time
P2-16	0x6210	PID parameter 1 differential time Td1	0.000 to 10.000	0.000	s	Real-time
P2-17	0x6211	PID parameter 2 proportional gain Kp2	0.0 to 1000.0	20.0	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P2-18	0x6212	PID parameter 2 integral time Ti2	0.01 to +10.00	2.00	s	Real-time
P2-19	0x6213	PID parameter 2 differential time Td2	0.000 to 10.000	0.000	s	Real-time
P2-20	0x6214	PID initial value	0.0 to 800.0	0.0	%	Real-time
P2-21	0x6215	Active time of PID initial value	0.00 to 655.00	0.00	s	Real-time
P2-22	0x6216	PID deviation dead zone	0.0 to 800.0	0.0	%	Real-time
P2-23	0x6217	PID differential limit	0.00 to 600.00	0.10	%	Real-time
P2-26	0x621A	Source of maximum PID output	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
P2-27	0x621B	Source of minimum PID output	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
P2-28	0x621C	Forced value of PID output	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
P2-29	0x621D	Forced assignment of PID output enable	0: Disabled 1: Enabled Others: B connector	0	/	Real time
P2-30	0x621E	Upper limit for PID feedback loss detection	P2-31 to 800.0	100.0	%	Real-time
P2-31	0x621F	Lower limit for PID feedback loss detection	0.0-P2-30	0.0	%	Real-time
P2-32	0x6220	PID feedback loss detection time	0.0 to 20.0	0.0	s	Real-time
P2-33	0x6221	Selection of PID operation at stop selection	0: Disable at stop 1: Enable at stop Others: B connector	0	/	Real time

Item	Address	Name	Value Range	Default	Unit	Change Mode
P2-34	0x6222	PID integral property	Ones: Integral operation pause/separation 0: Invalid 1: Valid Tens: Whether to stop integral operation when the output reaches a limit 0: Continue integral operation 1: Stop integral operation Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	/	Real time
P2-36	0x6224	PID calculation during jog	0: Disable 1: Allow Others: B connector	0	/	Real time
P2-37	0x6225	PID execution interval	0 to 20	1	/	Change at stop
P2-38	0x6226	Valid mode selection for PID ramp setting	0: Valid when PID is enabled 1: Valid when PID operation starts Others: B connector	0	/	Change at stop

10.2.12.4 P3 Motorized potentiometer

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
P3-00	0x6300	Motorized potentiometer enable	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-01	0x6301	Memory retention at power failure of motor-driven potentiometer	0: Disable 1: Enable	0	/	Real time
P3-02	0x6302	Initial value of motor-driven potentiometer	-600.0 to 600.0	0.0	%	Real-time
P3-03	0x6303	Increase time base of motor-driven potentiometer	0.0 to 655.35	20.00	s	Real-time
P3-04	0x6304	Decrease time base of motor-driven potentiometer	0.0 to 655.35	20.00	s	Real-time
P3-05	0x6305	Source of motor-driven potentiometer increase command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-06	0x6306	Source of motor-driven potentiometer decrease command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-07	0x6307	Maximum value of motor-driven potentiometer output	P3-08 to 600.0	600.0	%	Real-time

Item	Address:	Name	Value Range	Default	Unit	Change:
P3-08	0x6308	Minimum value of motor-driven potentiometer output	-600.0–P3-07	-600.0	%	Real-time
P3-09	0x6309	Source 1 of motor-driven potentiometer pause command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-10	0x630A	Source 2 of motor-driven potentiometer pause command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-11	0x630B	Source 1 of motor-driven potentiometer reset command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-12	0x630C	Source 2 of motor-driven potentiometer reset command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time
P3-13	0x630D	Source of reset value of motorized potentiometer	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time
P3-14	0x630E	Reset value of motor-driven potentiometer	-600.0 to 600.0	0.0	%	Real-time
P3-15	0x630F	Source of motor-driven potentiometer force command	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 to DI7 (only valid for MD630S) Others: B connector	0	/	Real time

Item	Address:	Name	Value Range	Default	Unit	Change:
P3-16	0x6310	Forced value source of motorized potentiometer	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9; Communication Others: F connector	0	/	Real time
P3-17	0x6311	Force value of motor-driven potentiometer	-600.0 to 600.0	0.0	%	Real-time

10.2.12.5 P4 Brake control

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P4-00	0x6400	Brake function selection	0: No brake 1: Brake without detection information 2: Brake with detection information	0	/	Change at stop
P4-02	0x6402	Brake opening time	0.00 to 30.00	0.20	s	Real-time
P4-03	0x6403	Brake closing time	0.00 to 30.00	0.20	s	Real-time
P4-04	0x6404	Brake opening feedback point source	0：Invalid 1：Valid 3：DI1 4：DI2 5：DI3 (valid only for MD630S) 6：DI4 (valid only for MD630S) 7：DI5 (valid only for MD630S) 8：DI6 (valid only for MD630S) 9：DI7 (valid only for MD630S) Others: B connector	0	/	Real time
P4-05	0x6405	Brake feedback fault delay	0.00 to 30.00	2.00	s	Real-time
P4-07	0x6407	Brake auxiliary function selection	Bit0: With brake detection - open/close completion judgment 0: Action time + detection signal 1: Detection signal only bit1: With brake detection - detection signal fault judgment 0: Full-time judgment 1: No detection when turned on and off Bit2: Start speed logic selection 0: Active during brake release 1: Active upon completion of brake release Bit3: Brake release enable during auto-tuning 0: Disable switch-on 1: Brake release allowed bit4 to bit15: Reserved	0x0	-	Change at stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P4-08	0x6408	Starting torque source in the vector control mode	0: Disable 1: Retentive torque value 2: Digital setting of start torque 3: Defined by the digital setting of start torque and the operating direction of the motor Others: F connector	0	/	Real time
P4-09	0x6409	Digital setting of starting torque	-200.0 to 200.0	0.0	%	Real-time
P4-10	0x640A	Retentive start torque gain coefficient	0.0 to 300.0	100.0	%	Real-time
P4-11	0x640B	Starting torque increment time	0.00 to 5.00	0.04	s	Real-time
P4-13	0x640D	Start speed source	0: Disable 1: Defined by digital setting of starting speed 2: Defined by digital setting of starting speed and motor operating direction	0	/	Real time
P4-14	0x640E	Digital setting of starting speed	-30.0 to 30.0	0.0	%	Real-time
P4-17	0x6411	Forced brake closing command source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	0	/	Real time
P4-18	0x6412	Actual speed monitoring threshold upon brake closing	0.0 to 100.0	1.0	%	Real-time
P4-19	0x6413	Actual speed monitoring time upon brake closing	0.00 to 300.00	0.10	s	Real-time
P4-20	0x6414	Set speed monitoring threshold upon brake closing	0.0 to 100.0	0.0	%	Real-time
P4-21	0x6415	Set speed monitoring time upon brake closing	0.00 to 60.00	5.00	s	Real-time
P4-24	0x6418	Brake opening permission source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	1	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P4-25	0x6419	Comparison value source of brake opening	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (valid only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	/	Real time
P4-26	0x641A	Comparison threshold of brake opening	0.0 to 300.0	0.0	%	Real-time
P4-27	0x641B	Brake opening delay	0.00 to 30.00	0.20	s	Real-time
P4-28	0x641C	Positive speed - Starting torque gain coefficient	0.0 to 200.0	100.0	%	Real-time
P4-29	0x641D	Negative speed - Starting torque gain coefficient	0.0 to 200.0	100.0	%	Real-time
P4-34	0x6422	Brake torque decrement time	0.00 to 10.00	0.20	s	Real-time
P4-40	0x6428	Enable brake self-test	0: Disable 1: Enable Others: B connector	0	/	Real time
P4-41	0x6429	Brake test hold time	0.20 to 30.00	0.30	s	Real-time
P4-42	0x642A	Max. experimental torque for brake test	0.0 to 200.0	10.0	%	Real-time
P4-43	0x642B	Torque direction for brake test	0: Not reversed 1: Reversed Others: B connector	0	/	Real time
P4-44	0x642C	Slip speed threshold for brake test	0.00 to 30.00	0.10	%	Real-time
P4-45	0x642D	Slip speed hold time for brake test	0.000 to 10.000	0.004	s	Real-time

10.2.12.6 Pd Basic Tension Control Parameters

Param.	Address	Name	Value range	Default	Unit	Change
Pd-00	0x6D00	Tension control mode	0: Disabled 1: Open loop torque control 2: Closed loop speed control 3: Closed loop torque control 4: Constant linear speed control	0	-	At stop
Pd-01	0x6D01	Winding mode	0: Winding 1: Unwinding	0	-	Real time
Pd-02	0x6D02	Reverse tightening selection upon unwinding	0.0 to 500.0	0.0	m/min	Real time

Param.	Address	Name	Value range	Default	Unit	Change
Pd-03	0x6D03	Mechanical transmission ratio	0.01 to 300.00	1.00	-	Real time
Pd-04	0x6D04	Linear speed input source	0: PD-05 1: AI1 2: AI2 4: Pulse input (DI7) 5: Communication (1000H)	0	-	At stop
Pd-05	0x6D05	Digital setting of linear speed input	0.0 to PD-06	0.0	m/min	Real time
Pd-06	0x6D06	Maximum linear speed	0.0 to 6500.0	1000.0	m/min	Real time
Pd-07	0x6D07	Minimum linear speed for roll diameter calculation	0.0 to PD-06	20.0	m/min	Real time
Pd-08	0x6D08	Roll diameter not calculated in jogging	0: Disable 1: Enable	0	-	At stop
Pd-09	0x6D09	Roll diameter calculation method	0: Calculated based on linear speed 1:Calculated based on cumulative thickness 2: AI1 3: AI2 5: Pulse input (DI7) 6: Communication 7: PD-16	0	-	At stop
Pd-10	0x6D0A	Maximum roll diameter	PD-11 to 6000.0	500.0	mm	At once
Pd-11	0x6D0B	Empty roll diameter	0.1 to PD-10	100.0	mm	At once
Pd-12	0x6D0C	Initial roll diameter source	0: PD-13 to PD-15 1: AI1 2: AI2 4: Communication (1000H)	0	-	At stop
Pd-13	0x6D0D	Initial roll diameter 1	PD-11 to PD-10	100.0	mm	At once
Pd-14	0x6D0E	Initial roll diameter 2	PD-11 to PD-10	100.0	mm	At once
Pd-15	0x6D0F	Initial roll diameter 3	PD-11 to PD-10	100.0	mm	At once
Pd-16	0x6D10	Current roll diameter	0.1 to 6000.0	100.0	mm	At once
Pd-17	0x6D11	Roll diameter not reset upon stop	0: Disable 1: Enable	0	-	Real time
Pd-18	0x6D12	Roll diameter filter time	0.00 to 10.00	5.00	s	Real time
Pd-19	0x6D13	Roll diameter change rate	0.0 to 1000.0	0.0	-	Real time
Pd-20	0x6D14	Roll diameter change direction limit	0: Disabled 1: Decrease disabled during winding, and increase disabled during unwinding	0	-	Real time
Pd-21	0x6D15	Roll diameter reset during operation	0 to 1	0	-	Real time
Pd-22	0x6D16	Pre-drive speed gain	-100.0 to +200.0	0.0	%	Real-time
Pd-23	0x6D17	Pre-charge torque limit source	0: Set based on d1-09 to d1-12 1: Set based on tension control torque	1	-	At stop

Param.	Address	Name	Value range	Default	Unit	Change
Pd-24	0x6D18	Pre-drive torque correction	-100.0 to +100.0	0.0	%	Real-time
Pd-26	0x6D1A	Pre-drive acceleration time	0.0 to 6000.0	20.0	s	Real time
Pd-27	0x6D1B	Pre-drive deceleration time	0.0 to 6000.0	20.0	s	Real time
Pd-28	0x6D1C	Minimum pre-drive torque limit	0.0 to 100.0	0.0	-	Real time
Pd-29	0x6D1D	Pre-drive roll diameter calculation	0 to 1	0	-	Real time
Pd-30	0x6D1E	Tension frequency limit	0.0 to 100.0	50.0	%	Real-time
Pd-31	0x6D1F	Tension frequency limit offset	0.00 to 100.00	5.00	Hz	Real time
Pd-32	0x6D20	Tension frequency limit	0: Disable 1: Enable	0	-	Real time
Pd-33	0x6D21	Closed-loop tension torque mode selection	0: Torque calculated only through PID 1: Torque calculated through main + PID	0	-	At stop
Pd-34	0x6D22	Tension closed-loop torque limit	0.0 to 200.0	100.0	%	Real-time
Pd-35	0x6D23	Number of pulses per revolution	1 to 60000	1	-	Real time
Pd-36	0x6D24	Number of revolutions per layer	1 to 10000	1	-	Real time
Pd-37	0x6D25	Material thickness reference source	0: Digital setting 1: AI1 2: AI2	0	-	At stop
Pd-38	0x6D26	Material thickness 0	0.01 to 100.00	0.01	mm	At once
Pd-39	0x6D27	Material thickness 1	0.01 to 100.00	0.01	mm	At once
Pd-40	0x6D28	Material thickness 2	0.01 to 100.00	0.01	mm	At once
Pd-41	0x6D29	Material thickness 3	0.01 to 100.00	0.01	mm	At once
Pd-42	0x6D2A	Maximum thickness	0.01 to 100.00	1.00	mm	At once
Pd-44	0x6D2C	Constant linear speed source selection	0: Digital setting (PD-45) 1: AI1 2: AI2 4: Pulse reference (DI7) 5: Communication (1000H)	0	-	At stop
Pd-45	0x6D2D	Digital setting of constant linear speed input	0.0 to PD-06	0.0	m/min	Real time
Pd-46	0x6D2E	Tension control speed limit offset	0.00 to A2-17	0.00	Hz	Real time
Pd-47	0x6D2F	Tension control torque mode	0: Bidirectional offset 1: Unidirectional offset	1	-	At stop
Pd-48	0x6D30	Cable drum application mode	0: Horizontal cable drum application 1: Vertical cable drum application	0	-	At stop

Param.	Address	Name	Value range	Default	Unit	Change
Pd-49	0x6D31	Pulse counting mode	0: Calculated based on the winding/unwinding mode 1: Calculated based on the motor operating direction	0	-	At stop
Pd-50	0x6D32	Unwinding compensation	0.0 to 100.0	0.0	%	Real-time
Pd-51	0x6D33	Minimum tension reference for vertical cable drum applications	0 to PE-02	500	N	Real time
Pd-52	0x6D34	Maximum torque reference for vertical cable drum applications	PD-53 to 200.0	0.0	%	Real-time
Pd-53	0x6D35	Minimum torque reference for vertical cable drum applications	0.0 to PD-52	0.0	%	Real-time
Pd-54	0x6D36	Automatic material run-out detection	0: Disable 1: Enable	0	-	At stop
Pd-55	0x6D37	Minimum linear speed of automatic material run-out detection	PD-07 to PD-06	20.0	-	Real time
Pd-56	0x6D38	Error range of automatic material run-out detection	0.1 to 50.0	10.0	%	Real-time
Pd-57	0x6D39	Judgment delay of automatic material run-out detection	0.1 to 60.0	2.0	-	Real time

10.2.12.7 PE Tension Setting Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PE-00	0x6E00	Tension reference source	0: PE-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI7) 5: Communication (1000H)	0	/	Change at stop
PE-01	0x6E01	Tension digital setting	0–PE-02	50	N	Real time
PE-02	0x6E02	Maximum tension	0 to 65000	500	N	Real time
PE-03	0x6E03	Zero-speed threshold	0.0 to 20.0	0.0	%	Real-time
PE-04	0x6E04	Zero-speed tension rise	0.0 to 100.0	0.0	%	Real-time
PE-05	0x6E05	Frequency acceleration time in torque control mode	0.0 to 6500.0	0.0	s	Real-time
PE-06	0x6E06	Frequency deceleration time in torque control mode	0.0 to 6500.0	0.0	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PE-07	0x6E07	Friction force compensation	0.0 to 50.0	0.0	%	Real-time
PE-08	0x6E08	Mechanical inertia compensation coefficient	0 to 65535	0	N·m²	Real time
PE-09	0x6E09	Correction of acceleration inertia compensation	0.0 to 200.0	100.0	%	Real-time
PE-10	0x6E0A	Correction of deceleration inertia compensation	0.0 to 200.0	100.0	%	Real-time
PE-11	0x6E0B	Material density	0 to 65535	0	kg/m	Real time
PE-12	0x6E0C	Material width	0 to 65535	0	mm	At once
PE-13	0x6E0D	Inertia compensation exit delay	0 to 1000	0	ms	Real-time
PE-14	0x6E0E	Zero-speed compensation over-frequency	0.00 to 20.00	2.00	Hz	Real-time
PE-15	0x6E0F	Open-loop torque reversal	0: Disabled 1: Enabled	0	/	Real time
PE-16	0x6E10	Friction force compensation correction coefficient	-50.0 to 50.0	0.0	/	Real time
PE-17	0x6E11	Friction force compensation curve	0: Frequency 1: Linear speed 2: Multi-friction compensation curve 1 3: Multi-friction compensation curve 2	0	/	Change at stop
PE-18	0x6E12	Multi-friction force compensation torque 1	0.0 to 50.0	0.0	%	Real-time
PE-19	0x6E13	Multi-friction force compensation torque 2	0.0 to 50.0	0.0	%	Real-time
PE-20	0x6E14	Multi-friction force compensation torque 3	0.0 to 50.0	0.0	%	Real-time
PE-21	0x6E15	Multi-friction force compensation torque 4	0.0 to 50.0	0.0	%	Real-time
PE-22	0x6E16	Multi-friction force compensation torque 5	0.0 to 50.0	0.0	%	Real-time
PE-23	0x6E17	Multi-friction force compensation torque 6	0.0 to 50.0	0.0	%	Real-time
PE-24	0x6E18	Multi-friction compensation inflection point 1	0.00 to A2-17	0.00	Hz	Real-time
PE-25	0x6E19	Multi-segment force compensation inflection point 2	0.00 to A2-17	0.00	Hz	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PE-26	0x6E1A	Multi-friction force compensation inflection point 3	0.00 to A2-17	0.00	Hz	Real-time
PE-27	0x6E1B	Multi-friction force compensation inflection point 4	0.00 to A2-17	0.00	Hz	Real-time
PE-28	0x6E1C	Multi-friction force compensation inflection point 5	0.00 to A2-17	0.00	Hz	Real-time
PE-29	0x6E1D	Multi-friction force compensation inflection point 6	0.00 to A2-17	0.00	Hz	Real-time
PE-30	0x6E1E	Tension establishment	0: Disable 1: Enable	0	/	Change at stop
PE-31	0x6E1F	Tension establishment dead zone	0.0 to 100.0	2.0	%	Real-time
PE-32	0x6E20	Tension establishment frequency	0.00 to A2-17	0.10	Hz	Real-time
PE-33	0x6E21	Terminal torque boost proportion	0.0 to 500.0	50.0	%	Real-time
PE-34	0x6E22	Terminal torque boost cancellation time	0.0 to 50.0	0.0	s	Real-time
PE-35	0x6E23	Reel diameter auto-tuning coefficient	0 to 60000	100	%	Real-time
PE-36	0x6E24	Initial roll diameter auto-tuning	0: Disable 1: Enable	0	/	Change at stop
PE-37	0x6E25	Rod length	1 to 65535	300	mm	At stop:
PE-38	0x6E26	Rod angle	0.1 to 360.0	40.0	°	At stop
PE-39	0x6E27	Swing rod angle auto-tuning for reel diameter	0.0 to 100.0	50.0	%	Real-time
PE-40	0x6E28	Acceleration/ deceleration time of tension setup	0.0 to 60.0	10.0	s	Real-time
PE-41	0x6E29	Filter time of torque compensation	0 to 1000	20	/	Real time
PE-42	0x6E2A	Torque compensation gain	0.0 to 6000.0	100.0	%	Real-time
PE-44	0x6E2C	Proportional gain KP1 for tension setup	0.0 to 1000.0	20.0	/	Real time
PE-45	0x6E2D	Integral time Ti1 for tension setup	0.01 to 10.00	2.00	s	Real-time
PE-46	0x6E2E	Derivative time Td1 for tension setup	0.000 to 10.000	0.000	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PE-47	0x6E2F	Linear speed zero-crossing judgement	0.0 to 100.0	0.0	/	Real time
PE-48	0x6E30	Minimum frequency of tension setup (under maximum reel diameter)	0.00 to A2-17	0.10	Hz	Real-time
PE-49	0x6E31	Torque compensation effective time	0.00 to 650.00	2.00	s	Real-time
PE-50	0x6E32	Minimum torque compensation gain	0.0 to 6000.0	100.0	%	Real-time
PE-51	0x6E33	Proportional gain KP1 for emergency stop	0.0 to 1000.0	20.0	/	Real time
PE-52	0x6E34	Integral time Ti1 for emergency stop	0.01 to 10.00	2.00	s	Real-time
PE-53	0x6E35	Derivative time Td1 for emergency stop	0.000 to 10.000	0.000	s	Real-time
PE-54	0x6E36	PI function selection for emergency stop	0 to 1	0	/	Real time

10.2.12.8 PF tension setting parameter + Taper setting parameter

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PF-00	0x6F00	Taper curve	0: Curve taper 1: Multi-liner taper	0	/	Change at stop
PF-01	0x6F01	Setting source of tension taper	0：PF-02 1：AI1 2：AI2 4：Communication (1000H)	0	/	Change at stop
PF-02	0x6F02	Taper digital setting	0.0 to 100.0	0.0	%	Real-time
PF-03	0x6F03	Correction of tension taper compensation	0 to 10000	0	mm	At once
PF-05	0x6F05	Setting source of external taper AO	0：PF-06 1：AI1 2：AI2 4：Communication (1000H)	0	/	Change at stop
PF-06	0x6F06	External taper setting	0.0 to 100.0	100.0	%	Real-time
PF-08	0x6F08	Minimum roll diameter taper	0.0 to 100.0	100.0	%	Real-time
PF-09	0x6F09	Linear taper switchover point 1	PD-11 to PF-11	150.0	mm	At once
PF-10	0x6F0A	Taper of switchover point 1	0.0 to 100.0	100.0	%	Real-time
PF-11	0x6F0B	Linear taper switchover point 2	PF-09 to PF-13	200.0	mm	At once
PF-12	0x6F0C	Taper of switchover point 2	0.0 to 100.0	90.0	%	Real-time
PF-13	0x6F0D	Linear taper switchover point 3	PF-11 to PF-15	250.0	mm	At once

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PF-14	0x6F0E	Taper of switchover point 3	0.0 to 100.0	80.0	%	Real-time
PF-15	0x6F0F	Linear taper switchover point 4	PF-13 to PF-17	300.0	mm	At once
PF-16	0x6F10	Taper of switchover point 4	0.0 to 100.0	70.0	%	Real-time
PF-17	0x6F11	Linear taper switchover point 5	PF-15 to PD-10	400.0	mm	At once
PF-18	0x6F12	Taper of switchover point 5	0.0 to 100.0	50.0	%	Real-time
PF-19	0x6F13	Max. roll diameter taper	0.0 to 100.0	30.0	/	Real time
PF-30	0x6F1E	Reel diameter calculated based on the number of pulses	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-31	0x6F1F	Roll diameter reset	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-32	0x6F20	Initial reel diameter source selection terminal 1	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-33	0x6F21	Initial reel diameter source selection terminal 2	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PF-34	0x6F22	Pre-charge	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-35	0x6F23	Winding/Unwinding switchover	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-36	0x6F24	Roll diameter calculation stopped	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-37	0x6F25	Exiting from tension mode	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-38	0x6F26	Terminal tension rise	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
PF-39	0x6F27	Material thickness selection terminal 1	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-40	0x6F28	Material thickness selection terminal 2	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-41	0x6F29	Passive unwinding (cable drum application)	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time
PF-42	0x6F2A	Emergency stop - Tension torque compensation enable	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S)	0	/	Real time

10.2.13 U Common Monitoring

10.2.13.1 U0 Monitoring Parameters 0

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-00	0x7000	Running frequency	0.00 to 600.00	0.00	Hz	Unchangeable
U0-01	0x7001	Set frequency	0.00 to 600.00	0.00	Hz	Unchangeable
U0-02	0x7002	Bus voltage	0.0 to 6553.5	0.0	V	Unchangeable
U0-03	0x7003	Output voltage	0 to 65535	0	V	Unchangeable
U0-04	0x7004	Output current	0.00 to 655.35	0.00	A	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-05	0x7005	Output power	-3276.8 to 3276.7	0.0	kW	Unchangeable
U0-06	0x7006	Output torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U0-07	0x7007	DI input state	Bit 0: DI1 status Bit 1: DI2 status Bit 2: DI3 status (valid only for MD630S) Bit 3: DI4 state (valid only for MD630S) Bit 4: DI5 state (valid only for MD630S) Bit 5: DI6 state (valid only for MD630S) Bit 6: DI7 status (valid only for MD630S) Bit 7 to Bit 9: Reserved Bit 10: VDI1 status Bit 11: VDI2 status Bit 12: VDI3 status Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status The bit value is: 0: Low level 1: High level	0x0	/	Unchangeable
U0-08	0x7008	DO output status	Bit 0: RO status Bit 1 to Bit 3: Reserved Bit 4: DO status Bit 5 to Bit 7: Reserved Bit8: FMR status (valid only for MD630S) Bit 9: Reserved Bit 10: VDO1 status Bit 11: VDO2 status Bit 12: VDO3 status Bit 13: VDO4 status Bit 14: VDO5 status Bit 15: VDO6 status The bit value is: 0: Low level 1: High level	0x0	/	Unchangeable
U0-09	0x7009	AI1 voltage	-10.570 to 10.570	0.000	V	Unchangeable
U0-10	0x700A	AI2 voltage	-10.570 to 10.570	0.000	V	Unchangeable
U0-14	0x700E	Load speed display	0 to 65535	0	rpm	Unchangeable
U0-15	0x700F	PID reference	-32768 to 32767	0	-	Unchangeable
U0-16	0x7010	PID feedback	-32768 to 32767	0	-	Unchangeable
U0-17	0x7011	PLC stage	0 to 65535	0	-	Unchangeable
U0-18	0x7012	HDI input pulse frequency	0.00 to 20.00	0.00	kHz	Unchangeable
U0-19	0x7013	Actual motor frequency	-327.67 to 327.67	0.00	Hz	Unchangeable
U0-20	0x7014	Remaining running time	0.0 to 6553.5	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-21	0x7015	AI1 voltage before correction	-10.570 to 10.570	0.000	V	Unchangeable
U0-22	0x7016	AI2 voltage before correction	-10.570 to 10.570	0.000	V	Unchangeable
U0-24	0x7018	Actual motor speed	0 to 65535	0	rpm	Unchangeable
U0-25	0x7019	Current power-on time	0 to 65535	0	min	Unchangeable
U0-26	0x701A	Current running time	0.0 to 6553.5	0.0	min	Unchangeable
U0-28	0x701C	Communication setpoint	-300.00 to 300.00	0.00	%	Unchangeable
U0-29	0x701D	Encoder feedback speed	-500.00 to 500.00	0.00	Hz	Unchangeable
U0-30	0x701E	Digital setting of main frequency	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-31	0x701F	Digital setting of auxiliary frequency	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-35	0x7023	Target torque	-200.0 to 200.0	0.0	%	Unchangeable
U0-37	0x7025	Power factor angle	-3276.8 to 3276.7	0.0	°	Unchangeable
U0-39	0x7027	Target voltage upon V/f separation	0 to 65535	0	V	Unchangeable
U0-40	0x7028	Output voltage upon V/f separation	0 to 65535	0	V	Unchangeable
U0-45	0x702D	Alarm code	0.0 to 6553.5	0.0	-	Unchangeable
U0-46	0x702E	Minor fault code	0.0 to 6553.5	0.0	-	Unchangeable
U0-47	0x702F	Alarm code	0.0 to 6553.5	0.0	-	Unchangeable
U0-48	0x7030	Prompt code	0.0 to 6553.5	0.0	-	Unchangeable
U0-49	0x7031	Set fan speed	0 to 65535	0	rpm	Unchangeable
U0-50	0x7032	Actual fan speed	-32768 to 32767	0	rpm	Unchangeable
U0-51	0x7033	Adjustment of UP/ DOWN key or terminal functioning as UP/ DOWN key	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-52	0x7034	Internal temperature of the fan chip	0 to 65535	0	-	Unchangeable
U0-53	0x7035	Encoder position feedback (high-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-54	0x7036	Encoder position feedback (low-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-59	0x703B	Frequency reference (percentage)	-3276.8 to 3276.7	0.0	%	Unchangeable
U0-60	0x703C	Operating frequency (percentage)	-3276.8 to 3276.7	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-61	0x703D	Drive status 1	1: Forward running 2: Reverse running 3: Stopped 4: Auto-tuning 5: Faulty	0	-	Unchangeable
U0-65	0x7041	Torque upper limit	-2000.0 to 2000.0	0.0	%	Unchangeable
U0-68	0x7044	Drive status 2	Bit 0: Running 0: Stopped 1: Running Bit 1: Running direction 0: Forward 1: Reverse Bit 2: Fault status 0: No fault 1: Faulty Bit 3: Frequency reached 0: Not reached 1: Reached Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved Bit 8 to Bit 15: Fault code	0x0	-	Unchangeable
U0-69	0x7045	Actual motor frequency (signed)	-327.67 to 327.67	0.00	Hz	Unchangeable
U0-70	0x7046	Actual motor speed (signed)	-32768 to 32767	0	rpm	Unchangeable
U0-71	0x7047	Output current (with one decimal place)	0.0 to 6553.5	0.0	A	Unchangeable
U0-75	0x704B	Actual motor frequency (unsigned)	0.00 to 655.35	0.00	Hz	Unchangeable
U0-76	0x704C	Low-order bits of accumulative power consumption	0.0 to 6553.5	0.0	kWh	Unchangeable
U0-77	0x704D	High-order bits of accumulative power consumption	0 to 65535	0	kWh	Unchangeable
U0-82	0x7052	Module temperature	-20.0 to 120.0	0.0	°C	Unchangeable
U0-83	0x7053	Ambient temperature	-20.0 to 120.0	0.0	°C	Unchangeable
U0-84	0x7054	Load type display	0: Heavy load application 1: Light load application	0	-	Unchangeable
U0-85	0x7055	Auto-tuning and self-check procedure	0 to 65535	0	-	Unchangeable
U0-86	0x7056	Proportional coefficient of the speed loop	0.00 to 655.35	0.00	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-87	0x7057	Integral coefficient of the speed loop	0.00 to 655.35	0.00	-	Unchangeable
U0-90	0x705A	AI2 temperature mode - motor temperature	-50 to 300	0	°C	Unchangeable
U0-97	0x7061	Effective value of Phase-U current	0.00 to 655.35	0.00	%	Unchangeable
U0-98	0x7062	Effective value of Phase-V current	0.00 to 655.35	0.00	%	Unchangeable
U0-99	0x7063	Effective value of Phase-W current	0.00 to 655.35	0.00	%	Unchangeable

10.2.13.2 U1 Monitoring parameters 1

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U1-05	0x7105	AI1 curve input value	-327.68 to 327.67	0.00	V	Unchangeable
U1-06	0x7106	Input value of AI1 curve	-327.68 to 327.67	0.00	V	Unchangeable
U1-08	0x7108	AO output	-327.68 to 327.67	0.00	V	Unchangeable
U1-10	0x710A	AO output (original value)	-327.680 to 32.767	0.000	V	Unchangeable
U1-12	0x710C	AO current mode	-327.68 to 327.67	0.00	mA	Unchangeable
U1-14	0x710E	Frequency per-unit value after HDO display source selected	-327.68 to 327.67	0.00	%	Unchangeable
U1-15	0x710F	Frequency per-unit value before HDO curve correction	-327.68 to 327.67	0.00	%	Unchangeable
U1-16	0x7110	Final output frequency per-unit value of HDO	-327.68 to 327.67	0.00	%	Unchangeable
U1-17	0x7111	Final actual frequency output of HDO	0.00 to 655.35	0.00	kHz	Unchangeable

10.2.13.3 U2 Monitoring parameters 2

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U2-00	0x7200	Current motor parameter group	0: Motor parameter group 1 1: Motor parameter group 2 2: Motor parameter group 3 3: Motor parameter group 4	0	-	Unchangeable
U2-01	0x7201	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Unchangeable
U2-02	0x7202	Current reference channel	0: Reference channel 1 1: Reference channel 2	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U2-03	0x7203	Current stop mode	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop	0	-	Unchangeable
U2-05	0x7205	Current multi-reference selection	0 to 65535	0	-	Unchangeable
U2-06	0x7206	Current multi-reference effective value	-3276.8 to 3276.7	0.0	%	Unchangeable
U2-07	0x7207	Current running mode	0: Normal operation 1: Jogging	0	-	Unchangeable
U2-08	0x7208	Current jog source	0: Jogging source 1 1: Jogging source 2	0	-	Unchangeable
U2-09	0x7209	Current control mode	0: Speed control mode 1: Torque control mode 2: Position control mode (reserved)	0	-	Unchangeable
U2-10	0x720A	Current active carrier frequency	0 to 65535	0	Hz	Unchangeable
U2-11	0x720B	Local/Remote	0: Remote 1: Local	0	-	Unchangeable
U2-18	0x7212	Jump frequency flag	0 to 65535	0	-	Unchangeable
U2-19	0x7213	Self-test/Auto-tuning pre-state	0: Invalid 1: Wait for auto-tuning 2: Wait for self-test 3: Forced DC braking	0	-	Unchangeable
U2-20	0x7214	Self-test/Auto-tuning request	0 to 65535	0	-	Unchangeable
U2-21	0x7215	Self-test/Auto-tuning completed	0 to 65535	0	-	Unchangeable
U2-22	0x7216	Current items auto-tuned/tested upon power-on	0 to 65535	0	-	Unchangeable
U2-23	0x7217	Decelerate to stop/DC braking	0 to 65535	0	-	Unchangeable
U2-24	0x7218	Immediate DC braking of DI	0: Invalid 1: Immediate DC braking 2: Decelerate to DC braking	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U2-25	0x7219	Fault and limit severity	Bit 0: Coast to stop Bit 1: Maximum capacity to stop Bit 2: Quick stop Bit 3: Decelerate to stop Bit 4 to Bit 6: Reserved Bit 7 to Bit 8: Reserved Bit 9: Limit running Bit 10: Alarm Bit 11: Notification Bit 12 to Bit 15: Reserved Value of bit: 0: Invalid 1: Valid	0x0	-	Unchangeable
U2-26	0x721A	Fault auto reset and restart step	0 to 65535	0	-	Unchangeable
U2-27	0x721B	Automatic reset command flag for communication fault	0: Invalid 1: Valid	0	-	Unchangeable
U2-35	0x7223	Undervoltage fault flag bit	0: Invalid 1: Valid	0	-	Unchangeable
U2-36	0x7224	Fault restart clear command	0 to 65535	0	-	Unchangeable
U2-37	0x7225	Torque control frequency offset mode	0 to 65535	0	-	Unchangeable
U2-38	0x7226	Separated V/f RFG clear command	0: Invalid 1: Valid	0	-	Unchangeable
U2-39	0x7227	V/f separation	0: Invalid 1: Valid	0	-	Unchangeable
U2-40	0x7228	Stop frequency control for separated V/f	0: Invalid 1: Valid	0	-	Unchangeable
U2-41	0x7229	RFG performance enabled forcibly	0: Invalid 1: Valid	0	-	Unchangeable
U2-42	0x722A	RFG acceleration/ deceleration state	0 to 65535	0	-	Unchangeable
U2-43	0x722B	RFG arc state	0 to 65535	0	-	Unchangeable
U2-44	0x722C	Active RFG selection	0: Ramp 1 1: Ramp 2 2: Ramp 3 3: Ramp 4	0	-	Unchangeable
U2-45	0x722D	Current additional torque 2 state	Bit 0: Setting channel 1 0: Invalid 1: Valid Bit 1: Setting channel 2 0: Invalid 1: Valid Bit 2 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U2-49	0x7231	Remaining running duration during timed running	0.0 to 6553.5	0.0	min	Unchangeable
U2-50	0x7232	Change the decimal place flag according to the power parameter.	0.0 to 6553.5	0.0	-	Unchangeable
U2-51	0x7233	Wobble frequency acceleration/ deceleration timeout flag	0 to 65535	0	-	Unchangeable
U2-55	0x7237	Parameter record information 0	0 to 65535	0	-	Unchangeable

10.2.13.4 U3 Monitoring parameters 3

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
U3-00	0x7300	LCD command word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-02	0x7302	IDS command word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-03	0x7303	Command used by commissioning software to obtain control permission	0 to 65535	0	/	Unchangeable
U3-07	0x7307	LED control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-08	0x7308	Control word of the commissioning software	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-09	0x7309	SOP control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-11	0x730B	LED command clear flag	0 to 65535	0	/	Unchangeable
U3-12	0x730C	SOP command clear flag	0 to 65535	0	/	Unchangeable
U3-13	0x730D	IDS command clear flag	0 to 65535	0	/	Unchangeable
U3-14	0x730E	Automatic reset command flag for communication fault	0 to 65535	0	/	Unchangeable
U3-16	0x7310	Speed 2 set through communication (0x7310)	0 to 65535	0	/	Unchangeable
U3-17	0x7311	Control word 2 set through communication (0x7311)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-18	0x7312	DO state setting (DO function setting source: communication)	0 to 65535	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
U3-19	0x7313	AO1 output (AO1 function setting source: communication)	0 to 65535	0	%	Unchangeable
U3-21	0x7315	HDO output reference (HDO function option: communication)	0 to 65535	0	/	Unchangeable
U3-23	0x7317	Monitoring of communication speed setting value 1 (0x1000)	-32768 to 32767	0	/	Unchangeable
U3-24	0x7318	0x1000H decimal places set through communication	0 to 65535	0	/	Unchangeable
U3-28	0x731C	Communication status word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-29	0x731D	Communication error reset enable	0 to 65535	0	/	Unchangeable
U3-33	0x7321	Communication setting control word 1 (0x7321)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-34	0x7322	DO state setting (DO function setting source: communication)	0 to 65535	0	/	Unchangeable
U3-35	0x7323	AO1 output (AO1 function setting source: communication)	0 to 65535	0	/	Unchangeable
U3-36	0x7324	AO1 output (AO1 function setting source: communication)	0 to 65535	0	/	Unchangeable
U3-37	0x7325	Software tool control flag	0 to 65535	0	/	Unchangeable
U3-38	0x7326	Command from the command channel (previous cycle)	0 to 65535	0	/	Unchangeable
U3-41	0x7329	Communication command clear flag	0 to 65535	0	/	Unchangeable
U3-50	0x7332	Fault code reading	0 to 65535	0	/	Unchangeable
U3-51	0x7333	Fault sub-code reading	0 to 65535	0	/	Unchangeable
U3-52	0x7334	Minor fault code reading	0 to 65535	0	/	Unchangeable
U3-53	0x7335	Minor fault sub-code reading	0 to 65535	0	/	Unchangeable
U3-54	0x7336	Warning code reading	0 to 65535	0	/	Unchangeable
U3-55	0x7337	Warning subcode reading	0 to 65535	0	/	Unchangeable
U3-56	0x7338	Prompt code reading	0 to 65535	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
U3-57	0x7339	Prompt sub-code reading	0 to 65535	0	/	Unchangeable
U3-90	0x735A	Floating-point concatenator-to-monitoring parameter module A output	-32768 to 32767	0	/	Unchangeable
U3-91	0x735B	Floating-point concatenator-to-monitoring parameter module B output	-32768 to 32767	0	/	Unchangeable
U3-92	0x735C	Floating-point concatenator-to-monitoring parameter module C output	-32768 to 32767	0	/	Unchangeable
U3-93	0x735D	Floating-point concatenator-to-monitoring parameter module D output	-32768 to 32767	0	/	Unchangeable
U3-94	0x735E	Floating-point concatenator-to-monitoring parameter module E output	-32768 to 32767	0	/	Unchangeable
U3-95	0x735F	Floating-point concatenator-to-monitoring parameter module F output	-32768 to 32767	0	/	Unchangeable
U3-96	0x7360	Floating-point concatenator-to-monitoring parameter module G output	-32768 to 32767	0	/	Unchangeable
U3-97	0x7361	Floating-point concatenator-to-monitoring parameter module H output	-32768 to 32767	0	/	Unchangeable

10.2.13.5 U6 Monitoring parameters 6

Item	Address	Name	Value Range	Default	Unit	Change Mode
U6-62	0x763E	STO fault exception flag	0 to 65535	0	/	Unchangeable
U6-63	0x763F	STO initialization flag	0 to 1	0	/	Unchangeable
U6-64	0x7640	STO status monitoring word	0 to 65535	0	/	Unchangeable
U6-65	0x7641	STO model	0 to 65535	0	/	Unchangeable
U6-66	0x7642	STO_1.2 V_AD sampling value	0 to 65535	0	/	Unchangeable

Item	Address	Name	Value Range	Default	Unit	Change Mode
U6-67	0x7643	STO_5v_AD sampling value	0 to 65535	0	/	Unchangeable
U6-70	0x7646	Power-off time	0 to 65535	0	/	Unchangeable
U6-71	0x7647	Address mapping enable state	0: Invalid 1: Valid	0	/	Unchangeable
U6-72	0x7648	User load curve enable	0: Invalid 1: Valid	0	/	Unchangeable
U6-73	0x7649	User load curve setting error flag	0 to 65535	0	/	Unchangeable
U6-74	0x764A	Multi-point curve setup error flag	bit0: Multi-point curve A 0: No error 1: With error bit1: Multi-point curve B 0: No error 1: With error	0x0	-	Unchangeable
U6-76	0x764C	Power-on initialization completion flag	0 to 65535	0	/	Unchangeable
U6-77	0x764D	Model-related parameter update flag	0 to 65535	0	/	Unchangeable
U6-84	0x7654	Prompt for parameter setting error	0 to 65535	0	/	Unchangeable
U6-85	0x7655	Macro parameter backup error	0 to 65535	0	/	Unchangeable
U6-86	0x7656	Flag of invalid restoration for backup parameter	0 to 65535	0	/	Unchangeable

10.2.13.6 U8: General Monitoring Parameter 8

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U8-00	0x7800	Current state of brake control	0: Initializing 1: Inhibited 2: Closing 3: Closed 4: Waiting for switch-on 5: Switching on 6: Switched on 7: Waiting for switch-off 8: Brake test	0	/	Unchangeable
U8-01	0x7801	Brake module control word	0 to 65535	0	/	Unchangeable
U8-02	0x7802	Brake module status word	0 to 65535	0	/	Unchangeable
U8-03	0x7803	Status word for brake module ON uncompleted	0 to 65535	0	/	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U8-04	0x7804	Status word for brake module OFF uncompleted	0 to 65535	0	/	Unchangeable
U8-05	0x7805	Starting frequency enable state of brake module	0 to 65535	0	/	Unchangeable
U8-06	0x7806	Starting torque enable state of brake module	0 to 65535	0	/	Unchangeable
U8-07	0x7807	Brake feedback state during auto-tuning	0 to 65535	0	/	Unchangeable

10.2.13.7 U9: General Monitoring Parameter 9

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U9-00	0x7900	Linear speed	0.0 to 6553.5	0.0	m/min	Unchangeable
U9-01	0x7901	Current roll diameter	0.0 to 6553.5	0.0	mm	Unchangeable
U9-02	0x7902	Linear speed synchronization frequency	-327.68 to 327.67	0.00	Hz	Unchangeable
U9-03	0x7903	Closed loop speed output	-327.68 to 327.67	0.00	Hz	Unchangeable
U9-04	0x7904	Tension reference (before taper)	0 to 65535	0	N	Unchangeable
U9-05	0x7905	Tension reference (after taper)	0 to 65535	0	N	Unchangeable
U9-06	0x7906	Torque reference	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-07	0x7907	Closed loop torque output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-08	0x7908	Tension control state machine	0 to 65535	0	/	Unchangeable
U9-09	0x7909	Closed loop tension (speed/torque) PID setting display	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-10	0x790A	Closed loop tension (speed/torque) PID feedback display	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-11	0x790B	Closed loop tension (speed/torque) PID proportional output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-12	0x790C	Closed loop tension (speed/torque) PID integral output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-13	0x790D	Closed loop tension (speed/torque) PID derivative output	-3276.8 to 3276.7	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U9-14	0x790E	Tension process execution time	0 to 65535	0	/	Unchangeable
U9-15	0x790F	Winding mode	0 to 65535	0	/	Unchangeable
U9-16	0x7910	Tension torque setpoint	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-17	0x7911	Static friction torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-18	0x7912	Dynamic friction torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-19	0x7913	Inertia torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-20	0x7914	Terminal lift torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-21	0x7915	Torque upper limit in vertical cable drum application (calculated value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-22	0x7916	Torque lower limit in vertical cable drum application (calculated value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-23	0x7917	Torque upper limit in vertical cable drum application (actual value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-24	0x7918	Torque lower limit in vertical cable drum application (actual value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-25	0x7919	Closed loop tension (speed/torque) PID output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-26	0x791A	Linear acceleration	-32768 to 32767	0	/	Unchangeable

10.2.13.8 General monitoring parameter 11

Item	Ad dress:	Name	Value Range	Default	Unit	Change:
Ub-10	0x7B0A	Component lifetime alarm state output	0x0 to 0xFFFF	0x0	-	Unchangeable
Ub-12	0x7B0C	Displayed value of the predicted lifetime margin of the main circuit capacitor	0.00 to 100.00	0.00	%	Unchangeable
Ub-17	0x7B11	Displayed value of predicted lifetime margin of IGBT	0.00 to 100.00	0.00	%	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
Ub-18	0x7B12	Displayed value of the remaining operating time (x 10h) of the fan in real time	0 to 65535	0	/	Unchangeable
Ub-19	0x7B13	Displayed value of predicted lifetime margin of the fan	0.00 to 100.00	0.00	%	Unchangeable
Ub-96	0x7B60	Drive overload protection mode	0 to 65535	0	/	Unchangeable

10.2.14 L Connector

10.2.14.1 L00 Bit Connector 1 Parameters

Item	Address	Name	Value Range	Default	Unit	Change Mode
L0000	0x9000	Logic 0	0 to 1	0	/	Unchangeable
L0001	0x9001	Logic 1	0 to 1	0	/	Unchangeable
L0002	0x9002	DI1	0 to 1	0	/	Unchangeable
L0003	0x9003	DI2	0 to 1	0	/	Unchangeable
L0004	0x9004	DI3 (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0005	0x9005	DI4 (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0006	0x9006	DI5 (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0007	0x9007	DI6 (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0008	0x9008	DI7 (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0012	0x900C	VDI1	0 to 1	0	/	Unchangeable
L0013	0x900D	VDI2	0 to 1	0	/	Unchangeable
L0014	0x900E	VDI3	0 to 1	0	/	Unchangeable
L0015	0x900F	VDI4	0 to 1	0	/	Unchangeable
L0016	0x9010	VDI5	0 to 1	0	/	Unchangeable
L0017	0x9011	VDI6	0 to 1	0	/	Unchangeable
L0018	0x9012	DI1 inversion	0 to 1	0	/	Unchangeable
L0019	0x9013	DI2 inversion	0 to 1	0	/	Unchangeable
L0020	0x9014	DI3 inverted (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0021	0x9015	DI4 inverted (valid only for MD630S)	0 to 1	0	/	Unchangeable

Item	Address	Name	Value Range	Default	Unit	Change Mode
L0022	0x9016	DI5 inverted (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0023	0x9017	DI6 inverted (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0024	0x9018	DI7 inverted (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0028	0x901C	VDI1 inversion	0 to 1	0	/	Unchangeable
L0029	0x901D	VDI2 inversion	0 to 1	0	/	Unchangeable
L0030	0x901E	VDI3 inversion	0 to 1	0	/	Unchangeable
L0031	0x901F	VDI4 inversion	0 to 1	0	/	Unchangeable
L0032	0x9020	VDI5 inversion	0 to 1	0	/	Unchangeable
L0033	0x9021	VDI6 inversion	0 to 1	0	/	Unchangeable
L0034	0x9022	RO	0 to 1	0	/	Unchangeable
L0038	0x9026	DO	0 to 1	0	/	Unchangeable
L0042	0x902A	FMR (valid only for MD630S)	0 to 1	0	/	Unchangeable
L0044	0x902C	VDO1	0 to 1	0	/	Unchangeable
L0045	0x902D	VDO2	0 to 1	0	/	Unchangeable
L0046	0x902E	VDO3	0 to 1	0	/	Unchangeable
L0047	0x902F	VDO4	0 to 1	0	/	Unchangeable
L0048	0x9030	VDO5	0 to 1	0	/	Unchangeable
L0049	0x9031	VDO6	0 to 1	0	/	Unchangeable
L0050	0x9032	AI1 input overlimit	0: Not exceeded 1: Exceeded	0	/	Unchangeable
L0051	0x9033	AI2 input overlimit	0: Not exceeded 1: Exceeded	0	/	Unchangeable
L0053	0x9035	HDI input disconnection	0: Not disconnected 1: Disconnected	0	/	Unchangeable
L0054	0x9036	AI1 used as DI level	0: Low level 1: High level	0	/	Unchangeable
L0055	0x9037	AI2 used as DI level	0: Low level 1: High level	0	/	Unchangeable
L0057	0x9039	AI2 temperature mode - Motor temperature reach	0: Temperature not reached 1: Temperature reached	0	/	Unchangeable
L0058	0x903A	AI2 temperature mode - Motor overtemperature fault	0: Overtemperature not occur 1: Overtemperature occur	0	/	Unchangeable
L0059	0x903B	AI2 temperature mode- motor overtemperature alarm	0: Overtemperature alarm not reported 1: Overtemperature alarm reported	0	/	Unchangeable

10.2.14.2 L01: Bit Connector 2 Parameters

Item	Address:	Name	Value Range	Default	Unit	Change:
L0100	0x9064	Ready to switch on	0: Not ready to switch on 1: Ready to switch on	0	/	Unchangeable
L0101	0x9065	Ready to run	0: Not ready to run 1: Ready to run	0	/	Unchangeable
L0102	0x9066	In operation	0: Not in operation 1: In operation	0	/	Unchangeable
L0103	0x9067	Fault activation	0: Not faulty 1: Faulty	0	/	Unchangeable
L0104	0x9068	OFF2 (coast to stop) flag	0: Valid 1: Invalid	0	/	Unchangeable
L0105	0x9069	OFF3 (quick stop) flag	0: Valid 1: Invalid	0	/	Unchangeable
L0106	0x906A	Switch-on inhibited	0: Switch-on allowed 1: Switch-on inhibited	0	/	Unchangeable
L0107	0x906B	Alarm/Minor fault activated	0: No alarm/minor fault 1: Alarms/minor faults occur.	0	/	Unchangeable
L0108	0x906C	Actual speed following speed reference	0: There is no deviation between the reference and actual value. 1: The deviation between the reference and actual value is in the allowed range.	0	/	Unchangeable
L0109	0x906D	Local/remote	0: Local 1: Remote	0	/	Unchangeable
L0110	0x906E	Target speed reached	0: Not reached 1: Reached	0	/	Unchangeable
L0111	0x906F	Torque limit reach	0: Torque/Current not limited 1: Torque/Current limited	0	/	Unchangeable
L0112	0x9070	Forward speed	0: Invalid 1: Valid	0	/	Unchangeable
L0113	0x9071	Reverse speed	0: Invalid 1: Valid	0	/	Unchangeable
L0114	0x9072	Motor running flag	0: Stopped 1: Running (pulse output)	0	/	Unchangeable
L0116	0x9074	Low bit of current motor parameter group	0: Logic 0 1: Logic 1	0	/	Unchangeable
L0117	0x9075	High bit of current motor parameter group	0: Logic 0 1: Logic 1	0	/	Unchangeable
L0118	0x9076	Current control channel	0: Control channel 1 1: Control channel 2	0	/	Unchangeable
L0119	0x9077	Current set channel	0: Set channel 1 1: Set channel 2	0	/	Unchangeable
L0120	0x9078	Active terminal start/ stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0121	0x9079	Terminal control selection	0: Invalid 1: Valid	0	/	Unchangeable
L0122	0x907A	Torque control selection	0: Invalid 1: Valid	0	/	Unchangeable
L0123	0x907B	Speed control selection	0: Invalid 1: Valid	0	/	Unchangeable
L0124	0x907C	Position control selection	0: Invalid 1: Valid	0	/	Unchangeable
L0125	0x907D	Separated V/f selection	0: Invalid 1: Valid	0	/	Unchangeable
L0126	0x907E	RFG function selection	0: Disable 1: Enable	0	/	Unchangeable
L0127	0x907F	RFG module operation	0: Stopped 1: Operating	0	/	Unchangeable
L0132	0x9084	Error output	0: No error is reported. 1: Errors are reported.	0	/	Unchangeable
L0133	0x9085	Error output (undervoltage fault excluded)	0: No error is reported. 1: Errors are reported.	0	/	Unchangeable
L0134	0x9086	Fault output	0: A fault occurs and the relay is invalid during automatic reset. 1: A fault occurs and the relay is valid during automatic reset.	0	/	Unchangeable
L0135	0x9087	Stop at fault	0: Invalid 1: Valid	0	/	Unchangeable
L0136	0x9088	Normal running	0: Normal operation 1: Jogging	0	/	Unchangeable
L0137	0x9089	Jog	0: Normal operation 1: Jogging	0	/	Unchangeable
L0138	0x908A	Decelerate-to-stop state	0: Disable 1: Deceleration to stop	0	/	Unchangeable
L0141	0x908D	Self-test in progress	0: Invalid 1: Self-check in progress	0	/	Unchangeable
L0142	0x908E	Auto-tuning state	0: Invalid 1: Auto-tuning in progress	0	/	Unchangeable
L0152	0x9098	Operation at zero speed (invalid at stop)	0: Invalid 1: Valid	0	/	Unchangeable
L0153	0x9099	Operating-at-zero-speed (valid at stop) state	0: Invalid 1: Valid	0	/	Unchangeable
L0156	0x909C	Reverse run	0: Invalid 1: Reverse run	0	/	Unchangeable
L0157	0x909D	Wobble frequency limited	0: Unlimited 1: Limited	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0158	0x909E	Torque limit state	0: Unlimited 1: Limited	0	/	Unchangeable
L0159	0x909F	Motor speed positive	0: Reverse 1: Forward	0	/	Unchangeable
L0160	0x90A0	Motor speed negative	0: Forward 1: Reverse	0	/	Unchangeable
L0161	0x90A1	Startup frequency RFG forcing	0: Not forced 1: Forced	0	/	Unchangeable
L0162	0x90A2	Stop at frequencies lower than lower limit/ starting frequency	0: Inactive 1: Active	0	/	Unchangeable
L0163	0x90A3	Coast to stop at frequencies lower than lower limit	0: Inactive 1: Active	0	/	Unchangeable
L0164	0x90A4	Power dip ride-through deceleration and clear	0: Inactive 1: Active	0	/	Unchangeable
L0165	0x90A5	Decelerate to stop upon power dip ride-through	0: Inactive 1: Active	0	/	Unchangeable
L0174	0x90AE	Bus voltage state	0: Abnormal bus voltage 1: Normal bus voltage	0	/	Unchangeable
L0175	0x90AF	Excessive speed deviation	0: Invalid 1: Excessive motor speed deviation	0	/	Unchangeable
L0176	0x90B0	Motor overspeed	0: Invalid 1: Motor overspeed	0	/	Unchangeable
L0177	0x90B1	Overcurrent	0: Invalid 1: Valid	0	/	Unchangeable
L0178	0x90B2	Bus overvoltage	0: Invalid 1: Valid	0	/	Unchangeable
L0179	0x90B3	Bus undervoltage	0: Invalid 1: Bus undervoltage	0	/	Unchangeable
L0180	0x90B4	Motor pre-overload	0: Invalid 1: Motor pre-overload activated	0	/	Unchangeable
L0181	0x90B5	Motor overload fault	0: Invalid 1: Valid	0	/	Unchangeable
L0182	0x90B6	AC drive pre-overload	0: Invalid 1: Valid	0	/	Unchangeable
L0183	0x90B7	AC drive overload	0: Invalid 1: Valid	0	/	Unchangeable
L0185	0x90B9	Motor overheat	0: Invalid 1: Valid	0	/	Unchangeable
L0186	0x90BA	Drive pre-overtemperature	0: Invalid 1: Valid	0	/	Unchangeable
L0187	0x90BB	Drive overtemperature	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0188	0x90BC	Input phase loss	0: Invalid 1: Valid	0	/	Unchangeable
L0189	0x90BD	Output phase loss	0: Invalid 1: Valid	0	/	Unchangeable
L0190	0x90BE	Motor locked-rotor fault	0: Invalid 1: Valid	0	/	Unchangeable
L0192	0x90C0	Motor disconnected	0: Invalid 1: Valid	0	/	Unchangeable
L0195	0x90C3	External fault 1	0: Invalid 1: Valid	0	/	Unchangeable
L0196	0x90C4	External fault 2	0: Invalid 1: Valid	0	/	Unchangeable
L0197	0x90C5	User-defined fault 1	0: Invalid 1: Valid	0	/	Unchangeable
L0198	0x90C6	User-defined fault 2	0: Invalid 1: Valid	0	/	Unchangeable

10.2.14.3 L02: Bit Connector 3 Parameters

Item	Address:	Name	Value Range	Default	Unit	Change:
L0200	0x90C8	STO output	0: Invalid 1: Valid	0	/	Unchangeable
L0244	0x90F4	Power-on time reached	0: Not reached 1: Reached	0	/	Unchangeable
L0245	0x90F5	Running time reach	0: Not reached 1: Reached	0	/	Unchangeable
L0246	0x90F6	Timing duration reach	0: Not reached 1: Reached	0	/	Unchangeable
L0247	0x90F7	Current running duration reach	0: Not reached 1: Reached	0	/	Unchangeable
L0250	0x90FA	Hibernation enable flag	0: Inactive 1: Active	0	/	Unchangeable
L0251	0x90FB	Individual stop of simple PLC	0: Inactive 1: Active	0	/	Unchangeable
L0252	0x90FC	Simple PLC module operation for one cycle	0: Not completed 1: Completed	0	/	Unchangeable
L0253	0x90FD	Cycle operation of simple PLC module	0: Not completed 1: Completed	0	/	Unchangeable
L0258	0x9102	Current 1 reached	0: Not reached 1: Reached	0	/	Unchangeable
L0259	0x9103	Current 2 reach	0: Not reached 1: Reached	0	/	Unchangeable
L0260	0x9104	Zero current state	0: Invalid 1: Valid	0	/	Unchangeable
L0261	0x9105	Output current overlimit	0: Invalid 1: Valid	0	/	Unchangeable
L0262	0x9106	Frequency level detection 1	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0263	0x9107	Frequency level detection 2	0: Invalid 1: Valid	0	/	Unchangeable
L0264	0x9108	Frequency reached	0: Not reached 1: Reached	0	/	Unchangeable
L0265	0x9109	Detection frequency 1 reach	0: Not reached 1: Reached	0	/	Unchangeable
L0266	0x910A	Detection frequency 2 reach	0: Not reached 1: Reached	0	/	Unchangeable
L0267	0x910B	Frequency upper limit reach	0: Not reached 1: Reached	0	/	Unchangeable
L0268	0x910C	Frequency lower limit reached (no output at stop)	0: Not reached 1: Reached	0	/	Unchangeable
L0269	0x910D	Frequency lower limit reached (output available at stop)	0: Not reached 1: Reached	0	/	Unchangeable
L0270	0x910E	Speed comparison reached 1	0: Not reached 1: Reached	0	/	Unchangeable
L0271	0x910F	Speed comparison reach 2	0: Not reached 1: Reached	0	/	Unchangeable
L0279	0x9117	IGBT temperature reach	0: Not reached 1: Reached	0	/	Unchangeable
L0280	0x9118	Lifetime alarm	0: No alarm outputted 1: Component alarm outputted	0	/	Unchangeable
L0281	0x9119	Main circuit capacitor lifetime alarm output	0: No output 1: Alarm outputted	0	/	Unchangeable
L0283	0x911B	IGBT lifetime alarm output	0: No output 1: Alarm outputted	0	/	Unchangeable
L0284	0x911C	Cooling fan lifetime alarm output	0: No output 1: Alarm outputted	0	/	Unchangeable

10.2.14.4 L03: Bit Connector 4 Parameters

Item	Address:	Name	Value Range	Default	Unit	Change:
L0304	0x9130	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0305	0x9131	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0306	0x9132	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0307	0x9133	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0308	0x9134	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0309	0x9135	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0310	0x9136	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0311	0x9137	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0312	0x9138	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0313	0x9139	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0314	0x913A	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0315	0x913B	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0316	0x913C	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0317	0x913D	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0318	0x913E	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0319	0x913F	Output bit00 of W2B module A	0: Invalid 1: Valid	0	/	Unchangeable
L0320	0x9140	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0321	0x9141	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0322	0x9142	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0323	0x9143	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0324	0x9144	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0325	0x9145	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0326	0x9146	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0327	0x9147	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0328	0x9148	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0329	0x9149	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0330	0x914A	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0331	0x914B	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0332	0x914C	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0333	0x914D	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0334	0x914E	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0335	0x914F	Output bit00 of W2B module B	0: Invalid 1: Valid	0	/	Unchangeable
L0336	0x9150	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0337	0x9151	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0338	0x9152	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0339	0x9153	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0340	0x9154	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0341	0x9155	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0342	0x9156	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0343	0x9157	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0344	0x9158	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0345	0x9159	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0346	0x915A	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0347	0x915B	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0348	0x915C	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0349	0x915D	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0350	0x915E	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0351	0x915F	Output bit00 of W2B module C	0: Invalid 1: Valid	0	/	Unchangeable
L0352	0x9160	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0353	0x9161	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0354	0x9162	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0355	0x9163	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0356	0x9164	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0357	0x9165	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0358	0x9166	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0359	0x9167	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0360	0x9168	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0361	0x9169	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0362	0x916A	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0363	0x916B	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0364	0x916C	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0365	0x916D	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0366	0x916E	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0367	0x916F	Output bit00 of W2B module D	0: Invalid 1: Valid	0	/	Unchangeable
L0368	0x9170	Output of binary selector module A	0: Invalid 1: Valid	0	/	Unchangeable
L0369	0x9171	Output of binary selector module B	0: Invalid 1: Valid	0	/	Unchangeable
L0370	0x9172	Output of binary selector module C	0: Invalid 1: Valid	0	/	Unchangeable
L0371	0x9173	Output of binary selector module D	0: Invalid 1: Valid	0	/	Unchangeable
L0372	0x9174	Output of binary selector module E	0: Invalid 1: Valid	0	/	Unchangeable
L0373	0x9175	Output of binary selector module F	0: Invalid 1: Valid	0	/	Unchangeable
L0374	0x9176	Output of binary selector module G	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0375	0x9177	Output of binary selector module H	0: Invalid 1: Valid	0	/	Unchangeable
L0376	0x9178	Output of logic AND/OR module A	0: Invalid 1: Valid	0	/	Unchangeable
L0377	0x9179	Output of logic AND/OR module B	0: Invalid 1: Valid	0	/	Unchangeable
L0378	0x917A	Output of logic AND-OR module C	0: Invalid 1: Valid	0	/	Unchangeable
L0379	0x917B	Output of logic AND-OR module D	0: Invalid 1: Valid	0	/	Unchangeable
L0380	0x917C	Output of logic AND-OR module E	0: Invalid 1: Valid	0	/	Unchangeable
L0381	0x917D	Output of logic AND-OR module F	0: Invalid 1: Valid	0	/	Unchangeable
L0382	0x917E	Output of logic AND-OR module G	0: Invalid 1: Valid	0	/	Unchangeable
L0383	0x917F	Output of logic AND-OR module H	0: Invalid 1: Valid	0	/	Unchangeable
L0384	0x9180	Output of logic NOT module A	0: Invalid 1: Valid	0	/	Unchangeable
L0385	0x9181	Output of logic NOT module B	0: Invalid 1: Valid	0	/	Unchangeable
L0386	0x9182	Output of logic NOT module C	0: Invalid 1: Valid	0	/	Unchangeable
L0387	0x9183	Output of logic NOT module D	0: Invalid 1: Valid	0	/	Unchangeable
L0388	0x9184	Output of logic NOT module E	0: Invalid 1: Valid	0	/	Unchangeable
L0389	0x9185	Output of logic NOT module F	0: Invalid 1: Valid	0	/	Unchangeable
L0390	0x9186	Output of logic NOT module G	0: Invalid 1: Valid	0	/	Unchangeable
L0391	0x9187	Output of logic NOT module H	0: Invalid 1: Valid	0	/	Unchangeable
L0392	0x9188	Output of logic XOR/ XNOR module A	0: Invalid 1: Valid	0	/	Unchangeable
L0393	0x9189	Output of logic XOR/ XNOR module B	0: Invalid 1: Valid	0	/	Unchangeable
L0394	0x918A	Output of logic XOR/ XNOR module C	0: Invalid 1: Valid	0	/	Unchangeable
L0395	0x918B	Output of logic XOR/ XNOR module D	0: Invalid 1: Valid	0	/	Unchangeable
L0396	0x918C	Output of logic XOR\ XNOR module E	0: Invalid 1: Valid	0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L0397	0x918D	Output of logic XOR\ XNOR module F	0: Invalid 1: Valid	0	/	Unchangeable
L0398	0x918E	Output of logic XOR\ XNOR module G	0: Invalid 1: Valid	0	/	Unchangeable
L0399	0x918F	Output of logic XOR/ XNOR module H	0: Invalid 1: Valid	0	/	Unchangeable

10.2.14.5 L04: Bit Connector 5 Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0400	0x9190	Output of numeric comparator block A	0: Inactive 1: Active	0	-	Unchangeable
L0401	0x9191	Output of numeric comparator block B	0: Inactive 1: Active	0	-	Unchangeable
L0402	0x9192	Output of numeric comparator block C	0: Inactive 1: Active	0	-	Unchangeable
L0403	0x9193	Output of numeric comparator block D	0: Inactive 1: Active	0	-	Unchangeable
L0404	0x9194	Output of numeric comparator block E	0: Inactive 1: Active	0	-	Unchangeable
L0405	0x9195	Output of numeric comparator block F	0: Inactive 1: Active	0	-	Unchangeable
L0406	0x9196	Output of numeric comparator block G	0: Inactive 1: Active	0	-	Unchangeable
L0407	0x9197	Output of numeric comparator block H	0: Inactive 1: Active	0	-	Unchangeable
L0408	0x9198	Output of level-pulse conversion module A	0: Inactive 1: Active	0	-	Unchangeable
L0409	0x9199	Output of level-pulse conversion module B	0: Inactive 1: Active	0	-	Unchangeable
L0410	0x919A	Output of level-pulse conversion module C	0: Inactive 1: Active	0	-	Unchangeable
L0411	0x919B	Output of level-pulse conversion module D	0: Inactive 1: Active	0	-	Unchangeable
L0412	0x919C	Divisor being 0 flag of multiplier and divider block A	0: Not 0 1: 0	0	-	Unchangeable
L0413	0x919D	Divisor being 0 flag of multiplier and divider block B	0: Not 0 1: 0	0	-	Unchangeable
L0414	0x919E	Divisor being 0 flag of multiplier and divider block C	0: Not 0 1: 0	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0415	0x919F	Divisor being 0 flag of multiplier and divider block D	0: Not 0 1: 0	0	-	Unchangeable
L0416	0x91A0	Divisor being 0 flag of multiplier and divider block E	0: Not 0 1: 0	0	-	Unchangeable
L0417	0x91A1	Divisor being 0 flag of multiplier and divider block F	0: Not 0 1: 0	0	-	Unchangeable
L0418	0x91A2	Divisor being 0 flag of multiplier and divider block G	0: Not 0 1: 0	0	-	Unchangeable
L0419	0x91A3	Divisor being 0 flag of multiplier and divider block H	0: Not 0 1: 0	0	-	Unchangeable
L0420	0x91A4	Flag indicating whether input of absolute value module A is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0421	0x91A5	Flag indicating whether input of absolute value module B is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0422	0x91A6	Flag indicating whether input of absolute value module C is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0423	0x91A7	Flag indicating whether input of absolute value module D is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0424	0x91A8	Flag indicating whether input of absolute value module E is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0425	0x91A9	Flag indicating whether input of absolute value module F is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0426	0x91AA	Flag indicating whether input of absolute value module G is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0427	0x91AB	Flag indicating whether input of absolute value module H is negative	0: Not negative 1: Negative	0	-	Unchangeable
L0428	0x91AC	Lower limit flag of limiting module A	0: Inactive 1: Active	0	-	Unchangeable
L0429	0x91AD	Upper limit flag of limiting module A	0: Inactive 1: Active	0	-	Unchangeable
L0430	0x91AE	Lower limit flag of limiting module B	0: Inactive 1: Active	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0431	0x91AF	Upper limit flag of limiting module B	0: Inactive 1: Active	0	-	Unchangeable
L0432	0x91B0	Lower limit flag of limiting module C	0: Inactive 1: Active	0	-	Unchangeable
L0433	0x91B1	Upper limit flag of limiting module C	0: Inactive 1: Active	0	-	Unchangeable
L0434	0x91B2	Lower limit flag of limiting module D	0: Inactive 1: Active	0	-	Unchangeable
L0435	0x91B3	Upper limit flag of limiting module D	0: Inactive 1: Active	0	-	Unchangeable
L0456	0x91C8	Output of logic delay module A	0: Inactive 1: Active	0	-	Unchangeable
L0457	0x91C9	Output of logic delay module B	0: Inactive 1: Active	0	-	Unchangeable
L0458	0x91CA	Output of logic delay module C	0: Inactive 1: Active	0	-	Unchangeable
L0459	0x91CB	Output of logic delay module D	0: Inactive 1: Active	0	-	Unchangeable
L0460	0x91CC	Output of logic delay module E	0: Inactive 1: Active	0	-	Unchangeable
L0461	0x91CD	Output of logic delay module F	0: Inactive 1: Active	0	-	Unchangeable
L0462	0x91CE	Output of logic delay module G	0: Inactive 1: Active	0	-	Unchangeable
L0463	0x91CF	Output of logic delay module H	0: Inactive 1: Active	0	-	Unchangeable
L0484	0x91E4	DI1 (forcibly modified by E0-00)	0 to 1	0	-	Unchangeable
L0485	0x91E5	DI2 (forcibly modified by E0-01)	0 to 1	0	-	Unchangeable
L0486	0x91E6	DI3 (modified by E0-02 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0487	0x91E7	DI4 (modified by E0-03 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0488	0x91E8	DI5 (modified by E0-04 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0489	0x91E9	DI6 (modified by E0-05 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0490	0x91EA	DI7 (modified by E0-06 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0494	0x91EE	VDI1 (forcibly modified by E0-10)	0 to 1	0	-	Unchangeable
L0495	0x91EF	VDI2 (forcibly modified by E0-11)	0 to 1	0	-	Unchangeable
L0496	0x91F0	VDI3 (forcibly modified by E0-12)	0 to 1	0	-	Unchangeable
L0497	0x91F1	VDI4 (forcibly modified by E0-13)	0 to 1	0	-	Unchangeable
L0498	0x91F2	VDI5 (forcibly modified by E0-14)	0 to 1	0	-	Unchangeable
L0499	0x91F3	VDI6 (forcibly modified by E0-15)	0 to 1	0	-	Unchangeable

10.2.14.6 L06: Bit Connector 7 Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0600	0x9258	I/O expansion card 1-DI1	0 to 1	0	-	Unchangeable
L0601	0x9259	I/O expansion card 1-DI2	0 to 1	0	-	Unchangeable
L0603	0x925B	I/O expansion card 1-DI1 inverted	0 to 1	0	-	Unchangeable
L0604	0x925C	I/O expansion card 1-DI2 inverted	0 to 1	0	-	Unchangeable
L0606	0x925E	I/O expansion card 1-DO	0 to 1	0	-	Unchangeable
L0607	0x925F	I/O expansion card 1-RO	0 to 1	0	-	Unchangeable
L0608	0x9260	I/O expansion card 1-Motor temperature reached	0: Temperature not reached 1: Temperature reached	0	-	Unchangeable
L0609	0x9261	I/O expansion card 1-Motor overtemperature	0: Overtemperature not occur 1: Overtemperature occur	0	-	Unchangeable
L0610	0x9262	I/O expansion card 1-Motor overtemperature alarm	0: Overtemperature alarm not reported 1: Overtemperature alarm reported	0	-	Unchangeable
L0611	0x9263	I/O expansion card 1-AI1 input limit violated	0: Not exceeded 1: Exceeded	0	-	Unchangeable
L0612	0x9264	I/O expansion card 1-AI1 used as the DI level	0: Low level 1: High level	0	-	Unchangeable
L0616	0x9268	I/O expansion card 2-DI1	0 to 1	0	-	Unchangeable
L0617	0x9269	I/O expansion card 2-DI2	0 to 1	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0619	0x926B	I/O expansion card 2-DI1 inverted	0 to 1	0	-	Unchangeable
L0620	0x926C	I/O expansion card 2-DI2 inverted	0 to 1	0	-	Unchangeable
L0622	0x926E	I/O expansion card 2-DO	0 to 1	0	-	Unchangeable
L0623	0x926F	I/O expansion card 2-RO	0 to 1	0	-	Unchangeable
L0624	0x9270	I/O expansion card 2-Motor temperature reached	0: Temperature not reached 1: Temperature reached	0	-	Unchangeable
L0625	0x9271	I/O expansion card 2-Motor overtemperature	0: Overtemperature not occur 1: Overtemperature occur	0	-	Unchangeable
L0626	0x9272	I/O expansion card 2 -Motor overtemperature alarm	0: Overtemperature alarm not reported 1: Overtemperature alarm reported	0	-	Unchangeable
L0627	0x9273	I/O expansion card 2-AI1 input limit violated	0: Not exceeded 1: Exceeded	0	-	Unchangeable
L0628	0x9274	I/O expansion card 2-AI1 used as the DI level	0: Low level 1: High level	0	-	Unchangeable

10.2.14.7 L07: Bit Connector 8 Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0700	0x92BC	Brake command output	0: Close 1: Release	0	-	Unchangeable
L0701	0x92BD	Brake released	0 to 1	0	-	Unchangeable
L0702	0x92BE	Brake closed	0 to 1	0	-	Unchangeable

10.2.14.8 L10 Word Connector 1

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1000	0x93E8	Current state of system state machine	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
L1001	0x93E9	Switchover command of system status machine	Bit 0: Start active Bit 1: Stop active Bit 2: OFF2 stop (coast to stop) active Bit 3: OFF3 stop (quick stop) active Bit 4: Operation permission active (non-hibernation state) Bit 5: Operation inhibition active Bit 6: Stop fault active Bit 7 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1002	0x93EA	System status word 1	Bit 0: Ready to start 0: Invalid 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 stop (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 stop (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (pulsing) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1003	0x93EB	System status word 2	Bit 0: Self-test Bit 1: Parameter auto-tuning Bit 2: Minor fault status Bit 3: Warning status Bit 4: Speed mode Bit 5: Torque mode Bit 6: Position mode (reserved) Bit 7: RFG enabled Bit 8: RFG running Bit 9: Fault stop Bit 10: Normal operation Bit 11: Jog operation Bit 12: Decelerate to stop Bit 13: Brake (reserved) Bit 14: Terminal control Bit 15: User-defined status 1 Bit value: 1: Invalid 0: Invalid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1004	0x93EC	System status word 3	Bit 0: Control channel selection 0: Control channel 1 1: Control channel 2 Bit 1: Set channel selection 0: Set channel 1 1: Set channel 2 Bit 2: Motor selection 0 0: Logic 0 1: Logic 1 Bit 3: Motor selection 1 0: Logic 0 1: Logic 1 Bit 4: Abnormality (fault/warning) 0: No abnormality 1: Abnormality (fault) Bit 5: EEPROM idle 0: EEPROM idle 1: EEPROM in use Bit 6: Communication control 0: Invalid 1: Valid Bit 7: Relay action upon automatic fault reset 0: Relay invalid 1: Relay valid Bit 8: IGBT pulsing status 0: Stop 1: Run Bit 9: System command direction 0: Forward 1: Reverse Bit 10: IGBT pulsing status with delay 0: Stop 1: Run Bit 11: Internal parameter process flag 0: Not operated 1: Processing Bit 12: Internal voltage normal 0: Undervoltage or uninitialized 1: Normal Bit 13: Reserved 0: Invalid 1: Valid Bit 14 to bit 15: Power board initialization state 0: Uninitialized 1: Initialization in progress 2: Initialization completed 3: Reserved	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1005	0x93ED	System status word 4	Bit 0: Zero-speed running (inactive at stop) 0: Invalid 1: Valid Bit 1: Zero speed (valid at stop) 0: Invalid 1: Valid Bit 2: Frequency level detection 1 0: Invalid 1: Valid Bit 3: Frequency level detection 2 0: Invalid 1: Valid Bit 4: AI1 > AI2 0: Invalid 1: Valid Bit 5: Simple PLC cycle completed 0: Uncompleted 1: Completed Bit 6: Communication setpoint 0: Invalid 1: Valid Bit 7: Reserved Bit 8: Current 1 reached 0: Invalid 1: Valid Bit 9: Current 2 reached 0: Invalid 1: Valid Bit 10: Zero current state 0: Invalid 1: Valid Bit 11: Output current overlimit 0: Invalid 1: Valid Bit 12: Motor overload warning 0: Invalid 1: Valid Bit 13: AC drive overload warning 0: Invalid 1: Valid Bit 14: Undervoltage 0: Invalid 1: Valid Bit 15: Three-phase loss 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1006	0x93EE	Drive main status word	Bit 0 to bit 1: Running state 0: Initialization 1: Sampling preparation 2: Undervoltage 3: Preparation completed Bit 2: Hardware status 0: Not ready 1: Ready Bit 3: Running/stop status 0: Stop 1: Running Bit 4: Forced output blockage upon fault 0: Invalid 1: Valid Bit 5: Bus undervoltage status 0: Invalid 1: Valid Bit 6 to bit 15: Reserved	0x0	/	Unchangeable
L1012	0x93F4	Inverter protection status word	Bit 0: Pulse-by-pulse current limit protection Bit 1: Pulse-by-pulse current limit inhibition Bit 2: Input phase loss Bit 3: Output phase loss Bit 4: Pre-charge resistor exception Bit 5: Drive overload Bit 6: Drive pre-overload Bit 7: Bus overvoltage Bit 8: Bus undervoltage Bit 9: Output overcurrent Bit 10: Drive overtemperature Bit 11: Drive pre-overtemperature Bit 12: Leakage current protection Bit 13: Current control exception Bit 14: Software overcurrent Bit 15: Short circuit to ground (reserved) Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1015	0x93F7	Motor protection status word	Bit 0: Motor overload Bit 1: Motor pre-overload Bit 2: Three-phase loss (reserved) Bit 3: Motor overheat (reserved) Bit 4: PG detection fault (reserved) Bit 5: Current control error Bit 6: Motor stall Bit 7: Motor disconnection, two-phase or three-phase loss Bit 8: Motor constant-current load too large (reserved) Bit 9: VC operation step loss due to motor flux error Bit 10: Speed measurement fluctuation error (reserved) Bit 11: Motor parameter setting error (reserved) Bit 12: HSVM sampling card disconnection, phase error (reserved) Bit 13: Synchronous motor overcurrent (reserved) Bit 14: Synchronous motor output voltage error (reserved) Bit 15: Encoder disconnection (reserved) Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable
L1017	0x93F9	Vector Vdc status word	Bit 0: Undervoltage suppression activation Bit 1: Overvoltage suppression activation Bit 2: Undervoltage suppression enters the lower limit of low frequency Bit 3 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1022	0x93FE	Motor torque limit status word	Bit 0 to bit 2: Upper limit selection 0: Unlimited 1: Torque limit 1 2: Current limit 1 3: External torque limit 4: Power limit 5: Current limit 2 or torque limit 2 Bit 3 to bit 5: Lower limit selection 0: Unlimited 1: Torque limit 1 2: Current limit 1 3: External torque limit 4: Power limit 5: Current limit 2 or torque limit 2 Bit 6: Speed forward limit 0: Invalid 1: Valid Bit 7: Speed reverse limit 0: Invalid 1: Valid Bit 8: External forced torque limit 0: Invalid 1: Valid Bit 9: Torque withdrawal activation 0: Invalid 1: Valid Bit 10 to bit 15: Reserved	0x0	/	Unchangeable
L1024	0x9400	Encoder output status word	0x0 to 0xFFFF	0x0	/	Unchangeable
L1025	0x9401	Maximum permissible speed measurement of the encoder	0 to 65535	0	-	Unchangeable
L1030	0x9406	Active control mode	0: Speed control 1: Torque control 2: Position control (reserved)	0	-	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1044	0x9414	Custom command word of control channel 1	Bit 0: ON_OFF1 stop (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 0: Stop 1: Running Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: Reset command 0: Disable 1: Enable Bit 5: JOG1 0: Disable 1: Enable Bit 6: JOG2 0: Disable 1: Enable Bit 7: Opposite to the speed 0: Not reversed 1: Reversed Bit 8 to Bit 15: Reserved	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1045	0x9415	Control channel 2 custom command word	Bit 0: ON_OFF1 stop (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 0: Stop 1: Running Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: Reset command 0: Disable 1: Enable Bit 5: JOG1 0: Disable 1: Enable Bit 6: JOG2 0: Disable 1: Enable Bit 7: Opposite to the speed 0: Not reversed 1: Reversed Bit 8 to Bit 15: Reserved	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1046	0x9416	Auxiliary command word of control channel 1	Bit 0: OFF2 stop (coast to stop) 2 0: Stop 1: Running Bit 1: OFF 2 stop (coast to stop) 3 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 2 0: Stop 1: Running Bit 3: OFF3 stop (quick stop) 3 0: Disable 1: Enable Bit 4: Reset command 2 0: Disable 1: Enable Bit 5: Reset command 3 0: Disable 1: Enable Bit 6: RFG inhibition 0: Activated 1: Invalid Bit 7: RFG pause 0: Activated 1: Invalid Bit 8: RFG force 0: Activated 1: Invalid Bit 9 to bit 15: Reserved	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1047	0x9417	Auxiliary command word of control channel 2	Bit 0: OFF2 stop (coast to stop) 2 0: Stop 1: Running Bit 1: OFF 2 stop (coast to stop) 3 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 2 0: Stop 1: Running Bit 3: OFF3 stop (quick stop) 3 0: Disable 1: Enable Bit 4: Reset command 2 0: Disable 1: Enable Bit 5: Reset command 3 0: Disable 1: Enable Bit 6: RFG inhibition 0: Activated 1: Invalid Bit 7: RFG pause 0: Activated 1: Invalid Bit 8: RFG force 0: Activated 1: Invalid Bit 9 to bit 15: Reserved	0x0	/	Unchangeable
L1050	0x941A	STO output status word	0x0 to 0xFFFF	0x0	/	Unchangeable
L1051	0x941B	LED control word	Bit 0: Start Bit 1: Stop Bit 2: Jog 1 Bit 3: Local control Bit 4: Reset Bit 5: Jog 2 Bit 6: Direction switch Bit 7 to bit 15: Reserved Bit value :0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1052	0x941C	IDS control word	Bit 0: Start Bit 1: Stop Bit 2: Jog 1 Bit 3: Jog 2 bit 4: Reset Bit 5: Forward Bit 6: Reverse Bit 7: Auto-tuning Bit:8: Self-test Bit 9 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable
L1053	0x941D	SOP control word	Bit 0: Start Bit 1: Stop Bit 2: Jog 1 Bit 3: Jog 2 Bit 4: Reset Bit 5: Forward Bit 6: Reverse Bit 7: Auto-tuning Bit 8: Self-test Bit 9 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1054	0x941E	Command channel control word	Bit 0: ON_OFF1 stop (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 stop (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (1JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (2JOG2) 0: Disable 1: Enable Bit 10: Remote control (reserved) 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1055	0x941F	Communication setting control word	Bit 0: ON_OFF1 stop (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 0: Stop 1: Running Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: Reset command 0: Disable 1: Enable Bit 5: JOG1 0: Disable 1: Enable Bit 6: JOG2 0: Disable 1: Enable Bit 7: Opposite to the speed 0: Not reversed 1: Reversed Bit 8 to Bit 15: Reserved	0x0	/	Unchangeable
L1056	0x9420	Software tool control flag	0: Not controlled 1: Controlled	0	-	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1057	0x9421	Terminal module control word	Bit 0: ON_OFF1 stop (start/stop) 0: Stop 1: Running Bit 1: OFF2 stop (coast to stop) 0: Stop 1: Running Bit 2: OFF3 stop (quick stop) 0: Stop 1: Running Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: Reset command 0: Disable 1: Enable Bit 5: JOG1 0: Disable 1: Enable Bit 6: JOG2 0: Disable 1: Enable Bit 7: Opposite to the speed 0: Not reversed 1: Reversed Bit 8 to Bit 15: Reserved	0x0	/	Unchangeable
L1058	0x9422	Input state of terminal module A	Bit 0: ON_OFF1 stop (start/stop) Bit 1: Reverse running (Rev) Bit 2: Running allowed (Enable) Bit 3: Reset command (Reset) Bit 4: Jog 1 (JOG1) Bit 5: Jog 2(JOG2) Bit 6: Reserved (Rsvd1) Bit 7: Terminal input (In1) Bit 8: Terminal input (In2) Bit 9: Terminal input (In3) Bit 10 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1059	0x9423	Input state of terminal module B	Bit 0: ON_OFF1 stop (start/stop) Bit 1: Reverse running (Rev) Bit 2: Running allowed (Enable) Bit 3: Reset command (Reset) Bit 4: Jog 1 (JOG1) Bit 5: Jog 2(JOG2) Bit 6: Reserved (Rsvd1) Bit 7: Terminal input (In1) Bit 8: Terminal input (In2) Bit 9: Terminal input (In3) Bit 10 to bit 15: Reserved Bit value: 0: Invalid 1: Valid	0x0	/	Unchangeable
L1060	0x9424	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	Unchangeable
L1062	0x9426	RFG status word	Bit 0 and bit 1: Acceleration or deceleration status 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 and bit 3: Acceleration or deceleration arc status 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to Bit 9: Acceleration or deceleration state of the previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Arc status of the previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration segment 3: End segment Bit 12 to bit 15: Reserved	0x0	-	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1063	0x9427	RFG command word	Bit 0: Calculation enable 0: Disable 1: Enable Bit 1: Output forced enable 0: Disable 1: Enable Bit 2: Calculation pause 0: Disable 1: Enable Bit 3: Bypass enable 0: Disable 1: Bypass Bit 4: Reserved Bit 5: Arc type 0: Continuous arc 1: Non-continuous arcs Bit 6 to Bit 15: Reserved	0x0	-	Unchangeable
L1065	0x9429	DI state	Bit 0: DI1 state Bit 1: DI2 state Bit 2: DI3 state (reserved for MD630N) Bit 3: DI4 state (reserved for MD630N) Bit 4: DI5 state (reserved for MD630N) Bit 5: DI6 state (reserved for MD630N) Bit 6: DI7 state (reserved for MD630N) Bit 7 to bit 9: Reserved Bit 10: VDI1 state Bit 11: VDI2 state Bit 12: VDI3 state Bit 13: VDI4 status Bit 14: VDI5 status Bit 15: VDI6 status Bit value: 0: Low level 1: High level	0x0	/	Unchangeable
L1068	0x942C	DO state	Bit 0 RO state Bit 1 to bit 3: Reserved Bit 4: DO states Bit 5 to bit 7: Reserved Bit 8: FMR status (only valid for MD630S) Bit 9: Reserved Bit 10: VDO1 state Bit 11: VDO2 state Bit 12: VDO3 state Bit 13: VDO4 state Bit 14: VDO5 state Bit 15: VDO6 state Bit value: 0: Low level 1: High level	0x0	/	Unchangeable

10.2.14.9 L11: Word Connector 2 Parameters

Item	Address:	Name	Value Range	Default	Unit	Change:
L1100	0x944C	Base value of speed per-unit value	0 to 65535	0	RPM	Unchangeable
L1101	0x944D	Base value of frequency per-unit value	0.0 to 6553.5	0.0	Hz	Unchangeable
L1102	0x944E	Voltage per-unit value base value	0.0 to 6553.5	0.0	V	Unchangeable
L1103	0x944F	Base value of current per-unit value	0.0 to 6553.5	0.0	A	Unchangeable
L1104	0x9450	Base value of power per-unit value	0.0 to 655.35	0.00	kW	Unchangeable
L1105	0x9451	Base value of torque per-unit value	0.0 to 655.35	0.00	N·m	Unchangeable
L1106	0x9452	Base value of DC bus voltage per-unit value	0 to 65535	0	V	Unchangeable

10.2.14.10 L12 Word Connector 3

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1200	0x94B0	Constant setpoint 1 (word)	-32768 to 32767	0	-	Unchangeable
L1201	0x94B1	Constant setpoint 2 (word)	-32768 to 32767	0	-	Unchangeable
L1202	0x94B2	Constant setpoint 3 (word)	-32768 to 32767	0	-	Unchangeable
L1203	0x94B3	Constant setpoint 4 (word)	-32768 to 32767	0	-	Unchangeable
L1204	0x94B4	Constant setpoint 5 (word)	-32768 to 32767	0	-	Unchangeable
L1205	0x94B5	Constant setpoint 6 (word)	-32768 to 32767	0	-	Unchangeable
L1206	0x94B6	Constant setpoint 7 (word)	-32768 to 32767	0	-	Unchangeable
L1207	0x94B7	Constant setpoint 8 (word)	-32768 to 32767	0	-	Unchangeable
L1208	0x94B8	Output of bit-to-word module A	0x0 to 0xFFFF	0x0	/	Unchangeable
L1209	0x94B9	Output of bit-to-word module B	0x0 to 0xFFFF	0x0	/	Unchangeable
L1210	0x94BA	Output of bit-to-word module C	0x0 to 0xFFFF	0x0	/	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1211	0x94BB	Output of bit-to-word module D	0x0 to 0xFFFF	0x0	/	Unchangeable
L1212	0x94BC	HIWORD of double word-to-word module A output	0 to 65535	0	-	Unchangeable
L1213	0x94BD	LOWORD of double word-to-word module A output	0 to 65535	0	-	Unchangeable
L1214	0x94BE	HIWORD of double word-to-word module B output	0 to 65535	0	-	Unchangeable
L1215	0x94BF	LOWORD of double word-to-word module B output	0 to 65535	0	-	Unchangeable
L1216	0x94C0	HIWORD of double word-to-word module C output	0 to 65535	0	-	Unchangeable
L1217	0x94C1	LOWORD of double word-to-word module C output	0 to 65535	0	-	Unchangeable
L1218	0x94C2	HIWORD of double word-to-word module D output	0 to 65535	0	-	Unchangeable
L1219	0x94C3	LOWORD of double word-to-word module D output	0 to 65535	0	-	Unchangeable

Parameter code	Communication address	Parameter name	Range	Default value	Unit	Change mode
L1234	0x94D2	Input selection state of binary selector module	Bit 0: Module A Bit 1: Module B Bit 2: Module C Bit 3: Module D Bit 4: Module E Bit 5: Module F Bit 6: Module G Bit 7: Module H Bit 8 to bit 15: Reserved Bit value: 0: Input 1 1 : Input 2	0x0	/	Unchangeable
L1235	0x94D3	Input selection state for digital selector module	Bit 0: Module A Bit 1: Module B Bit 2: Module C Bit 3: Module D Bit 4: Module E Bit 5: Module F Bit 6: Module GBit 7: Module H Bit 8 to bit 15: Reserved Bit value: 0: Input 1 1 : Input 2	0x0	/	Unchangeable

10.2.14.11 L15: Word Connector 6 Parameters

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L1500	0x95DC	Tension process control mode	0 to 65535	0	/	Unchangeable
L1501	0x95DD	Tension process operation mode	0 to 65535	0	/	Unchangeable
L1502	0x95DE	Initial reel diameter	0.0 to 6553.5	0.0	mm	Unchangeable
L1503	0x95DF	Taper setting	0.0 to 6553.5	0.0	%	Unchangeable
L1504	0x95E0	Constant linear speed	0.0 to 6553.5	0.0	m/min	Unchangeable
L1505	0x95E1	Tension process mask	0 to 65535	0	/	Unchangeable

10.2.14.12 L20: Double-word connector 1

Item	Address:	Name	Value Range	Default	Unit	Change:
L2000	0x97D0	Output of W-DW conversion module A	0x0 to 0xFFFFFFFF	0x0	-	Unchangeable
L2002	0x97D2	Output of W-DW conversion module B	0x0 to 0xFFFFFFFF	0x0	-	Unchangeable
L2004	0x97D4	Output of W-DW conversion module C	0x0 to 0xFFFFFFFF	0x0	-	Unchangeable
L2006	0x97D6	Output of W-DW conversion module D	0x0 to 0xFFFFFFFF	0x0	-	Unchangeable

10.2.14.13 L22 Floating-point connector 1

Item	Address:	Name	Value Range	Default	Unit	Change:
L2200	0x9898	Output frequency	-8 to 8	0.0	/	Unchangeable
L2202	0x989A	Motor velocity	-8 to 8	0.0	/	Unchangeable
L2204	0x989C	Output current	-8 to 8	0.0	/	Unchangeable
L2206	0x989E	Output voltage	-8 to 8	0.0	/	Unchangeable
L2208	0x98A0	Output power	-8 to 8	0.0	/	Unchangeable
L2210	0x98A2	Output torque	-8 to 8	0.0	/	Unchangeable
L2244	0x98C4	AI1 input value	-8 to 8	0.0	/	Unchangeable
L2246	0x98C6	AI2 input value	-8 to 8	0.0	/	Unchangeable
L2250	0x98CA	HDI input value	-8 to 8	0.0	/	Unchangeable
L2252	0x98CC	AO value percentage written through communication	-8 to 8	0.0	%	Unchangeable
L2258	0x98D2	Per-unit current value based on the maximum 1000 A	-8 to 8	0.0	/	Unchangeable
L2260	0x98D4	Per-unit voltage value based on the maximum 1000 V	-8 to 8	0.0	/	Unchangeable
L2262	0x98D6	AO output torque absolute value output	-8 to 8	0.0	/	Unchangeable
L2264	0x98D8	AO output torque -200.0% to 200.0%	-8 to 8	0.0	/	Unchangeable
L2266	0x98DA	I/O standard card 1-AI1 input value	-8 to 8	0.0	/	Unchangeable
L2268	0x98DC	I/O standard card 2-AI1 input value	-8 to 8	0.0	/	Unchangeable
L2272	0x98E0	Estimated lifetime margin of the main circuit capacitor	0 to 100	0.00	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L2276	0x98E4	Predicted lifetime margin of IGBT	0 to 100	0.00	/	Unchangeable
L2278	0x98E6	The estimated lifetime margin of the cooling fan	0 to 100	0.00	/	Unchangeable

10.2.14.14 L23 Floating-point connector 2

Item	Address:	Name	Value Range	Default	Unit	Change:
L2300	0x98FC	Fixed value 0%	-8 to 8	0.0	/	Unchangeable
L2302	0x98FE	Fixed value 100%	-8 to 8	0.0	/	Unchangeable
L2304	0x9900	Fixed value 200%	-8 to 8	0.0	/	Unchangeable
L2306	0x9902	Fixed value 400%	-8 to 8	0.0	/	Unchangeable
L2308	0x9904	Fixed value 600%	-8 to 8	0.0	/	Unchangeable
L2310	0x9906	Fixed value -100%	-8 to 8	0.0	/	Unchangeable
L2312	0x9908	Fixed value -200%	-8 to 8	0.0	/	Unchangeable
L2314	0x990A	Fixed value -400%	-8 to 8	0.0	/	Unchangeable
L2316	0x990C	Fixed value -600%	-8 to 8	0.0	/	Unchangeable
L2318	0x990E	Multi-reference selection output	-8 to 8	0.0	/	Unchangeable
L2320	0x9910	Output corresponding to multi-reference 0	-8 to 8	0.0	/	Unchangeable
L2322	0x9912	Multi-reference 1 output	-8 to 8	0.0	/	Unchangeable
L2324	0x9914	Multi-reference 2 output	-8 to 8	0.0	/	Unchangeable
L2326	0x9916	Multi-reference 3 output	-8 to 8	0.0	/	Unchangeable
L2328	0x9918	Multi-reference 4 output	-8 to 8	0.0	/	Unchangeable
L2330	0x991A	Multi-reference 5 output	-8 to 8	0.0	/	Unchangeable
L2332	0x991C	Multi-reference 6 output	-8 to 8	0.0	/	Unchangeable
L2334	0x991E	Multi-reference 7 output	-8 to 8	0.0	/	Unchangeable
L2336	0x9920	Multi-reference 8 output	-8 to 8	0.0	/	Unchangeable
L2338	0x9922	Multi-reference 9 output	-8 to 8	0.0	/	Unchangeable
L2340	0x9924	Multi-reference 10 output	-8 to 8	0.0	/	Unchangeable
L2342	0x9926	Multi-reference 11 output	-8 to 8	0.0	/	Unchangeable
L2344	0x9928	Multi-reference 12 output	-8 to 8	0.0	/	Unchangeable
L2346	0x992A	Multi-reference 13 output	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L2348	0x992C	Multi-reference 14 output	-8 to 8	0.0	/	Unchangeable
L2350	0x992E	Multi-reference 15 output	-8 to 8	0.0	/	Unchangeable
L2352	0x9930	Constant setpoint 1 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2354	0x9932	Constant setpoint 2 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2356	0x9934	Constant setpoint 3 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2358	0x9936	Constant setpoint 4 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2360	0x9938	Constant setpoint 5 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2362	0x993A	Constant setpoint 6 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2364	0x993C	Constant setpoint 7 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2366	0x993E	Constant setpoint 8 (per-unit value)	-8 to 8	0.0	/	Unchangeable
L2368	0x9940	Output of addition and subtraction module A	-8 to 8	0.0	/	Unchangeable
L2370	0x9942	Output of adder and subtractor block B	-8 to 8	0.0	/	Unchangeable
L2372	0x9944	Output of adder and subtractor block C	-8 to 8	0.0	/	Unchangeable
L2374	0x9946	Output of adder and subtractor block D	-8 to 8	0.0	/	Unchangeable
L2376	0x9948	Output of addition and subtraction module E	-8 to 8	0.0	/	Unchangeable
L2378	0x994A	Output of addition and subtraction module F	-8 to 8	0.0	/	Unchangeable
L2380	0x994C	Output of addition and subtraction module G	-8 to 8	0.0	/	Unchangeable
L2382	0x994E	Output of addition and subtraction module H	-8 to 8	0.0	/	Unchangeable
L2384	0x9950	Output of multiplication and division module A	-8 to 8	0.0	/	Unchangeable
L2386	0x9952	Output of multiplier and divider block B	-8 to 8	0.0	/	Unchangeable
L2388	0x9954	Output of multiplier and divider block C	-8 to 8	0.0	/	Unchangeable
L2390	0x9956	Output of multiplier and divider block D	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L2392	0x9958	Output of multiplication and division module E	-8 to 8	0.0	/	Unchangeable
L2394	0x995A	Output of multiplication and division module F	-8 to 8	0.0	/	Unchangeable
L2396	0x995C	Output of multiplication and division module G	-8 to 8	0.0	/	Unchangeable
L2398	0x995E	Output of multiplication and division module H	-8 to 8	0.0	/	Unchangeable

10.2.14.15 L24 Floating-point connector 3

Item	Address:	Name	Value Range	Default	Unit	Change:
L2400	0x9960	Output of absolute value module A	-8 to 8	0.0	/	Unchangeable
L2402	0x9962	Output of absolute value module B	-8 to 8	0.0	/	Unchangeable
L2404	0x9964	Output of absolute value module C	-8 to 8	0.0	/	Unchangeable
L2406	0x9966	Output of absolute value module D	-8 to 8	0.0	/	Unchangeable
L2408	0x9968	Output of absolute value module E	-8 to 8	0.0	/	Unchangeable
L2410	0x996A	Output of absolute value module F	-8 to 8	0.0	/	Unchangeable
L2412	0x996C	Output of absolute value module G	-8 to 8	0.0	/	Unchangeable
L2414	0x996E	Output of absolute value module H	-8 to 8	0.0	/	Unchangeable
L2416	0x9970	Output of digital selector A	-8 to 8	0.0	/	Unchangeable
L2418	0x9972	Output of digital selector B	-8 to 8	0.0	/	Unchangeable
L2420	0x9974	Output of digital selector C	-8 to 8	0.0	/	Unchangeable
L2422	0x9976	Output of digital selector D	-8 to 8	0.0	/	Unchangeable
L2424	0x9978	Output of digital selector E	-8 to 8	0.0	/	Unchangeable
L2426	0x997A	Output of digital selector F	-8 to 8	0.0	/	Unchangeable
L2428	0x997C	Output of digital selector G	-8 to 8	0.0	/	Unchangeable
L2430	0x997E	Output of digital selector H	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L2432	0x9980	Output of limiting module A	-8 to 8	0.0	/	Unchangeable
L2434	0x9982	Output of limiting module B	-8 to 8	0.0	/	Unchangeable
L2436	0x9984	Output of limiting module C	-8 to 8	0.0	/	Unchangeable
L2438	0x9986	Output of limiting module D	-8 to 8	0.0	/	Unchangeable
L2440	0x9988	Output of filter module A	-8 to 8	0.0	/	Unchangeable
L2442	0x998A	Output of filter module B	-8 to 8	0.0	/	Unchangeable
L2444	0x998C	Output of filter module C	-8 to 8	0.0	/	Unchangeable
L2446	0x998E	Output of filter module D	-8 to 8	0.0	/	Unchangeable
L2448	0x9990	Output of multi-point curve A	-8 to 8	0.0	/	Unchangeable
L2450	0x9992	Output of multi-point curve B	-8 to 8	0.0	/	Unchangeable
L2452	0x9994	Force value of motor-driven potentiometer	-8 to 8	0.0	/	Unchangeable
L2454	0x9996	Reset value of motorized potentiometer	-8 to 8	0.0	/	Unchangeable
L2456	0x9998	Maximum value of motorized potentiometer	-8 to 8	0.0	/	Unchangeable
L2458	0x999A	Minimum value of motorized potentiometer	-8 to 8	0.0	/	Unchangeable
L2460	0x999C	Initial value of motor-driven potentiometer	-8 to 8	0.0	/	Unchangeable
L2462	0x999E	Process operation value of motorized potentiometer	-8 to 8	0.0	/	Unchangeable
L2464	0x99A0	Final output value of motorized potentiometer	-8 to 8	0.0	/	Unchangeable
L2466	0x99A2	General PID output	-8 to 8	0.0	/	Unchangeable
L2468	0x99A4	General PID error	-8 to 8	0.0	/	Unchangeable
L2470	0x99A6	General PID reference	-8 to 8	0.0	/	Unchangeable
L2472	0x99A8	General PID feedback	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L2474	0x99AA	General PID proportional output	-8 to 8	0.0	/	Unchangeable
L2476	0x99AC	General PID integral output	-8 to 8	0.0	/	Unchangeable
L2478	0x99AE	General PID derivative output	-8 to 8	0.0	/	Unchangeable
L2480	0x99B0	General PID reversal cut-off output	-8 to 8	0.0	/	Unchangeable
L2482	0x99B2	Per-unitized value of simple PLC step	-8 to 8	0.0	/	Unchangeable

10.2.14.16 L25 Floating-point connector 4

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L2500	0x99C4	Float point output of word-to-double word module A	-8 to 8	0.00	/	Unchangeable
L2502	0x99C6	Float point output of word-to-double word module B	-8 to 8	0.00	/	Unchangeable
L2504	0x99C8	Float point output of word-to-double word module C	-8 to 8	0.00	/	Unchangeable
L2506	0x99CA	Float point output of word-to-double word module D	-8 to 8	0.00	/	Unchangeable
L2508	0x99CC	Float point output of double word-to-single word module A	-8 to 8	0.00	/	Unchangeable
L2510	0x99CE	Float point output of double word-to-single word module B	-8 to 8	0.00	/	Unchangeable
L2512	0x99D0	Float point output of double word-to-single word module C	-8 to 8	0.00	/	Unchangeable
L2514	0x99D2	Float point output of double word-to-single word module D	-8 to 8	0.00	/	Unchangeable

10.2.14.17 L30 Floating-point connector 9

Item	Address:	Name	Value Range	Default	Unit	Change:
L3000	0x9BB8	Actual motor speed	-8 to 8	0.0	/	Unchangeable
L3002	0x9BBA	Final motor speed setpoint	-8 to 8	0.0	/	Unchangeable
L3004	0x9BBC	Encoder feedback speed	-8 to 8	0.0	/	Unchangeable
L3006	0x9BBE	Target frequency	-8 to 8	0.0	/	Unchangeable
L3008	0x9BC0	Operating frequency	-8 to 8	0.0	/	Unchangeable
L3010	0x9BC2	Target frequency of the channel	-8 to 8	0.0	/	Unchangeable
L3012	0x9BC4	Additional frequency of the channel	-8 to 8	0.0	/	Unchangeable
L3014	0x9BC6	Digital setting of additional frequency	-8 to 8	0.0	/	Unchangeable
L3016	0x9BC8	Jog 1 frequency	-8 to 8	0.0	/	Unchangeable
L3018	0x9BCA	Jog 2 frequency	-8 to 8	0.0	/	Unchangeable
L3026	0x9BD2	Main frequency reference after gain processing	-8 to 8	0.0	/	Unchangeable
L3028	0x9BD4	Auxiliary frequency reference after gain processing	-8 to 8	0.0	/	Unchangeable
L3030	0x9BD6	Frequency reference after direction inversion	-8 to 8	0.0	/	Unchangeable
L3032	0x9BD8	Frequency reference after speed limit	-8 to 8	0.0	/	Unchangeable
L3034	0x9BDA	Frequency reference after UP/DOWN offset	-8 to 8	0.0	/	Unchangeable
L3036	0x9BDC	Frequency reference after direction limit	-8 to 8	0.0	/	Unchangeable
L3038	0x9BDE	Frequency reference after limit	-8 to 8	0.0	/	Unchangeable
L3040	0x9BE0	Frequency reference after frequency jump	-8 to 8	0.0	/	Unchangeable
L3042	0x9BE2	Frequency reference after ramp change	-8 to 8	0.0	/	Unchangeable
L3046	0x9BE6	RFG reference input	-8 to 8	0.0	/	Unchangeable
L3048	0x9BE8	RFG calculation input	-8 to 8	0.0	/	Unchangeable
L3050	0x9BEA	RFG actual target	-8 to 8	0.0	/	Unchangeable
L3052	0x9BEC	RFG calculation output	-8 to 8	0.0	/	Unchangeable
L3054	0x9BEE	RFG acceleration	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L3056	0x9BF0	RFG forced value of startup frequency function	-8 to 8	0.0	/	Unchangeable
L3058	0x9BF2	Offset amount of UPDOWN	-8 to 8	0.0	/	Unchangeable
L3060	0x9BF4	UP/DOWN upper limit	-8 to 8	0.0	/	Unchangeable
L3062	0x9BF6	UP/DOWN lower limit	-8 to 8	0.0	/	Unchangeable
L3064	0x9BF8	Speed reference set through communication	-8 to 8	0.0	/	Unchangeable
L3066	0x9BFA	Communication setting	-8 to 8	0.0	/	Unchangeable
L3068	0x9BFC	Maximum forward frequency	-8 to 8	0.0	/	Unchangeable
L3070	0x9BFE	Minimum forward frequency	-8 to 8	0.0	/	Unchangeable
L3072	0x9C00	Maximum reverse frequency	-8 to 8	0.0	/	Unchangeable
L3074	0x9C02	Minimum reverse frequency	-8 to 8	0.0	/	Unchangeable
L3076	0x9C04	Forward frequency limit after the additional frequency	-8 to 8	0.0	/	Unchangeable
L3078	0x9C06	Reverse frequency limit after the additional frequency	-8 to 8	0.0	/	Unchangeable
L3094	0x9C16	Encoder position	-8 to 8	0.0	/	Unchangeable

10.2.14.18 L31 Floating-point connector 10

Item	Address:	Name	Value Range	Default	Unit	Change:
L3100	0x9C1C	Torque reference	-8 to 8	0.0	/	Unchangeable
L3102	0x9C1E	Additional torque	-8 to 8	0.0	/	Unchangeable
L3104	0x9C20	Torque reference after filtering	-8 to 8	0.0	/	Unchangeable
L3106	0x9C22	Target torque reference	-8 to 8	0.0	/	Unchangeable
L3108	0x9C24	Speed limit in torque control mode	-8 to 8	0.0	/	Unchangeable
L3110	0x9C26	Frequency offset in torque control mode	-8 to 8	0.0	/	Unchangeable
L3112	0x9C28	Max. forward torque	-8 to 8	0.0	/	Unchangeable
L3114	0x9C2A	Max. reverse torque	-8 to 8	0.0	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L3120	0x9C30	Target voltage upon V/f separation	-8 to 8	0.0	/	Unchangeable
L3122	0x9C32	V/f separation voltage output	-8 to 8	0.0	/	Unchangeable
L3144	0x9C48	D-axis output voltage	-8 to 8	0.0	/	Unchangeable
L3146	0x9C4A	Q-axis output voltage	-8 to 8	0.0	/	Unchangeable

10.2.14.19 L32 Floating-point connector 11

Item	Address:	Name	Value Range	Default	Unit	Change:
L3206	0x9C86	Drive overload cumulative value	-8 to 8	0.0	/	Unchangeable
L3208	0x9C88	Drive overload cumulative value	-8 to 8	0.0	/	Unchangeable
L3210	0x9C8A	Motor overload cumulative value	-8 to 8	0.0	/	Unchangeable
L3212	0x9C8C	Synchronous frequency	-8 to 8	0.0	/	Unchangeable
L3214	0x9C8E	Synchronous rotation angle	-8 to 8	0.0	/	Unchangeable
L3216	0x9C90	Torque reference	-8 to 8	0.0	/	Unchangeable
L3218	0x9C92	Control flux setpoint	-8 to 8	0.0	/	Unchangeable
L3220	0x9C94	Excitation current reference	-8 to 8	0.0	/	Unchangeable
L3222	0x9C96	Torque current reference	-8 to 8	0.0	/	Unchangeable
L3224	0x9C98	Actual excitation current	-8 to 8	0.0	/	Unchangeable
L3226	0x9C9A	Actual torque current	-8 to 8	0.0	/	Unchangeable
L3228	0x9C9C	Phase U current (transient value)	-8 to 8	0.0	/	Unchangeable
L3230	0x9C9E	Phase V current (transient value)	-8 to 8	0.0	/	Unchangeable
L3232	0x9CA0	Phase W current (transient value)	-8 to 8	0.0	/	Unchangeable
L3234	0x9CA2	Output current amplitude	-8 to 8	0.0	/	Unchangeable
L3238	0x9CA6	Output voltage amplitude	-8 to 8	0.0	/	Unchangeable
L3240	0x9CA8	Output voltage phase	-8 to 8	0.0	/	Unchangeable
L3248	0x9CB0	Drive bus voltage	0.0 to 6553.5	0.0	V	Unchangeable
L3288	0x9CD8	Capacitor core temperature	0.0 to 655.35	0.00	/	Unchangeable

Item	Address:	Name	Value Range	Default	Unit	Change:
L3290	0x9CDA	Effective value of capacitor current	0.0 to 655.35	0.00	/	Unchangeable
L3292	0x9CDC	U phase loss	0.0 to 655.35	0.00	/	Unchangeable
L3294	0x9CDE	Phase V loss	0.0 to 655.35	0.00	/	Unchangeable
L3296	0x9CE0	W phase loss	0.0 to 655.35	0.00	/	Unchangeable
L3298	0x9CE2	Rec average loss	0.0 to 655.35	0.00	/	Unchangeable

10.2.14.20 L33 Floating-point connector 12

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L3354	0x9D1A	Speed loop active Kp	0 to 6553.5	0.0	/	Unchangeable
L3356	0x9D1C	Speed loop active Ti	0 to 6553.5	0.0	/	Unchangeable
L3358	0x9D1E	Speed loop output	0 to 6553.5	0.0	/	Unchangeable
L3360	0x9D20	Speed loop output Kp	0 to 6553.5	0.0	/	Unchangeable
L3362	0x9D22	Speed loop output Ti	0 to 6553.5	0.0	/	Unchangeable
L3364	0x9D24	Forward torque limit value	0 to 6553.5	0.0	/	Unchangeable
L3366	0x9D26	Reverse torque limit value	0 to 6553.5	0.0	/	Unchangeable
L3368	0x9D28	Forward torque\current limit	0 to 6553.5	0.0	/	Unchangeable
L3370	0x9D2A	Reverse torque\current limit	0 to 6553.5	0.0	/	Unchangeable
L3372	0x9D2C	Unlimited speed loop output	0 to 6553.5	0.0	/	Unchangeable
L3374	0x9D2E	Torque feedforward output	0 to 6553.5	0.0	/	Unchangeable
L3376	0x9D30	Torque of load observer	0 to 6553.5	0.0	/	Unchangeable
L3378	0x9D32	Total additional torque	0 to 6553.5	0.0	/	Unchangeable

10.2.14.21 L34 Floating-point connector 13

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L3400	0x9D48	Tension process target speed	-3276.8 to 3276.7	0.0	%	Unchangeable
L3402	0x9D4A	Tension process target torque	-3276.8 to 3276.7	0.0	%	Unchangeable
L3404	0x9D4C	Tension process speed limit	-3276.8 to 3276.7	0.0	%	Unchangeable
L3406	0x9D4E	Tension process speed limit offset	-3276.8 to 3276.7	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L3408	0x9D50	Tension process torque limit	-3276.8 to 3276.7	0.0	%	Unchangeable
L3410	0x9D52	Taper AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3412	0x9D54	Roll diameter AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3414	0x9D56	Tension AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3440	0x9D70	Retentive value of brake torque	-8 to 8	0.00	/	Unchangeable
L3442	0x9D72	Indicates the starting speed of the brake.	-8 to 8	0.00	/	Unchangeable
L3444	0x9D74	Indicates the starting torque of the torque.	-8 to 8	0.00	/	Unchangeable

11 Certification and Standard Compliance

Table 11–1 List of application standards

Application standard	Application scenario
IEC/EN 61800-5-1	Electrical drive system for speed regulation Part 5-1: Safety requirements Electrical, thermal, and energy
IEC/EN 61800-3:	Electrical drive system for speed regulation Part 3: Electromagnetic compatibility requirements and specific test methods
IEC/EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN/ISO 13849-2	Safety-related components of the mechanical safety control system Part 2: Confirm
UL 61800-5-1	Electrical drive system for speed regulation Part 5-1: Safety requirements Electrical, thermal, and energy
CSA C22.2 No. 274	Adjustable speed drive
IEC/EN 63000	Technical document for assessing hazardous substances in electrical and electronic products

The following directives and standards apply to this series of AC drives (actual certification is subject to the product nameplate certification information).

Certification Mark	Compliance with the instruction	Standards compliance	Remarks
c UL us LISTED	/	UL 61800-5-1	The AC drive complies with the drive component access requirements in North America
	/	CSA C22.2 No. 274	
CE	2014/35/EU	IEC/EN 61800-5-1	The AC drive complies with the requirements of the EU Low Voltage Directive 2014/35/EU
	2014/30/EU	IEC/EN 61800-3:	The AC drive complies with EU EMC Directive 2014/30/EU
	2011/65/EU	IEC/EN 63000	The AC drive complies with the requirements of the EU Hazardous Substances Directive 2011/65/EU
SGS TÜV SAAR FUNKTIONALE SICHERHEIT GEPRÜFT FUNCTIONAL SAFETY APPROVED	/	IEC/EN 61508	The AC drive complies with functional safety standards
	/	EN/ISO 13849-2	

Certificate download:

To download the certificate, go to:

https://www.inovance.com/portal/serviceSupport/download

12 Appendix

12.1 Service and Support

Downloads

User guides, brochures, certificates, 2D/3D drawings and other information can be downloaded in the following way:

Go to our official website *https://www.inovance.com*, choose **Service and Support** > **Download**, enter keywords, and download the documentation.

Pre-sales consulting

We are honored to have you as our client. You can submit basic information to us in the following way, so that we can reach you as soon as possible. We are committed to your privacy. We will never share your information with any third party.

Go to our official website (*https://www.inovance.com*), choose **Service and Support** > **Contact Us**, and submit your information.

After-sales service

If you have product quality problems and need after-sales service, or you need to purchase spare parts, you can get the after-sales service person in your region through the following way.

Go to our official website (*https://www.inovance.com*), choose **Service and Support > After-sales Service**, and submit the product category and your region.

Repair

If a product is faulty and needs to be repaired, you can check the maintenance instructions, submit the service request and check the service record in the following way.

Go to our official website (*https://www.inovance.com*), choose **Service and Support** > **Repair**, and submit the repair request.

Authentication

You can authenticate Inovance products in the following way:

Go to our official website (*https://www.inovance.com*), select **"Service and Support-Authentication"** , and enter the 16-digit serial number.

Feedback

You can submit your feedback in the following way:

Go to our official website *https://www.inovance.com*, choose **Service and Support** > **Feedback**, and submit your feedback.

INOPlanet

The forum provides high-quality courses for beginners and advanced learners. You are free to learn and share there. To get access to the forum:

Go to our official website *https://www.inovance.com* and choose **Service and Support** > **INOPlanet**.

Product announcement

You can find out the life cycle of Inovance products in the following ways:

Log in to the official website of Inovance (*https://www.inovance.com*). Select **"Service and Support - Product Notice"** , Query the product life cycle management.

Authority channel

Choose authorized channels and partners when purchasing Inovance products. You can query and verify Inovance's authorized channel qualification through the following window.

Go to our official website *https://www.inovance.com* and choose **Service and Support** > **Authorized Channel**.

Video section

The video section provides video teaching courses on various products, including unpacking instructions, installation wiring, and software operation. The evaluation, collection, sharing, and learning experience is more interesting. To get access to the forum:

Log in to the official website of Inovance (*https://www.inovance.com*). Select **"Service and Support - Video Zone"** . Search by class.

12.2 List of Terms

Table 12–1 List of Terms

Function	Name	Explanation	Alias
Input/Output	DI	Functions of digital input terminals	/
	AI	AI Terminals	/
	VDI	Virtual digital input terminal	/
	HDI	High-speed digital input	/
	DO	Functions of digital output terminals	/
	AO	Analog output terminal	/
	VDO	Virtual digital output terminal functions	/
	HDO	High-speed digital output	/
	HDO pulse output (FMP)	High-speed pulse output terminal	/
	Digital output (FMR)	Open collector digital output terminals	/
	RO	Relay output terminal	/
Application Macro	Application macro	Multiple parameter group. The user can modify some parameters based on the function requirements based on one of the macros, and save the parameters as the user-defined parameters. This simplifies the commissioning process. Application macros are divided into interface macros and industry macros.	/
	Interface macro	The parameter set in the interface macro is mainly control interfaces such as digital input (DI), digital output (DO), and analog input (AI), facilitating user commissioning of control interface parameters.	/
	Industry macro	Mainly oriented to specific industrial applications, such as fans and water pumps, to facilitate user commissioning during application.	/
Frequency Detection	Frequency detection (FDT)	This function sets the detection value of the output frequency as well as the hysteresis value upon output cancellation. The hysteresis value is valid only during deceleration. Hysteresis does not occur in detection during acceleration.	/
	Jump frequency	Frequency jump The jump frequency enables the AC drive to avoid mechanical resonance points of the load.	/
Current Detection	Current detection	When the output current of the AC drive is higher than the threshold for a period, the DO outputs an active signal.	/

Function	Name	Explanation	Alias
Load Monitoring	Load monitoring	The load monitoring function monitors input signals (such as output current, output torque, and output power) related to the AC drive output speed including the overload or load loss monitoring.	/
	Load loss monitoring	Load loss monitoring is used to detect whether a load is lost, such as belt breakage or mechanical shaft breakage.	/
	Overload monitoring	Overload monitoring is used to detect whether the load is blocked, such as motor stall.	/
	Overload	After the actual motor speed enters the monitoring range set by the user, the AC drive collects the current motor speed and monitoring signal. It then uses a multi-point curve to determine the upper and lower limit areas of the monitoring signal that correspond to the current motor speed. If the current monitoring signal exceeds the upper limit, the load is overlimit.	/
	Load loss	If the current monitoring signal exceeds the lower limit, the load is lost.	/
Process PID control	Process PID control	PID control is a common method of process control. By performing proportional, integral, and derivative operations on the difference between the feedback signal and the target signal of the controlled variable, and adjusting the output of the AC drive, a closed-loop system is formed to stabilize the controlled variable at the target level.	/
	PID	Proportion integration differentiation	/
	Kp	Scaling coefficient	/
	Ti	Integral time	/
	Td	Differential time	/
Acceleration/ Deceleration, motoring	Ramp function generator	Ramp-function generator	/
	JOG1/2	Jogging command 1/2	/
Motorized potentiometer	Motorized potentiometer	It refers to the virtual potentiometer output implemented by the software, which can be set by parameters in group P3.	/
Connector	Connector	Group U parameters are read-only parameters that allow you to view the drive status and data. The parameters, also called connectors, can be read or used by other parameters	/
	Bit connector (B connector)	It is a bit from which the value can only be 0 or 1. It is used to monitor the switching state of the system or as a binary signal source for certain functions.	/
	Word connector (K connector)	It is divided into single-word and double-word connectors, which enable status word monitoring in the system or serve as a signal source for certain functions.	/
	Floating-point connector	The floating-point number in the system is used to monitor floating-point type data in the system or as a signal source for certain functions.	/

Function	Name	Explanation	Alias
Free function module	Free function module	In more complex engineering applications, the MD630 can use the free function module to associate multiple status signals and control signals together to achieve project control requirements. The application functions of MD630 include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting module. You can set related parameters to achieve simple logic operation.	/
Speed reference	Droop control	The operating frequency is automatically reduced when the load is heavy.	-
	Jump frequency	The set target frequency automatically jumps the resonance point.	Dangerous speed, jump speed
	Motor running direction	Switches the motor running direction without changing the positive and negative of the set frequency.	Motor phase sequence switchover, motor phase sequence

Function	Name	Explanation	Alias
Vector control	Vector control	The three-phase UVW current is divided into id/iq and the flux and torque are controlled separately. Speed and torque can be controlled, with good accuracy and dynamic response performance. DTC control has similar performance.	/
	FVC/SVC	Vector control with sensors / Vector control without sensors	/
	Acceleration feedforward torque	Calculate the acceleration/deceleration torque and perform compensation when speed reference changes, which can greatly reduce the demand for dynamic response of the speed loop Kp and Ti.	Acceleration feedforward, acceleration feedforward compensation, torque feedforward, acceleration compensation
	Kp	Proportional gain of the PI controller. The larger the Kp, the stronger the control effect, such as the SVC speed loop Kp.	/
	Ti	Integral time of the PI controller. The smaller the Ti, the stronger the integral control effect, such as the speed loop Ti in the SVC mode.	/
	Ki	The integral gain of the PI controller, the larger the Ki, the stronger the integral, and the Ki=Kp/Ti	/
	IF control	In the SVC control mode and at the zero speed, the set speed is used as the frequency of the output current. It is open-loop conrol. It improves the stability of the SVC mode at 0 speed.	Speed open-loop control
	Electromechanical time constant	Defines the time for the motor to accelerate to the rated speed with loads.	Mechanical time constant, rated motor start time
	Overspeed control	The overspeed controller runs after the motor overruns to prevent further acceleration.	Stall control
	V/f control	Constant voltage frequency ratio control. This mode is not highly dependent on parameters. It is simple, reliable, but has relatively poor dynamic performance and speed accuracy.	Scaler control
	DTC control	Direct torque control, which can control speed and torque, has good accuracy and dynamic response performance, and corresponds to vector control mode	/

Function	Name	Explanation	Alias
V/f control	Slip compensation	The rotor speed of the asynchronous motor is lower than the set speed after load is applied. The slip compensation can estimate the load size and automatically increase the frequency reference to improve the speed accuracy.	V/F slip compensation gain
	Overcurrent suppression	When the output torque is large, the frequency reference is automatically adjusted to reduce the output current to prevent overcurrent during heavy load or acceleration/deceleration.	Overcurrent stall suppression
	Torque boost	Used to compensate the voltage loss on the stator resistor to ensure the constant flux (voltage/frequency) of the motor in the V/f mode, improving the load capacity of the motor at a low speed.	Torque compensation, voltage boost, IR compensation
	Oscillation suppression	In the V/f control mode, oscillation may occur for motors with no load. Oscillation suppression prevents oscillation.	Resonance suppression

Function	Name	Explanation	Alias
Basic control	Shorting motor stator control	Synchronous motor control. The AC drive shorts the UVW output terminals together through IGBT control to form the braking torque. The higher the speed, the higher the braking torque. It prevents the motor from runaway, rotating at low speed and sliding freely for a long time.	Electronic motor stator shorting function, internal short-circuited braking
	Carrier frequency	Output pulse voltage frequency	Pulse frequency, switching frequency
	DPWM/PWM	5-reference IGBT trigger: IGBT switch 4 times for one carrier cycle; 7-reference IGBT trigger: IGBT switch 6 times for one carrier cycle.	5-reference wave generation/ 7-reference wave generation
	Overmodulation	The output voltage in general control mode is low in the weak magnetic zone. Overmodulation can increase the output voltage by up to 5%. The output current can be reduced effectively under the same load. However, the output harmonics become slightly larger.	Edge modulation
	Carrier ratio	The carrier ratio is the number of pulses in a sinusoidal wave current cycle. A low carrier ratio means fewer pulses within a sinusoidal current period, and the waveform of the output current will not achieve the ideal sinusoidal shape. Therefore, the performance of motor control is affected, and the motor generates severe heat. The synchronous motor may demagnetization.	Carrier frequency / output frequency
	Random PWM	The carrier frequency changes randomly during running. The sharp electromagnetic noise of the motor caused by the carrier frequency is dispersed. After random PWM is enabled, the motor has relatively soft "rustling" sound.	Pulse frequency wobble
	Overvoltage suppression	The motor deceleration time is automatically prolonged during deceleration and power generation to prevent overvoltage from motor power generation.	Vdc Max, overvoltage stall suppression, overvoltage control
	Undervoltage suppression	The motor speed is automatically reduced during the voltage dip of power grid to generate power to keep the AC drive bus free from undervoltage. After the power grid is restored, normal operation is restored. During long-term power failure of the power grid, this function reliably stops the motor to prevent the motor from rotating freely.	Power dip ride-through, voltage dip resistance, Vdc Min, undervoltage stall suppression, undervoltage control
	Overexcitation	The excitation current is automatically increased during deceleration, which increases the energy loss. The overvoltage during deceleration can be reduced and the motor can decelerate faster	Flux braking
	Speed tracking	For V/f and SVC controlled motors that rotate freely, the motor speed must be obtained before starting normally. The flying start algorithm can estimate the motor speed at startup and start without disturbance.	Speed tracking startup

Function	Name	Explanation	Alias
Basic control	Energy saving control	Energy-saving control of asynchronous motor, which automatically adjusts the output voltage according to the load size, reduces the output current to achieve energy-saving effect.	Efficiency optimization
	Back EMF	When the motor is dragged to the rated speed of no-load, the effective value of the output terminal (UV/VW/WU) voltage is the rated back potential of the motor.	/
	No-load current	The output excitation current is the no-load current when the asynchronous motor is running without load in the non-weak field of V/f	/
	Mutual inductance	The main flux that can be generated per unit of current also represents the conductivity of the magnetic circuit between the stator and the rotor.	/
	Moment of inertia ratio	Different motors have an inertia reference value calculated internally. After the inertia auto-tuning is accurate, the reference value is divided to the inertia ratio	/
	Number of motor pole pairs	The internal structure of the motor is determined by the same parameters. The higher the number of poles, the higher the output torque. The lower the mechanical speed.	/
	Rated motor slip	The deviation between the actual output rotor frequency and the given frequency is the rated slip	/
	Current loop	Control the feedback current to a given current through different models to ensure dynamic response.	/
	Speed loop	The actual motor speed is controlled to a given speed, which meets the speed control requirements.	/

Function	Name	Explanation	Alias
Parameter auto-tuning	Motor auto-tuning	In vector control mode, motor resistance, inductance, and other parameters shall be known to establish an accurate calculation model, which is used to calculate the flux, torque, and speed of the motor. Parameter auto-tuning must be performed in FVC/SVC control. It is also recommended to perform parameter auto-tuning in V/f control for better performance.	Auto-tuning, parameter auto-tuning
	Static auto-tuning	Auto-tuning for motors that do not need to rotate and is performed with load.	/
	Dynamic auto-tuning	Auto-tuning for motors that need to rotate and is performed without load.	/
	With-load auto-tuning	The motor can be auto-tuned with a load, and the motor may rotate.	/
	Magnetic pole position auto-tuning	Before the synchronous motor starts, search for the magnetic field position. The accurate magnetic field position ensures the motor to start with a load.	Phase searching, magnetic pole position identification
	Stator resistance, per-unit value of rotor resistance	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of resistance = rated motor voltage ÷ (1.732 x rated current) in Ω. Actual vlue of resistance value = Per-unit value of resistance x base value of resistance.	/
	Leakage inductance, mutual inductance, Ld/Lq inductance per unit value	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of inductance = Per-unit base value of resistance ÷ (2 x PI x rated frequency). The unit is H. Actual value of inductance = Per-unit value of inductance x base value of resistance.	/

12.3 Data flow description

Description
PXXX(0)

Description
PXXXX

Set values through parameters.

CC0001

This parameter stores a 16-bit or 32-bit value, which can be read by other parameters through address.

CC0001

This parameter stores a bit value (0 or 1), which can be read by other parameters through address.

Description
XXXXZ
YYYY

Read the value of another parameter (16- or 32-bit) through the parameter address.

Description
XXXXZ
YYYY

Read the value of another parameter (one bit) through the parameter address.

Description z
XXXX1
XXXX2

If EXT1 is active, the value is set by parameter 1.

Description z
XXXX1
XXXX2

If EXT2 is active, the value is set by parameter 2.

Description
XXXXZ
XXXXZ
YYYY

Read a 16- or 32-bit value through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.

Description
XXXXZ
XXXXZ
YYYY

Read a bit value (0 or 1) through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.

du/dt

Calculate the differential

Calculate the integral

Kp Tn Yp Y Yn

PID regulator

-1 0 1 2 3

Selection switch. Select one output from several inputs based on the condition

& ≥1 ≠

Logic AND/OR/XOR

Logic NOT/OR/XOR

X>Y X<Y X=Y X≥Y X≤Y X≠Y

Compare the two input values

MAX MIN

Select the maximum/minimum value

Limit the input value

Description z
XXXX.1

Description z
XXXX.1

Current motor and motor control parameters.
Four groups of parameters corresponding to different motors can be set.
Current motor data is selected through MDS1/2.

Description
XXXX.Z
YYYY

Read a 16- or 32-bit value through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2, corresponding to current motor control parameters.

Description
XXXX.2
YYYY

Read a bit value (0 or 1) through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2, corresponding to current motor control parameters.

y t

Low-pass filter

y t

High-pass filter
with integral of small inertial element

t1 t2

Low-pass filter. When the input signal increases or decreases, it has different time constants.

Rate of change of the input signal is limited, with a rise time of 1/T.

Add/subtract the input value

Multiply the input value

x y

Divide the input value(x/y)

Absolute value of signed values

-1

Opposite to the signed values

Set dead zone. When the input value is in the dead zone, the output is always 0.

T 0

Enable delay, delay occurs when in the rising edge (0->1).

0 T

Disable delay, delay occurs when in the falling edge (1->0).

T T

Bi-directional delay, delay occurs when the level changes.

Z^{-1}

Delay the input signal by one pulse.

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