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AC Drive | Servo System | PLC | HMI | Machine Vision | IoT | New Energy | Special Industrial Machine

IS810N-INT Series Servo System User Manual (Brief)

Brief Manual

A00

Data code: 19010531

Preface

Thank you for purchasing the IS810N-INT series servo drive.

The IS810N-INT series is a high-performance AC servo drive for small and medium power applications. The power of the IS810N-INT series ranges from 100 W to 75 kW. It supports MODBUS, CANopen, and CANlink communication protocols, which allows networking of multiple IS810N-INT drives controlled by a host controller via the corresponding communication port. The IS810N-INT is easy to use due to the functions of stiffness table setting, inertia auto-tuning and vibration suppression. It works together with Inovance ISMH series small/medium-inertia high-response servo motor configured with a 20-bit incremental encoder or 23-bit multi-turn absolute encoder, making running stable and quiet and positioning control more accurate. This servo drive is able to implement rapid and accurate position, speed, and torque control, and is applicable for such automation equipment as gravure press machines, flexo printing machines, corrugated paper printing equipment, semiconductor manufacturing equipment, chip mounters, PCB punching machines, transport machinery, food processing machinery, machine tools and conveying machinery.

This User Guide describes how to use the IS810N-INT series servo drive, covering safety information, mechanical and electrical installation, commissioning and maintenance. Read and understand this User Guide before use. If you have doubts about some functions or performance, contact the technical support personnel of Inovance.

The instructions in this User Guide are subject to change without notice due to product upgrade, specification modification, as well as efforts to increase the accuracy and convenience of the User Guide.

Authorised distributors shall deliver this User Guide a long with equipment to end users.

Unpacking and Check

Upon unpacking:

Check	Description
Whether the delivered product is consistent with your order	The box contains the equipment, and the IS810N User Guide. Verify the model according to the servo motor and servo drive nameplates.
Whether the product is damaged	Check the appearance of the product. If there is anything missing or damaged, contact Inovance or your supplier immediately.
Whether the rotating shaft of the servo motor rotates smoothly	Normally, the shaft of the servo motor can be rotated manually, unless the servo motor is configured with a brake.

Precautions
◆ This product is a general industrial product, and is not designed for use in machinery or systems on which lives depend. ◆ Wiring, operation, maintenance, and inspection of the product can only be conducted by a qualified person. ◆ When selecting the screw tightening torque, consider the strength of the screw and material of the installation part. Select a proper torque to tightly fasten a screw without damaging the installation part. ◆ Install a correct safety device when this product is to be used on machinery which may cause a serious accident or loss due to failures of the product. ◆ Contact Inovance when this product is to be used for atomic energy control, aerospace equipment, transport equipment, medical appliances, safety devices, or other equipment that require high cleanliness. ◆ Although this product has passed all QC tests, it may react unexpectedly due to faults arising from ambient noise, static electricity, input power supply, wiring, parts, and so on. Take mechanical safety measures into full consideration to ensure safety in the application site where all possible actions of the equipment occur. ◆ When the motor shaft rotates without being grounded, the motor bearing may suffer from electric corrosion or emit louder noise based on the actual mechanical and installation conditions. Check the problem yourself. ◆ Faults of this product may cause smoke. Pay special attention to such conditions when the product is used in a purification workshop or other similar environments. ◆ Chip resistor disconnection or poor contact may occur due to a sulfuration reaction if the product is used in an environment with dense sulphur or sulfuretted gas. ◆ Inputting a voltage far stronger than the rated voltage may cause damages to the internal components, thus resulting in smoke or a fire. ◆ End users shall decide whether the servo drive matches the structure, size, service life, features, specification change of the equipment where the servo drive is to be installed and its parts, and whether it complies with local laws and regulations. ◆ Note that use of this product beyond its specifications is not guaranteed. ◆ Some components of this product may be subject to change as we are dedicated to continuous improvement of the product.

Change History

Date	Version	Description
July 2017	A00	First release

§ Approvals

Certification marks on the product nameplate indicate compliance with the corresponding certificates and standards.

Certification	Mark	Directives		Standard	
CE		EMC directives	2014/30/EU	AC servo drive	EN 61800-3
				AC servo motor	EN 60034-1
		LVD directives	2014/35/EU	AC servo drive	EN61800-5-1
				AC servo motor	EN 60034-1
		RoHS directives	2011/65/EU	EN 50581	
TUV		-		AC servo drive	EN61800-5-1
				AC servo motor	EN 60034-1

Note:

- The preceding EMC directives are complied with only when the EMC electric installation requirements are strictly observed.
- Machines and devices used together with this drive must also be CE certified and marked. The integrator who integrates the drive with the CE mark into other devices has the responsibility to ensure CE standard compliance and verify that conditions meet European standards. The installer of the drive is responsible for complying with all relevant regulations on wiring, circuit fuse protection, earthing, accident prevention and electromagnetic (EMC regulations). In particular, fault discrimination for preventing fire risks and solid earthing practices must be adhered to for electrical safety (also for good EMC practice).
- For more information about certification, consult our distributor or sales representative.

Contents

Chapter 1 Safety Information and Precautions

This manual includes notices you have to observe in order to ensure your personal safety and prevent property damages. These notices shown below are graded according to the degree of danger.

DANGER	It indicates that failure to comply with the notice may result in a severe personal injury or even death.
CAUTION	It indicates that failure to comply with the notice may result in a minor or moderate personal injury or equipment damage.

1.1 General Safety

This section describes precautions on acceptance, storage, transportation, installation, wiring, running, inspection, and disposal of the product.

DANGER
◆ After the power is off for five minutes and the power indicator turns off, measure and check the voltage between ⊕ and ⊖ using a multimeter, and then install or uninstall the drive. Otherwise, you may get an electric shock due to residual voltage.
◆ Use the power from the TN/TT grid rather than the IT grid for the drive. Failure to comply may result in electric shocks.
◆ Do not touch the internal components of the drive. Failure to comply may result in electric shocks.
◆ Insulate connection parts of the power terminals. Failure to comply may result in electric shocks.
◆ Ground the terminal of the drive (D-class grounding). Failure to comply may result in electric shocks.
◆ Do not damage the cables, lay them under large tension or pressure, or hang them. Failure to comply may result in equipment stop or damages.
◆ Only specified persons are allowed to set, uninstall, and repair the drive. Failure to comply may result in electric shocks or personal injuries.
◆ Do not remove the cover, cables, connectors, or options when the drive is live. Failure to comply may result in electric shocks.
◆ Perform a trial run according to the procedure required in the manual.
◆ Improper operations when the servo motor is connected to the drive result in mechanical damages and even personal injuries.
◆ Do not change the maximum speed (H00-15) except for special purpose. Changing this value improperly may cause mechanical damages or personal injuryies.
◆ After power-on or within a short time after power-off, do not touch the heatsink of the servo drive, external regenerative resistor, or servo motor as they may get very hot and there is a risk of burns. Take safety measures, for example, installing the housing, to prevent hands or components such as cables from contacting these high-temperature components.
◆ Avoid contact with the rotating part of the servo motor when it is running. Failure to comply may result in personal injuries.
◆ Before operating the equipment, enable emergency stop of the connected servo motor. Failure to comply may result in personal injuries.
◆ Install a stop device on the mechanical side to ensure safety.
◆ The brake (if available) of the servo motor is not used as the stop device. Lacking the stop device may result in personal injuries.
◆ The machine may restart if power supply is restored after an instantaneous power failure occurs when it is running. Do not get close to the machine in this period.
◆ Take measures to ensure personal safety at restart.
◆ Do not alter the drive. Failure to comply may result in personal injuries or mechanical damages.
◆ Install the servo drive, motor, and external regenerative resistor on incombustible objects. Failure to comply may result in a fire.
◆ Connect the electromagnetic contactor and non-fuse circuit breaker between the power supply and main circuit of the drive (L1 and L2 for single-phase; R, S, and T for three-phase). Otherwise, large current may not be cut off when a fault occurs in the drive, resulting in a fire.
◆ Prevent combustible objects such as oil and grease and conductive objects such as screw and metal sheet from entry into the servo drive and motor. Failure to comply may result in a fire.

1.2 Acceptance Precautions

Item	Description
Whether the delivered product is consistent with your order	The box contains the equipment and the IS810N user guide. Verify the model according to the servo motor and servo drive nameplates.
Whether the product is damaged	Check the overall appearance of the product. If there is anything missing or damaged, contact Inovance or your supplier immediately.
Whether the rotating shaft of the servo motor rotates smoothly	Normally, the shaft of the servo motor can be rotated manually, unless it is configured with a brake.

1.3 Storage and Transportation Precautions

CAUTION

- Do not store or lay the equipment in the following environment conditions. Failure to comply will result in a fire, electric shock or equipment damage.
- Direct sunlight; Ambient temperature exceeding the required condition; Relative humidity exceeding the required condition Large temperature fluctuation and condensation Close to corrosive and combustible gas Heavy dust, dirt, salt, and metal powder Water, oil, and drug drop Vibration and impact transmitted to main body Do not move the equipment by holding the cables or motor shaft. Failure to comply may result in personal injuries or equipment damages.
- Do not stack drives. Failure to comply may result in personal injuries or equipment damages.

1.4 Installation Precautions

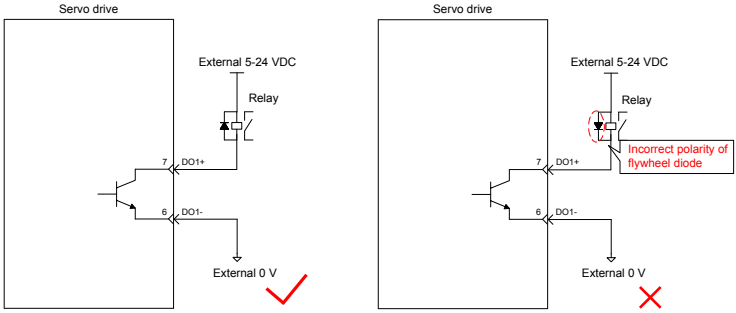
CAUTION

- Do not install the drive in an environment with water or corrosive gas.
- Do not subject the drive to combustibles. Failure to comply may result in an electric shock or a fire.
- Do not sit on the drive or put heavy objects on it. Failure to comply may result in personal injuries.
- Install the drive inside a cabinet with fire and electric protection. Failure to comply may result in a fire.
- Ensure good ventilation and prevent entry of foreign objects. Otherwise, aging of internal components may accelerate, causing a fault or fire.
- Install the drive in the required direction. Failure to comply may result in faults.
- Ensure that there is specified gap between the drive, cabinet internal surface, and other devices. Failure to comply will result in a fire or fault.
- Do not put much weight onto the product. Failure to comply may result in faults.

1.5 Wiring Precautions

CAUTION

- NEVER connect a power supply to the output terminals U, V, and W of the drive. Failure to comply may result in personal injuries or a fire.
- Connect the U, V, and W cables of the drive to the U, V, and W terminals of the motor directly. Do not connect an electromagnetic contactor. Failure to comply may result in faults.
- When connecting DO terminals to relays, pay attention to the polarity of the flywheel diode. Otherwise, the drive will be damaged and signal output becomes abnormal.



- Connect the power terminals and motor terminals securely. Failure to comply may result in a fire.
- Do not lead the power cable and signal cables through the same duct or bundle them together. Separate power cables at least 30 cm from signal cables.
- Use the twisted shielded cables as the signal cables and encoder cables, and ground both ends of the shield.
- The maximum length of reference input cables is 3 m, and that of encoder cables is 20 m.
- Wait at least five minutes before touching the power terminals because high voltage may still be present in the servo drive after the power is switched off.
- Perform check after confirming that the CHARGE indicator is OFF.
- Do not switch on/off the power frequently. If repeated power-on/off operations are required, perform an operations at an interval of at least one minute.
- The servo drive contains a capacitor in the power supply module, and a high current flows for 0.2 second after the servo drive is switched on/off. Frequently switching on/off the servo drive will deteriorate the performance of the main circuit components inside the drive.
- Observe the following precautions when wiring the main circuit:
  1. Remove the connectors from the drive when wiring.
  2. Only one cable can be inserted into one interface of the connector. Prevent short-circuit between the core and adjacent cables when inserting the cable.
  3. Do not connect a 220 V drive to a 380 V power supply. Failure to comply will result in damages to the drive.
  4. Connect the cables correctly and securely. Failure to comply may make the motor out of control, or cause personal injuries or faults.
  5. Use the specified power supply. Otherwise, the drive may be damaged.
  6. When the power supply is poor, ensure that voltage fluctuation is within the permissible range. Failure to comply may result in damages to the equipment.

CAUTION

7. Configure safety devices such as circuit breakers to prevent a short-circuit in the external circuit. Failure to comply may result in a fire.

- Take appropriate shielding measures in the following scenarios to prevent equipment damages:
  1. Interference occurs due to static electricity.
  2. There is a strong electric field or magnetic field.
  3. There may be radiation.
  4. Power cables are installed nearby.

1.6 Running Precautions

CAUTION

- During a trial run, make the servo motor unloaded (not connected to the drive shaft) to prevent accidents. Failure to comply may result in personal injuries.
- When the servo motor is installed on a supporting machine, preset user parameters matching the machine. Running the servo drive without parameter settings may make the machine out of control or cause faults.
- During home return, the forward limit switch (P-OT) and reverse limit switch (N-OT) signals are inactive.
- When the servo motor drives the vertical axis, configure a safety device to prevent the work from falling on conditions such as warning or sensing the limit switch. Set servo off when the motor senses the limit switch to prevent the work from falling.
- When online auto-tuning is not used, set the correct load inertia ratio to prevent vibration.
- After power-on or within a short time after power-off, do not touch the heatsink of the servo drive, external regenerative resistor, and servo motor as they may get very hot. There is a risk of burns.
- Inappropriate user parameter adjustment makes the servo system instable. Do not perform such operations. Failure to comply may result in personal injuries.
- When a warning occurs, resolve the causes and ensure safety before resetting the warning, and then start running again. Failure to comply may result in personal injuries.
- Do not use the motor's own brake for general braking. Failure to comply may result in faults.

1.7 Maintenance Precautions

CAUTION

- Only by professional personnel are allowed to turn on/off the power switch.
- When performing the insulation resistor test on the drive, disconnect all connections to the drive. Otherwise, faults will occur in the drive.
- Do not use oil, diluent, alcohol, or acid or alkaline detergent to prevent housing discoloring or damages.
- When replacing the drive, migrate the user parameters of the drive to be replaced to the new drive, and then run the new drive. Otherwise, the drive may be damaged.
- Do not change wiring when the drive is live. Failure to comply may result in electric shocks or personal injuries.
- Do not dismantle the servo motor. Failure to comply may result in electric shocks or personal injuries.

1.8 Check Item and Period

1.8.1 Normal Use Conditions

The required environment conditions are as follows:

Average ambient temperature: 30°C;
Average load ratio: below 80%;
D aily running time: less than 20 hours.

Perform daily and periodic checks according to the following table.

Type	Period	Check Item
Daily check	Day	Check the ambient temperature, humidity, dust, and foreign objects.
		Check whether there is abnormal vibration and noise.
		Check whether the mains voltage is normal.
		Check whether there is unexpected odor.
		Check whether the air vent is stuck with fiber threads.
		Check whether the front end and connectors of the drive are clean.
		Check whether there are foreign objects on the load side.
Periodic check	Year	Check whether the fastening parts become loose.
		Check whether the machine overheats.
		Check whether the terminal block is damaged.
		Check whether the fastening parts of the terminal block become loose.

1.8.2 Prohibition

The machine can be dismantled and repaired only by Inovance.

The electrical and electronic components inside the servo system will suffer mechanical wearing and aging after a long time of use. Replace the servo drive and motor according to the instructions in the following table. If replacement is required, contact the dealer or Inovance first to check whether the components need to be replaced.

Object	Type	General Replacing Period	Remarks
Drive	Bus filter capacitor	About 5 years	The general replacing period is only for reference. Even if the general replacing period is not reached, the components can be replaced when abnormalities occur.
	Cooling fan	2 to 3 years (10,000 to 30,000 hours)	
	Aluminum electrolytic capacitor on the circuit board	About 5 years	
	Pre-charge relay	About 100,000 times (depending on the use conditions)	
	Pre-charge resistor	About 20,000 times (depending on the use conditions)	
Motor	Bearing	3 to 5 years (20,000 to 30,000 hours)	
	Oil seal	5,000 hours	
	Encoder	3 to 5 years (20,000 to 30,000 hours)	
	Absolute encoder battery	Depending on the use conditions	

1.8.3 Disposal Precautions

CAUTION
When disposing the product, observe any applicable regulations or laws on recycling and reuse of electronic products.

1.9 Usage Precautions

CAUTION
◆ This drive is a general industrial product, and is not designed for use in machinery or systems on which lives depend. ◆ Wiring, operation, maintenance, and inspection of the product can only be conducted by qualified person. ◆ When selecting the screw tightening torque, consider the strength of the screw and material of the installation part. Select a proper torque to tightly fasten a screw without damaging the installation part. ◆ Install a proper safety device when this product is to be used on machinery which may cause serious accident or loss due to failures of the product. ◆ Contact Inovance when this product is to be used for atomic energy control, aerospace equipment, transport equipment, medical appliances, safety devices, or other equipment that require high cleanliness. ◆ Although this product has passed all QC tests, it may react unexpectedly due to faults arising from ambient noise, static electricity, input power supply, wiring, parts, and so on. Take mechanical safety measures into fully consideration to ensure safety in the application site where all possible actions of the equipment occur. ◆ When the motor shaft rotates without being grounded, the motor bearing may suffer from electric corrosion or emit louder noise based on the actual mechanical and installation conditions. ◆ Faults of this product may cause smoke. Pay special attention to such condition when the product is used in purification workshop or other similar environmentss. ◆ Chip resistor disconnection or poor contact may occur due to sulfuration reaction if the product is used in an environment with dense sulphur or sulfuretted gas. ◆ Inputting a voltage far stronger than the rated voltage may cause damages to the internal components, thus resulting in smoke or even a fire. ◆ End users shall decide whether the servo drive matches the structure, size, service life, features, specification change of the equipment where the servo drive is to be installed and its parts, and whether complies with local laws and regulations. ◆ Note that use of this product beyond its specifications is not guaranteed. ◆ Some components of this product may be subject to change as we are dedicated to continuous improvement of the product.

Chapter 2 Product Information

An MD810 power supply unit must be purchased before the use of this product. For information about the specifications of the power supply unit, refer to the User Guide MD810 Series AC Drive Multi-axis System.

2.1 Drive Unit

2.1.1 Designation Rules and Nameplate

Figure 2-1 Designation rules and nameplate of drive unit

IS810 N 50M 4T D 3R5 INT

Mark	Drive Series
IS810	IS810 series

Mark	Drive Type
N	EtherCAT network

Mark	Unit Type
50M	Inverter unit

Mark	Voltage Class
4T	380 V to 480 V

Mark	Number of Shafts
S	Single-shaft
D	Double-shaft

Mark	Version
INT	International

Mark	Rated Current Double-shaft (Rated current per shaft)
3R5	3.5 A
5R4	5.4 A
8R4	8.4 A
012	12 A
017	17 A
021	21 A
026	26 A
032	32 A
037	37 A
045	45 A
060	60 A
075	75 A
091	91 A
112	112 A
152	152 A

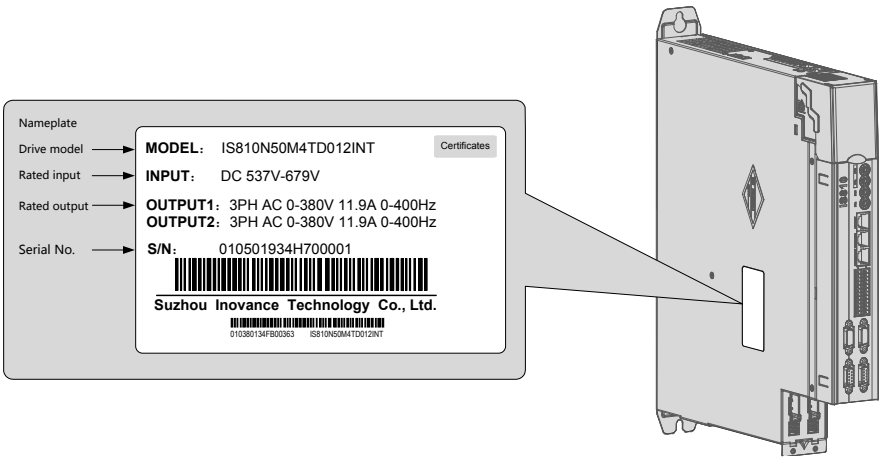


Figure 2-2 Production serial number of drive unit

01050193 4 H 7 00001

Mark	Internal Code
01******	Machine material code

Mark	Manufacturer Code
4	Suzhou Inovance Technology

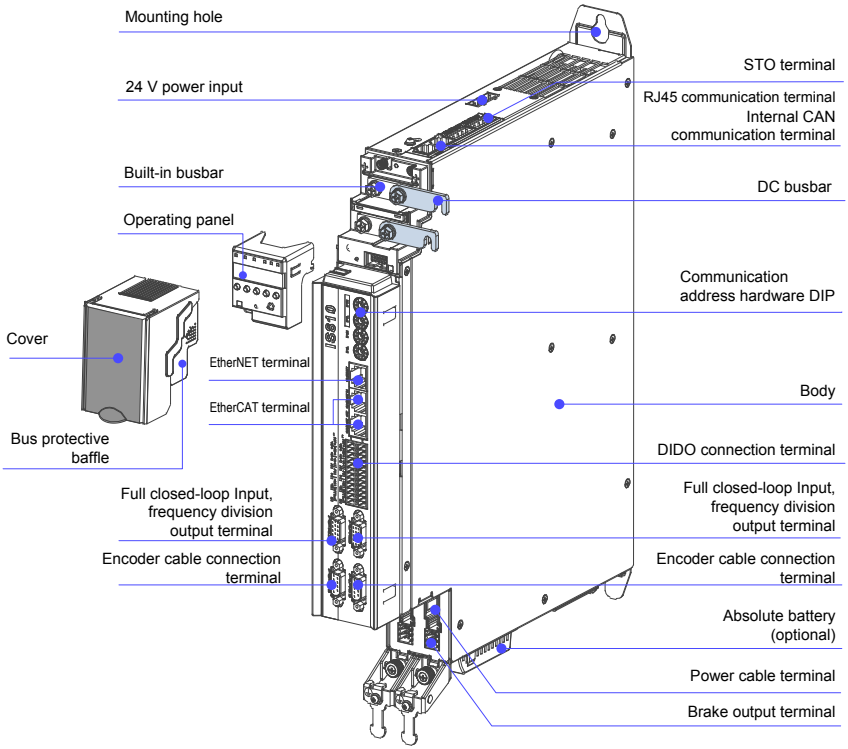
Mark	Year
9	2009
A	2010
B	2011
……	And so on
Description: I/L/O/Q is not used.	

Mark	Serial Number
00001	The 1st set in the current month
00002	The 2nd set in the current month
00003	The 3rd set in the current month
……	The Nth set in the current month
Range: 00001 to 99999	

Mark	Month
1	Jan.
2	Feb.
3	Mar.
……	*month
A	Oct.
B	Nov.
C	Dec.

Example: (S/N:010501934H700001) The machine manufacturing date is July 2017.

2.1.2 Components of Drive Unit



2.1.3 Specifications

1) Electrical Specifications

Three-phase 380 V

Item	SIZE-1				SIZE-2		
Drive model IS810N	T3R5	T5R4	T8R4	T012	T017	T021	T026
Continuous output current Arms	3.5	5.4	8.4	11.9	16.5	20.8	25.7
Maximum output current Arms	8.5	14	20	28	42	55	65
Main circuit power supply	537 to 679 VDC						
Control circuit power supply	24 VDC, +10% to -10%						

Item	SIZE-2					SIZE-3		
Drive model IS810N	T032	T037	T045	T060	T075	T091	T112	T152
Continuous output current Arms	32	37	45	60	75	91	112	152
Maximum output current Arms	80	92.5	112.5	150	187.5	227.5	280	380
Main circuit power supply	537 to 679 VDC							
Control circuit power supply	24 VDC, +10% to -10%							

Note: SIZE-2 and SIZE-3 are being developed. If you have need them, contact Inovance.

2) Basic Specifications

Item			Description
Basicspecifications	Control mode		IGBT PWM control, sine wave current drive mode 380 V: three-phase full-wave rectification
	Encoder feedback		Inovance 20-bit serial incremental encoder Inovance 23-bit serial absolute encoder
	Use conditions	Operating temperature*1	0–45°C (Derate it when the temperature is above 40°C, 1.5% deration per 1°C rise, maximum operating temperature: 50°C)
		Storage temperature	-40°C to 70°C
		Operating/Storage humidity	Below 90% RH (non-condensing)
		Vibration/Impact resistance	4.9 m/s^2, 19.6 m/s^2
		Degree of protection	IP20 (except the power terminal)
		Pollution class	2
		Altitude	Below 1000 m. Derate it when the altitude is over 1000 m (1% deration per 100 m rise, maximum operating altitude: 3000 m).
	Basic performance of EtherCAT slave	Comm. protocol	EtherCAT
		Supported service	CoE (PDO, SDO)
		Sync. mode	DC-distributed clock
		Physical layer	100BASE-TX
		Baud rate	100 Mbit/s (100Base-TX)
		Duplex mode	Full duplex
		Topological structure	Ring, linear
		Transmission medium	Shielded CAT5E or better network cable
		Transmission distance	< 100 M between two nodes (suitable environment with quality cables)
		Number of slaves	Up to 65535 by protocol, not exceeding 100 in actual use
		EtherCAT frame length	44 to 1498 bytes
		Process data	Up to 1486 bytes per frame
		Sync. jitter of two slaves	< 1 us
		Refresh time	1000 digital input/output: about 30 us 100 servo axes: about 100 us
		Bit error rate	10-10 Ethernet standard
	EtherCAT configuration unit	FMMU unit	8
		Memory sync. management unit	8
		Process data RAM	8 KB
		Distributed clock	64-bit
		EEPROM capacity	32 Kbit

Item			Description
Input/Output signal	Digital input signal	Allowing signal allocation change (shared between two shafts)	8 DIs (HDI4 and HDI8 being high-speed DI)
			37 DI functions:
			S-ON, fault/warning reset, gain switchover
			Main/auxiliary running reference switchover, multi-speed DI switchover, running direction selection, multi-reference switchover (4 DIs)
			Zero clamp enable, position reference inhibited
			Positive limit switch, negative limit switch
			External positive torque limit, external negative torque limit
			Forward jog, reverse jog, step reference
			Handwheel multiplying factor signal 1, handwheel multiplying factor signal 2, handwheel enabled
			Electronic gear selection, torque reference direction selection, speed reference direction selection, position reference direction selection
			Multi-position enable, position change on fly unlock, position change on fly inhibited
			Home switch, homing function, braking
			Position deviation cleared, internal speed limit selection, pulse reference inhibited
	Digital output signal	Allowing signal allocation change (shared between two shafts)	2 DOs
			19 DO functions:
			Servo ready, motor rotation output, zero speed signal
			Speed consistent, positioning completed, positioning near
			Torque limit, speed limit, brake output
			Warning output, fault output, fault code output (3-digit output)
			Position change on fly completed, home attaining output, electrical home attaining output
			Torque reached, speed reached
Built-in functions	Stop at limit switch		The servo drive stops immediately when P-OT or N-OT is active.
	Electronic gear ratio		0.1048576 ≤ B/A ≤ 419430.4

Item		Description
Built-in functions	Protection functions	Overcurrent, overvoltage, undervoltage Overload, main circuit detection abnormality Heatsink overheat, phase loss, overspeed Encoder abnormality, CPU abnormality, parameter abnormality, and so on.
	LED display	5-digit LED display indicating the main circuit charge
	Analog monitoring	Built-in analog monitoring connector for observing speed and torque reference signals
	Others	Gain adjustment, alarm recording, and jog running

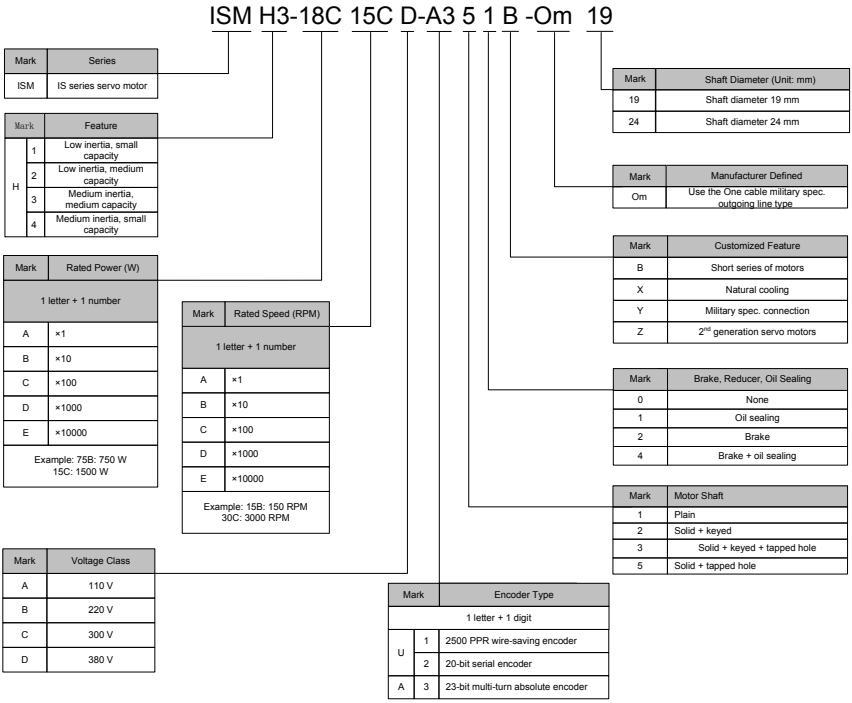
Note*1: Install the drive unit within the operating temperature range. When the drive unit is installed in an electric cabinet, the temperature inside the cabinet must be within this range.

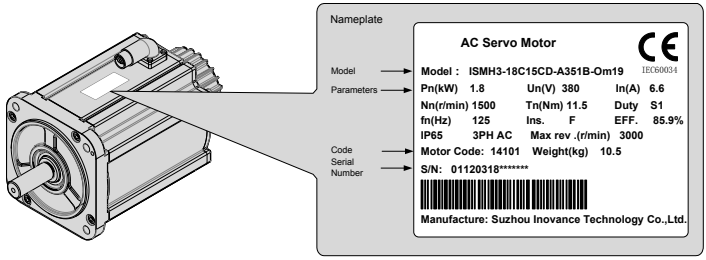
2.2 Servo Motor

2.2.1 Specifications of OneCable Servo Motor

1. Designation Rules and Nameplate

Figure 2-3 Designation rules and nameplate of servo motor





2. Specifications of Servo Motor

1) Motor Mechanical Specifications

Item	Description
Rated time	Continuous
Vibration level	V15
Insulation resistance	500 VDC, greater than 10 MΩ
Operating temperature	0–40°C
Excitation mode	Permanent magnetic
Installation method	Flange
Heat-resistance level	F
Housing protection mode	IP65
Operating humidity	20–80% (non-condensing)
Connection mode	Direct connection
Rotating direction	The motor rotates counterclockwise viewed from the load side (CCW) with the forward rotation command.

2) Motor Ratings

Model	Rated Output (kW)*1	Rated Torque (N•m)	Max. Torque (N•m)	Rated Current (A)	Max. Current (A)	Rated Speed (RPM)	Max. Speed (RPM)	Torque Coefficient (N•m/A)	Rotor Inertia (10-4 kg•m2)	Voltage (V)
ISMH										
ISMH2-20C30CD-A351Y-Om19	2	6.36	19.1	5.89	20	3000	5000	1.08	3.06	380
ISMH2-20C30CD-A331Y-Om19	2	6.36	19.1	5.89	20			1.08	3.06	
ISMH3-18C15CD-A351B-Om19	1.8	11.5	28.75	6.6	16.5	1500	3000	1.74	25.5	
ISMH3-18C15CD-A351B-Om24	1.8	11.5	28.75	6.6	16.5			1.74	25.5	
ISMH3-56C30CD-A351B-Om24	5	18	36	12	24	3000	3600	1.50	40	
ISMH3-56C30CD-A331B-Om24	5	18	36	12	24			1.50	40	

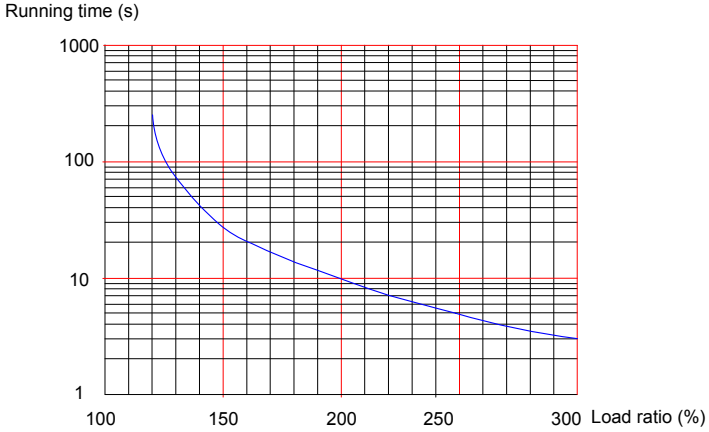
Note*1: The motor with an oil seal must be derated by 20% during use.

These items and torque-speed characteristic values are obtained when the motor works together with Inovance drive units and the armature coil temperature is 20°C.

3) Motor Overload Characteristics

Load Ratio (%)	Running Time (s)	Load Ratio (%)	Running Time (s)
120	230	200	10
130	80	210	8.5
140	40	220	7
150	30	230	6
160	20	240	5.5
170	17	250	5
180	15	300	3
190	12		

Figure 2-4 Motor overload curve



Note:

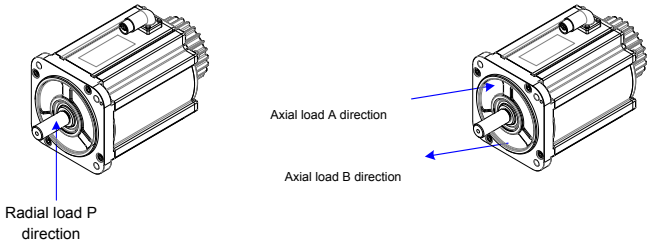
The maximum torque of H3-18C15CD is 2.5 times the rated torque.

The maximum torque of H3-56C30CD is 2 times the rated torque.

The maximum torque of H2-20C30CD is 3 times the rated torque.

4) Motor Radial and Axial Loads

Figure 2-5 Motor radial and axial load diagram



Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)
ISMH2-20C30CD-A331Y-Om19	686	196
ISMH2-20C30CD-A351Y-Om19		
ISMH3-56C30CD-A331B-Om24	1176	392
ISMH3-56C30CD-A351B-Om24		
ISMH3-18C15CD-A351B-Om19	980	392
ISMH3-18C15CD-A351B-Om24		

1. The power supply of the brake must not be shared with other electrical devices. This is to prevent malfunction of the brake due to voltage or current drop that occurs when other electrical devices work.

Cables of 0.5 mm^2 or greater in diameter are recommended.

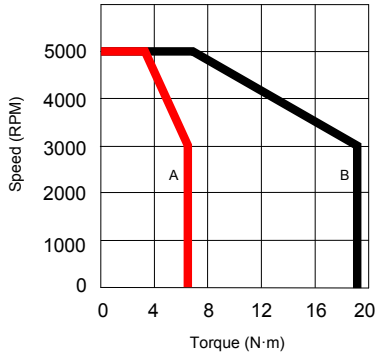
5) Motor Torque-Speed Characteristics

a) ISMH2 (low inertia, medium capacity)

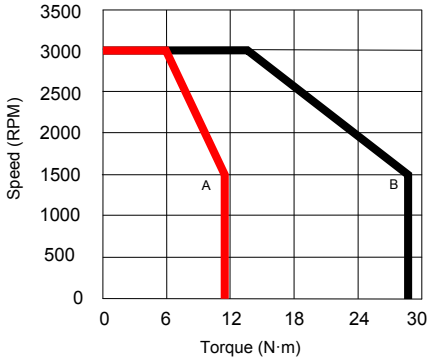
A Continuous operating area

B Short-time operating area

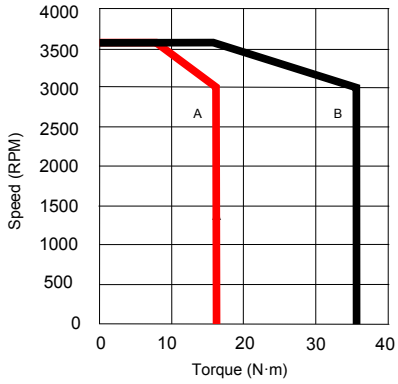
ISMH2-20C30CD



ISMH3-18C15CD



ISMH3-56C30CD



2.2.2 Specifications of the ISMH Servo Motor Series

1. Designation Rules and Nameplate

Figure 2-6 Designation rules and nameplate of servo motor

ISM H1-75B 30C B-A3 3 1 Z

Mark	Series
ISM	IS series servo motor

Mark		Feature
H	1	Low inertia, small capacity
	2	Low inertia, medium capacity
	3	Medium inertia, medium capacity
	4	Medium inertia, small capacity

Mark	Rated Power (W)
1 letter + 1 number	
A	×1
B	×10
C	×100
D	×1000
E	×10000
Example: 75B: 750 W 15C: 1500 W	

Mark	Rated Speed (RPM)
1 letter + 1 number	
A	×1
B	×10
C	×100
D	×1000
E	×10000
Example: 15B:150 RPM 30C: 3000 RPM	

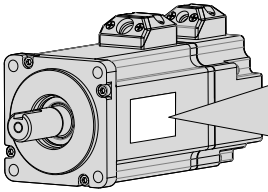
Mark	Voltage Class
A	110 V
B	220 V
C	300 V
D	380 V

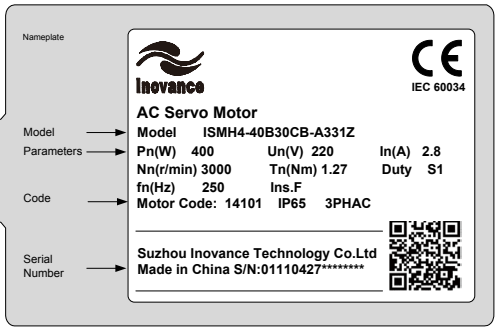
Mark	Motor Shaft
1	Plain
2	Solid + keyed
3	Solid + keyed + tapped hole
5	Solid + tapped hole

Mark		Encoder Type
1 letter + 1 digit		
U	1	2500 PPR wire-saving encoder
	2	20-bit serial encoder
A	3	23-bit multi-turn absolute encoder

Mark	Customized Feature
X	Natural cooling
Y	Military spec. connection
Z	2nd generation servo motor

Mark	Brake, Reducer, Oil Sealing
0	None
1	Oil sealing
2	Brake
4	Brake + oil sealing





2. Servo Motor Specifications

1) Motor Mechanical Characteristics

Item	Description
Rated time	Continuous
Vibration level	V15
Insulation resistance	500 VDC, above 10 MΩ
Operating temperature	0–40°C
Excitation mode	Permanent magnetic
Mounting mode	Flange
Heat-resistance level	F
Housing protection mode	H1, H4: IP65 (except the shaft-through portion) Other: IP67
Operating humidity	20–80% (non-condensing)
Connection mode	Direct connection
Rotating direction	The motor rotates counterclockwise viewed from the load side (CCW) with the forward rotation command.

2) Motor Ratings

Model	Rated Output (kW)*1	Rated Torque (N•m)	Maximum Torque (N•m)	Rated Current (A)	Maximum Current (Arms)	Rated Speed (RPM)	Maximum Speed (RPM)	Torque Parameter (N•m/A)	Rotor Load Inertia (10-4 kg•m2)	Voltage (V)
ISMH1 (Vn = 3000 RPM, Vmax = 6000 RPM)										
ISMH1-10B30CB-***Z	0.1	0.32	0.96	1.1	3.3	3000	6000	0.298	0.046 (0.048)*2	220
ISMH1-20B30CB-***Z	0.2	0.63	1.91	1.6	5.12			0.50	0.149 (0.163)	
ISMH1-40B30CB-***Z	0.4	1.27	3.82	2.8	8.96			0.50	0.25	
ISMH1-55B30CB-***Z	0.55	1.75	5.25	3.8	12.2			0.496	1.04	
ISMH1-75B30CB-***Z	0.75	2.39	7.16	4.80	15.10			0.57	1.3	
ISMH1-10C30CB-***Z	1.0	3.18	9.55	7.6	24.5			0.485	1.7	
ISMH2 (Vn = 3000 RPM, Vmax = 6000/5000 RPM)										
ISMH2-10C30CB-***Y	1.0	3.18	9.54	7.5	23.00	3000	6000	0.43	1.87 (3.12)	220
ISMH2-15C30CB-***Y	1.5	4.90	14.7	10.8	32.00		5000	0.45	2.46 (3.71)	
ISMH2-10C30CD-***Y	1.0	3.18	9.54	3.65	11.00		6000	0.87	1.87 (3.12)	380
ISMH2-15C30CD-***Y	1.5	4.90	14.7	4.50	14.00		5000	1.09	2.46 (3.71)	
ISMH2-20C30CD-***Y	2.0	6.36	19.1	5.89	20.00	3000	5000	1.08	3.06	380
ISMH2-25C30CD-***Y	2.5	7.96	23.9	7.56	25.00			1.05	3.65	
ISMH2-30C30CD-***Y	3.0	9.8	29.4	10.00	30.00			0.98	7.72	
ISMH2-40C30CD-***Y	4.0	12.6	37.8	13.60	40.80			0.93	12.1	
ISMH2-50C30CD-***Y	5.0	15.8	47.6	16.00	48.00			1.07	15.4	

Model	Rated Output (kW)*1	Rated Torque (N•m)	Maximum Torque (N•m)	Rated Current (A)	Maximum Current (Arms)	Rated Speed (RPM)	Maximum Speed (RPM)	Torque Parameter (N•m/A)	Rotor Load Inertia (10-4 kg•m2)	Voltage (V)
ISMH3 (Vn = 1500 RPM, Vmax = 3000 RPM)										
ISMH3-85B15CB-***Y	0.85	5.39	13.5	6.60	16.50	1500	3000	0.9	13 (15.5)	220
ISMH3-13C15CB-***Y	1.3	8.34	20.85	10.00	25.00			0.9	19.3 (21.8)	
ISMH3-85B15CD-***Y	0.85	5.39	13.5	3.30	8.25			1.75	13 (15.5)	380
ISMH3-13C15CD-***Y	1.3	8.34	20.85	5.00	12.50			1.78	19.3 (21.8)	
ISMH3-18C15CD-***Y	1.8	11.5	28.75	6.60	16.50			1.8	25.5 (28)	
ISMH3-29C15CD-***Z	2.9	18.6	37.2	11.90	28.00			1.7	55 (57.2)	
ISMH3-44C15CD-***Z	4.4	28.4	71.1	16.50	40.50			1.93	88.9 (90.8)	
ISMH3-55C15CD-***Z	5.5	35.0	87.6	20.85	52.00			1.80	107 (109.5)	
ISMH3-75C15CD-***Z	7.5	48.0	119	25.70	65.00			1.92	141 (143.1)	
ISMH4 (Vn = 3000 Rpm, Vmax = 6000 RPM)										
ISMH4-40B30CB-***Z	0.4	1.27	3.82	2.80	10.10	3000	6000	0.50	0.653 (0.667)	220
ISMH4-75B30CB-***Z	0.75	2.39	7.16	4.80	15.10			0.57	2.02 (2.033)	

Note 1: The motor with an oil seal must be derated by 10% during use.

Note 2: Parameters in () are for a motor with a brake.

The parameter values in the preceding table are applicable when the motor works together with the Inovance servo drive and the armature coil temperature is 20°C.

The preceding table shows the characteristic parameters of the motor after a heatsink below is installed for the motor.

ISMH1/ISMH4: 250 × 250 × 6 mm (aluminum)

ISMH2-10C to 25C: 300 × 300 × 12mm (aluminum)

ISMH2-30C to 50C: 400 × 400 × 20mm (aluminum)

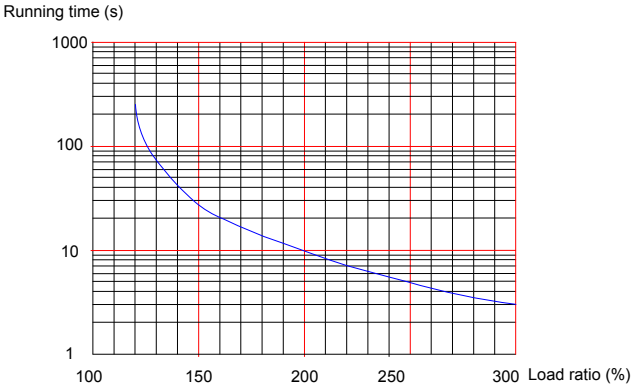
ISMH3-85B to 18C: 400 × 400 × 20mm (iron)

ISMH3-29C to 75C: 360 × 360 × 5mm (double aluminum plate)

3) Motor Overload Characteristics

Load Ratio (%)	Running Time (s)	Load Ratio (%)	Running Time (s)
120	230	200	10
130	80	210	8.5
140	40	220	7
150	30	230	6
160	20	240	5.5
170	17	250	5
180	15	300	3
190	12		

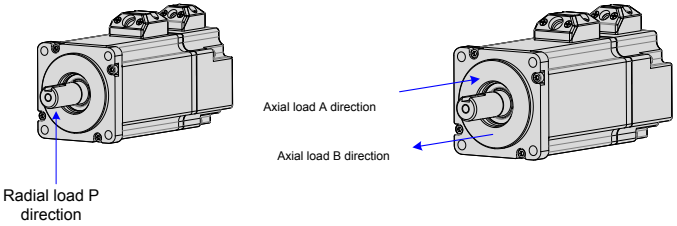
Figure 2-7 Motor overload curve



The maximum torque of H1, H2, and H4 are 3 times the rated torque.
Except for the 2.9 kW model, the maximum torque of H3 is 2.5 times the rated torque.
The maximum torque of the 2.9 kW model is 2 times the rated torque.

4) Motor Radial and Axial Loads

Figure 2-8 Motor radial and axial load diagram



Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)	Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)
ISMH1-10B30CB-***Z	78	54	ISMH2-40C30CD-***Y	1176	392
ISMH1-20B30CB-***Z	245	74	ISMH2-50C30CD-***Y	1176	392
ISMH1-40B30CB-***Z	245	74	ISMH3-85B15CB-***Y	490	98
ISMH1-55B30CB-***Z	392	147	ISMH3-13C15CB-***Y	686	343
ISMH1-75B30CB-***Z	392	147	ISMH3-85B15CD-***Y	490	98
ISMH1-10C30CB-***Z	392	147	ISMH3-13C15CD-***Y	686	343
ISMH2-10C30CB-***Y	686	196	ISMH3-18C15CD-***Y	980	392
ISMH2-15C30CB-***Y	686	196	ISMH3-29C15CD-***Z	1470	490
ISMH2-10C30CD-***Y	686	196	ISMH3-44C15CD-***Z	1470	490
ISMH2-15C30CD-***Y	686	196	ISMH3-55C15CD-***Z	1764	588
ISMH2-20C30CD-***Y	686	196	ISMH3-75C15CD-***Z	1764	588

Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)	Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)
ISMH2-25C30CD-***Y	686	196	ISMH4-40B30CB-***Z	245	74
ISMH2-30C30CD-***Y	980	392	ISMH4-75B30CB-***Z	392	147

5) Electrical Specifications of Motors with a Brake

Servo Motor Model	Holding Torque (Nm)	Supplied Voltage (V) ± 10%	Resistance (Ω)±7%	Supplied Current Range (A)	Brake Release Time (ms)	Brake Apply Time (ms)	Rotary Clearance
ISMH1-10B	0.32	24	96	0.23 to 0.27	10	30	< 1.7
ISMH1-20B/40B	1.3	24	82.3	0.25 to 0.34	20	50	< 1.5
ISMH1-75B	2.39	24	50.1	0.40 to 0.57	25	60	< 1.5
ISMH2-10C/15C	8	24	25	0.81 to 1.14	30	90	< 0.5
ISMH3-85B/13C/18C	16	24	21.3	0.95 to 1.33	60	120	< 0.5
ISMH3-29C/44C/55C/75C	48	24	13.7	1.47 to 2.07	100	230	< 0.5
ISMH4-40B	1.3	24	82.3	0.25 to 0.34	20	50	< 1.5
ISMH4-75B	2.39	24	50.1	0.40 to 0.57	25	60	< 1.5

The power supply of the brake must not be shared with other electrical devices. This is to prevent malfunction of the brake due to voltage or current drop that occurs when other electrical devices work.

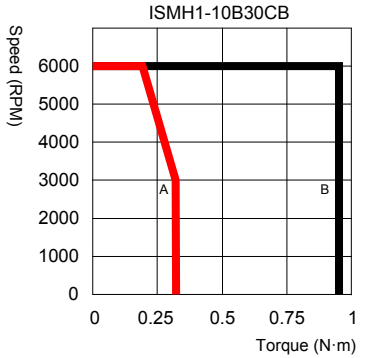
Cables of 0.5 mm^2 or greater in diameter are recommended.

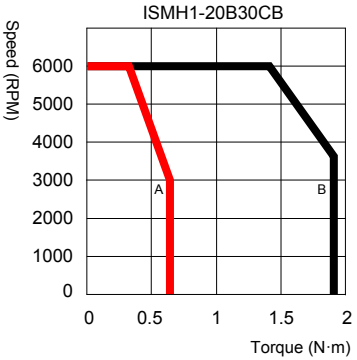
6) Motor Torque-Speed Characteristics

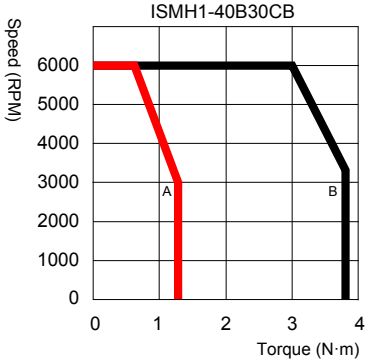
a) ISMH1 (low inertia, small capacity)

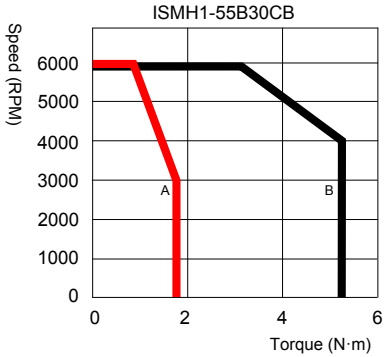
A Continuous operating area

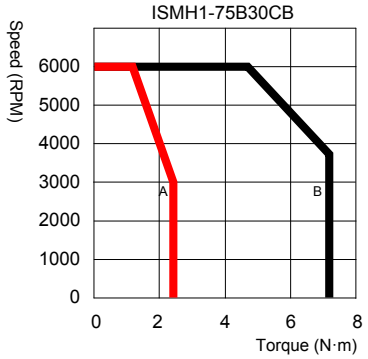
B Short-time operating area

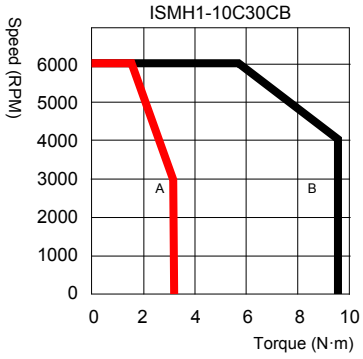








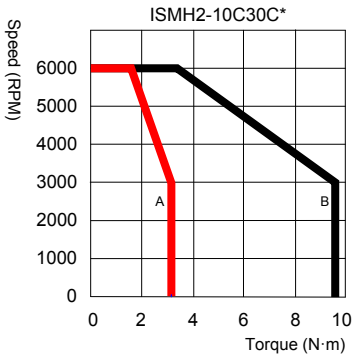


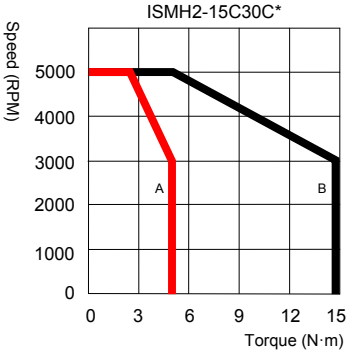


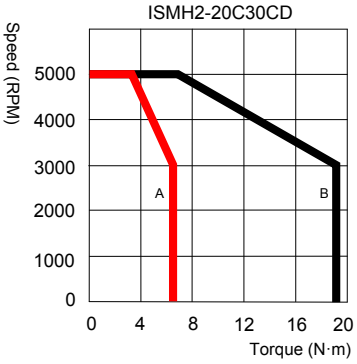
b) ISMH2 (low inertia, medium capacity)

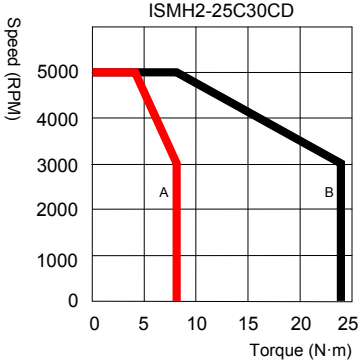
A Continuous operating area

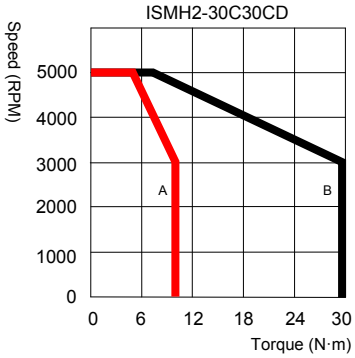
B Short-time operating area

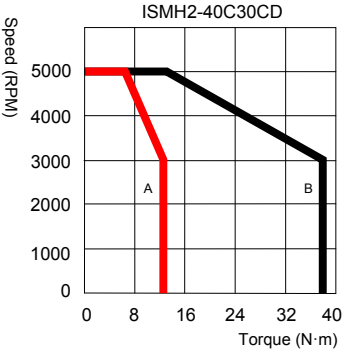


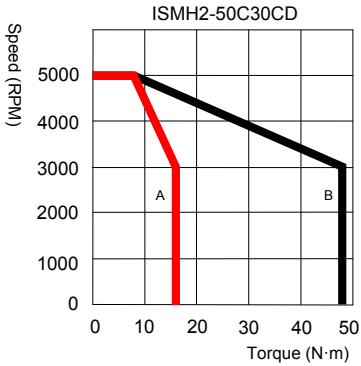








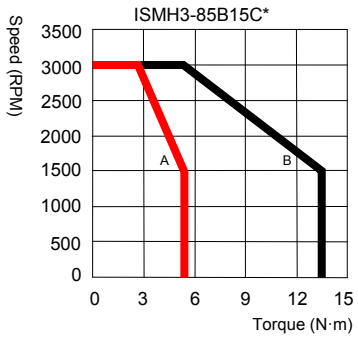


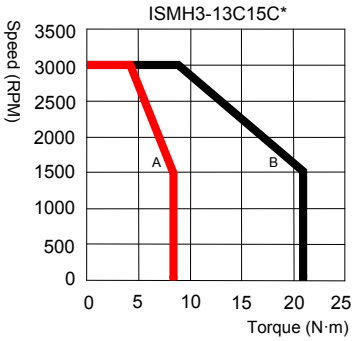


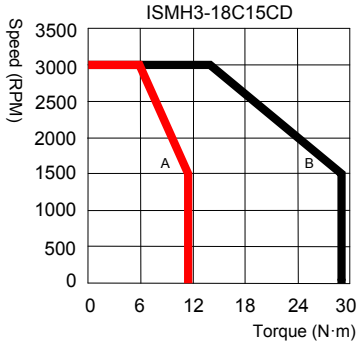
c) ISMH3 (medium inertia, medium capacity)

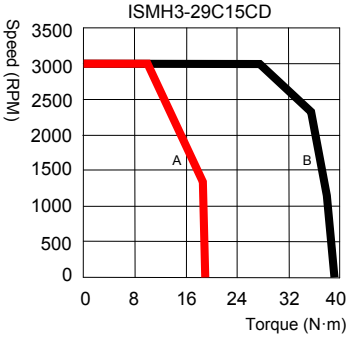
A Continuous operating area

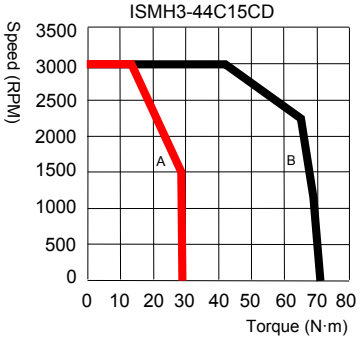
B Short-time operating area

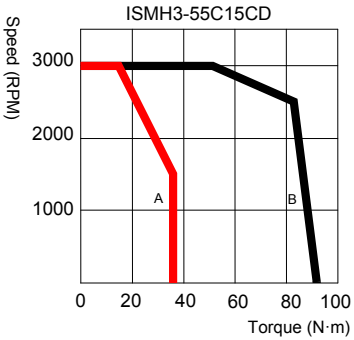


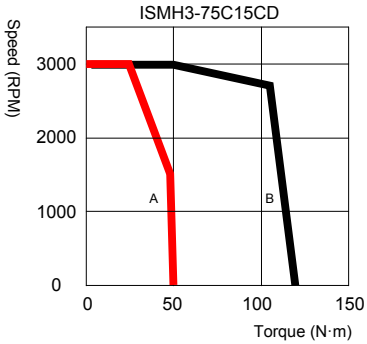








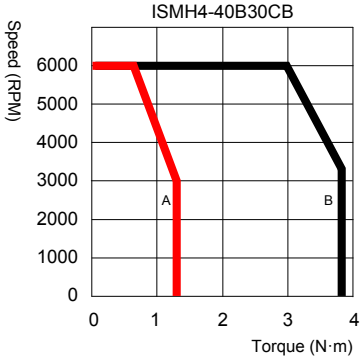


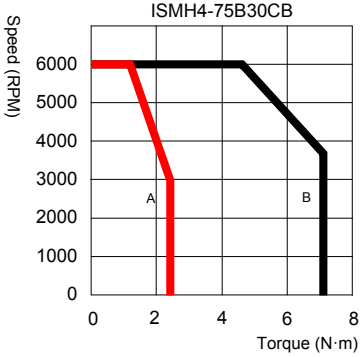


d) ISMH4 (medium inertia, small capacity)

A Continuous operating area

B Short-time operating area





2.2.3 Specifications of ISMG the Servo Motor Series

1. Designation Rules and Nameplate

ISM G1- 30D 15C D – A3 3 1 F A

Mark	Series
ISM	IS series servo motor

Mark	Base	
G	1	200×200 base
	2	266×266 base

Mark	Rated Power (W)
1 letter and 1 number	
A	×1
B	×10
C	×100
D	×1000
E	×10000
Example: 15C: 1500 W 30D: 30000 W	

Mark	Rated Speed (RPM)
1 letter and 1 number	
A	×1
B	×10
C	×100
D	×1000
E	×10000
Example: 15C:1500 RPM 20C: 2000 RPM	

Mark	Voltage Class
D	380 V

Mark	Product Code
A	2nd generation product

Mark	Customized Feature
X	Natural cooling
F	Forced cooling

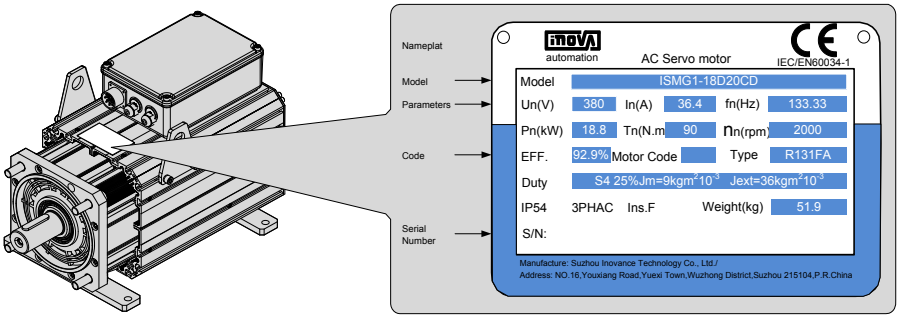
Mark	Brake, Reducer, Oil Sealing
1	Oil sealing

Mark	Motor Shaft
1	Plain
3	Solid + keyed + tapped hole

Mark	Encoder Type
1 letter + 1 digit	
A3	23-bit multi-turn absolute encoder

Note: Models ending with –A331* are standard models. Prior ordering is required for non-standard models.

Figure 2-9 Designation rules and nameplate of the servo motor series



2. Servo Motor Specifications

Table 2-1 Servo motor specifications

Servo Motor Model	Power (kW)	Voltage (V)	Current (A)	Speed (RPM)	Frequency (Hz)	Torque (Nm)	D-axis Phase Inductance (mH)	Q-axis Phase Inductance (mH)
ISMG1-95C15CD-A331FA	7.9	380	14.5	1500	100	50	5.34	5.34
ISMG1-12D20CD-A331FA	10.5	380	20.3	2000	133.33	50	2.73	2.73
ISMG1-14D15CD-A331FA	11.8	380	22.9	1500	100	75	3.49	3.49
ISMG1-17D15CD-A331FA	14.5	380	28.1	1500	100	92	2.73	2.73
ISMG1-18D20CD-A331FA	15.7	380	28.6	2000	133.33	75	2.24	2.24
ISMG1-22D15CD-A331FA	18.1	380	33.4	1500	100	115	2.46	2.46
ISMG1-23D20CD-A331FA	19.3	380	37.4	2000	133.33	92	1.53	1.53
ISMG1-28D20CD-A331FA	24.1	380	46.7	2000	133.33	115	1.26	1.26
ISMG1-30D15CD-A331FA	23.6	380	45.9	1500	100	150	1.64	1.64
ISMG1-41D20CD-A331FA	31.4	380	57.3	2000	133.33	150	1.05	1.05
ISMG2-31D15CD-A331FA	26.7	380	49.4	1500	100	170	2.22	2.22
ISMG2-42D20CD-A331FA	35.6	380	69.1	2000	133.33	170	1.13	1.13
ISMG2-42D15CD-A331FA	36.1	380	70.3	1500	100	230	1.46	1.46
ISMG2-52D15CD-A331FA	44.8	380	87.2	1500	100	285	1.14	1.14
ISMG2-57D20CD-A331FA	48.2	380	87.8	2000	133.33	230	0.93	0.93
ISMG2-60D15CD-A331FA	53.4	380	98.8	1500	100	340	1.03	1.03
ISMG2-70D20CD-A331FA	59.7	380	115.9	2000	133.33	285	0.64	0.64
ISMG2-80D20CD-A331FA	71.2	380	138.2	2000	133.33	340	0.53	0.53
ISMG2-80D15CD-A331FA	69.1	380	134.6	1500	100	440	0.69	0.69
ISMG2-94D15CD-A331FA	80.1	380	156	1500	100	510	0.55	0.55
ISMG2-11E20CD-A331F	92.1	380	167.9	2000	133.33	440	0.44	0.44

Servo Motor Model	Phase Resistance (mΩ)	Torque Para. (Nm/A)	Back EMF at Rated Speed (V)	Peak Speed (RPM)	Peak Torque (Nm)	Peak Current (A)	Inertia (kg.cm2)	Weight (kg)
ISMG1-95C15CD-A331FA	480	3.44	311.9	1830	135	43.2	75	45.2
ISMG1-12D20CD-A331FA	240	2.46	297	2560	135	60.4	75	45.2

Servo Motor Model	Phase Resistance (mΩ)	Torque Para. (Nm/A)	Back EMF at Rated Speed (V)	Peak Speed (RPM)	Peak Torque (Nm)	Peak Current (A)	Inertia (kg.cm2)	Weight (kg)
ISMG1-14D15CD-A331FA	282.8	3.27	297	1920	203	68.3	90	51.9
ISMG1-17D15CD-A331FA	200.4	3.27	297	1920	248	83.4	105	59
ISMG1-18D20CD-A331FA	174	2.62	316.8	2400	203	85.2	90	51.9
ISMG1-22D15CD-A331FA	171.9	3.44	311.9	1830	311	99.4	120	66
ISMG1-23D20CD-A331FA	114.9	2.46	297	2560	248	110.9	105	59
ISMG1-28D20CD-A331FA	87.7	2.46	297	2560	311	139.1	120	66
ISMG1-30D15CD-A331FA	108.1	3.27	297	1920	405	136.2	150	79.8
ISMG1-41D20CD-A331FA	69.8	2.62	316.8	2400	405	170	150	79.8
ISMG2-31D15CD-A331FA	70.7	3.44	311.9	1830	366	117	296	122
ISMG2-42D20CD-A331FA	36.2	2.46	297	2560	366	163.7	296	122
ISMG2-42D15CD-A331FA	42.4	3.27	297	1920	495	166.5	368	141.3
ISMG2-52D15CD-A331FA	30.9	3.27	297	1920	613	206.2	434	158.4
ISMG2-57D20CD-A331FA	26.9	2.62	316.8	2400	495	207.8	368	141.3
ISMG2-60D15CD-A331FA	30.4	3.44	311.9	1830	731	233.8	500	175.4
ISMG2-70D20CD-A331FA	17.4	2.46	297	2560	613	274.1	434	158.4
ISMG2-80D20CD-A331FA	16.4	2.46	297	2560	731	326.9	500	175.4
ISMG2-80D15CD-A331FA	20.1	3.27	297	1920	946	318.2	640	217
ISMG2-94D15CD-A331FA	12.6	3.27	297	1920	1097	369	800	260
ISMG2-11E20CD-A331F	10.7	2.62	316.8	2400	946	397.2	640	217

Note: For other motor specifications and models, contact Inovance.

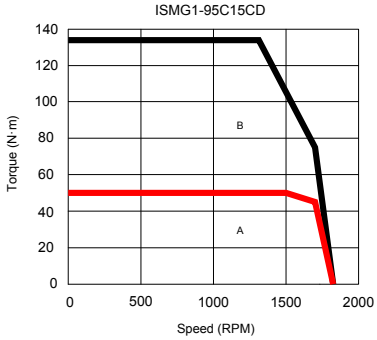
3. Specifications of ISMG Series Motors with a Brake

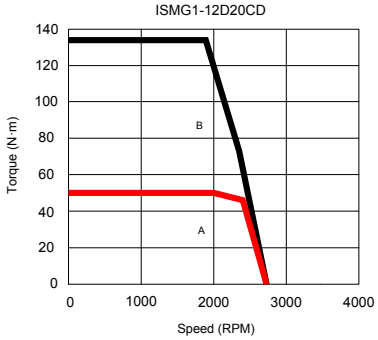
- When deciding the length of the cable on the motor brake side, consider voltage drop caused by the cable resistance. The input voltage must be at least 21.6 V to make the brake work.
- The following table lists brake specifications of ISMG servo motors.

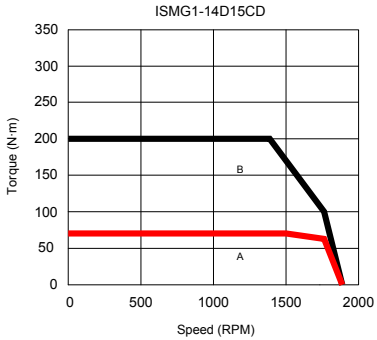
Table 2-2 Brake specifications

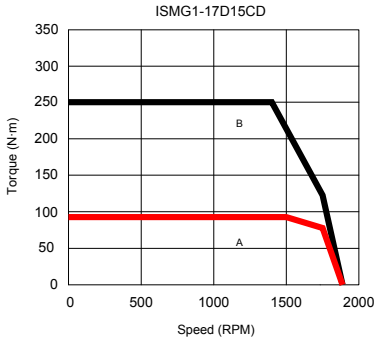
Servo Motor Model	Holding Torque (Nm)	Supply Voltage (V) ± 10%	Resistance at 20°C (Ω) ± 5%	Supply Current Range at 20°C (A) ± 10%	Brake Release Time (ms)	Braking Time (ms)	Rotary Clearance (mm)
ISMG1-95C15CD	150	DC 24	8.2	2.9	301	225	0.3 to 0.5
ISMG1-14D15CD							
ISMG1-17D15CD							
ISMG1-22D15CD							
ISMG1-30D15CD							

4. Safe Operating Area of Sevo Motor

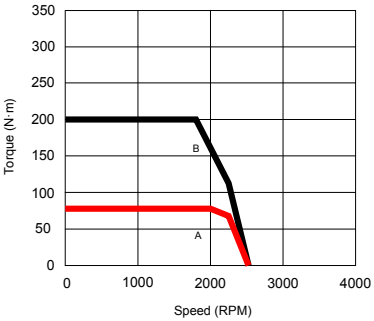




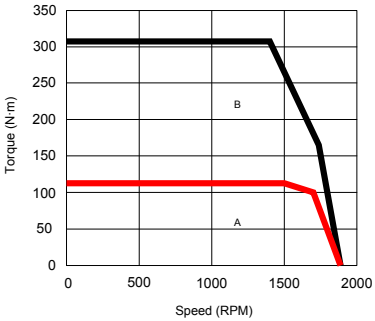




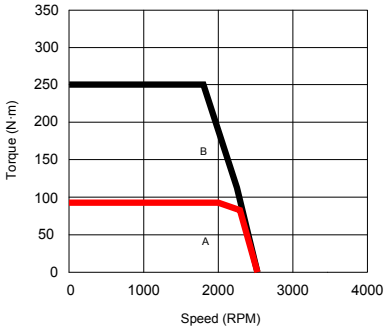
ISMG1-18D20CD



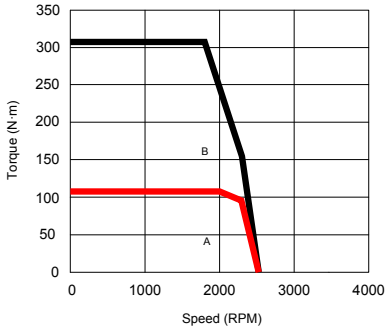
ISMG1-22D15CD



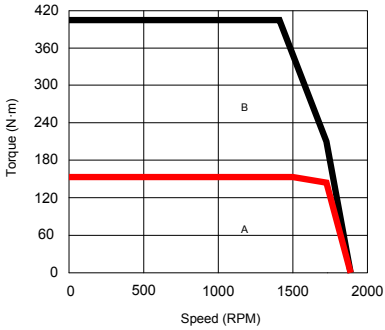
ISMG1-23D20CD



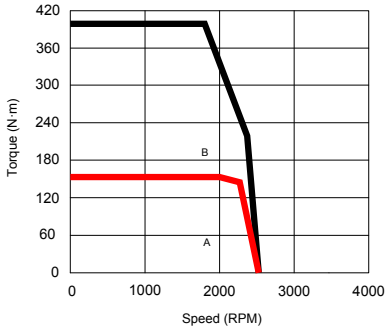
ISMG1-28D20CD



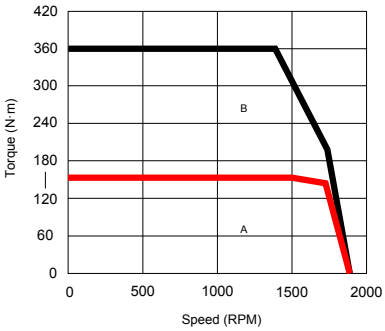
ISMG1-30D15CD



ISMG1-41D20CD



ISMG2-31D15CD



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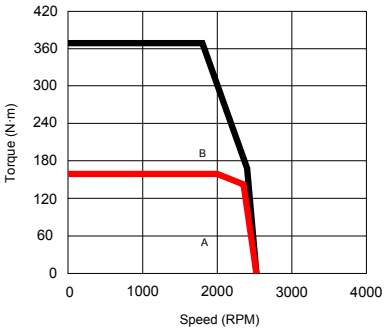

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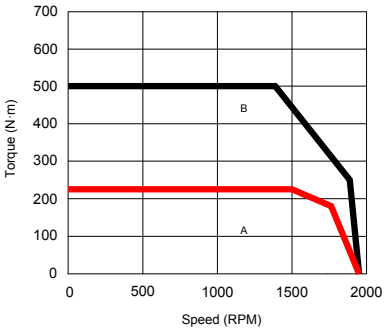
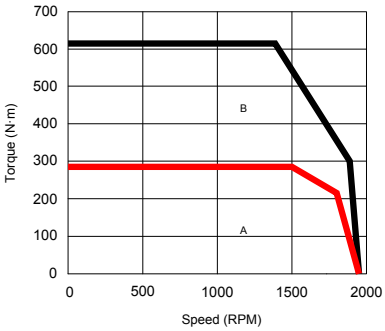
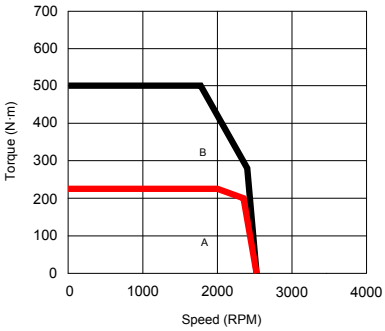


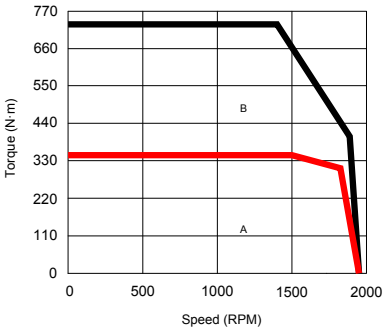
ISMG2-52D15CD



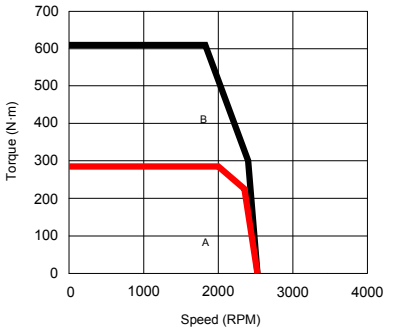
ISMG2-57D20CD



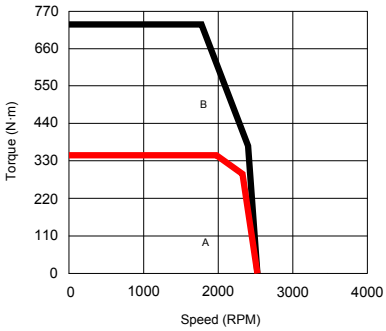
ISMG2-60D15CD



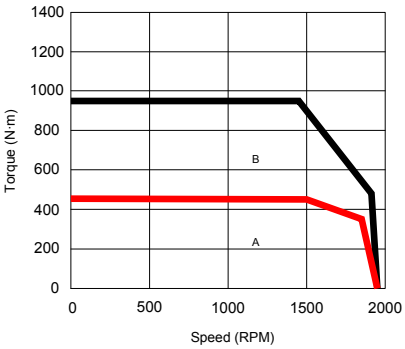
ISMG2-70D20CD



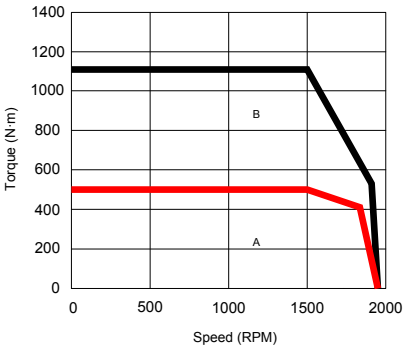
ISMG2-80D20CD



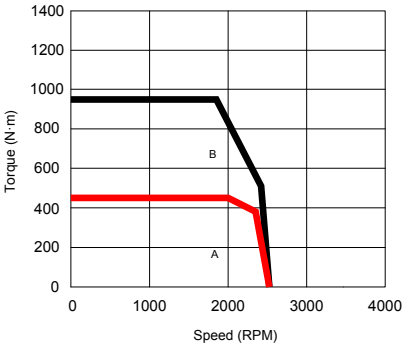
ISMG2-80D15CD



ISMG2-94D15CD



ISMG2-11E20CD



2.2.4 Specifications of the MS1 Servo Motor Series

1. Designation Rules and Nameplate

Figure 2-10 Designation rules and nameplate of the servo motor series

MS1 H1 – 40B 30C B – A3 3 1 Z

Mark	Series
MS1	MS series servo motor

Mark	Type
H	1: Low inertia, small capacity
	2: Low inertia, medium capacity
	3: Medium inertia, medium capacity
	4: Medium inertia, small capacity

Mark	Rated Power (W)
1 number + 1 letter	
A	x1
B	x10
C	x100
D	x1000
E	x10000
Example: 40B: 400 W	

Mark	Rated Speed (RPM)
1 number + 1 letter	
A	x1
B	x10
C	x100
D	x1000
E	x10000
Example: 30C: 3000 RPM	

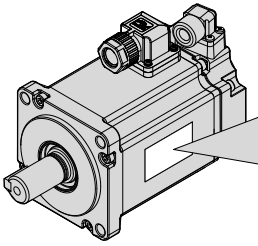
Mark	Motor Specification
Z	Z series motor
Z-S	Leadwire-type motor

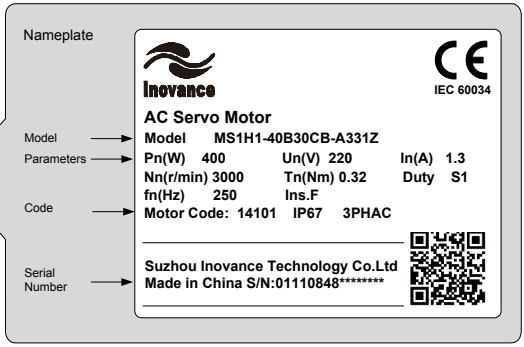
Mark	Brake, Reducer, Oil Sealing
0	None
1	Oil sealing
2	Brake
4	Oil sealing + brake

Mark	Motor Shaft
1	Plain
2	Solid + keyed
3	Solid + keyed + tapped hole
5	Solid +tapped

Mark	Encoder Type
1 letter + 1 digit	
A3	23-bit multi-turn absolute encoder

Mark	Voltage Class
B	220 V
D	380 V





Note: The information above applies only to 40\60\80 bases.

2. Specifications of Servo Motor

1) Motor Mechanical Characteristics

Item	Description
Rated time	Continuous
Vibration level	V15
Insulation resistance	500 V DC, greater than 10 MΩ
Operating temperature	0–40°C
Excitation mode	Permanent magnet
Mounting Mode	Flange
Heat-resistance level	Level F
Insulation voltage	1,500 V AC, 1 minute (200 V) 1,800 V AC, 1 minute (400 V)
Housing protection mode	H1 and H4: IP67 (except the through-shaft portion and connectors)
Operating humidity	20–80% (non-condensing)
Connection mode	Direct connection
Rotating direction	The motor rotates counterclockwise viewed from the load side (CCW) with the forward rotation command.

2) Motor Ratings

Model	Rated Output (kW)*1	Rated Torque (N•m)	Maximum Torque (N•m)	Rated Current (A)	Maximum Current (Arms)	Rated Speed (RPM)	Maximum Speed (RPM)	Torque Parameter (Nm/A)	Rotor Load Inertia (10-4 kg m2)	Voltage (V)
MS1H1 (Vn = 3000 RPM, Vmax = 6000 RPM)										
MS1H1-05B30CB-***Z-S	0.05	0.16	0.56	1.3	4.6	3000	6000	0.15	0.026 (0.028)*2	220
MS1H1-10B30CB-***Z-S	0.1	0.32	1.12	1.3	4.9			0.26	0.041 (0.043)*2	
MS1H1-20B30CB-***Z-S	0.2	0.64	2.2	1.5	5.6			0.46	0.207 (0.220)*2	
MS1H1-40B30CB-***Z-S	0.4	1.27	4.5	2.8	10.8			0.51	0.376 (0.390)*2	
MS1H1-55B30CB-***Z-S	0.55	1.75	6.13	3.8	15			0.48	1.06	
MS1H1-75B30CB-***Z-S	0.75	2.39	8.4	4.8	19			0.53	1.38 (1.43)*2	
MS1H1-10C30CB-***Z-S	1	3.18	11.13	7.6	28			0.46	1.75	
MS1H4 (Vn = 3000 RPM, Vmax = 6000 RPM)										
MS1H4-40B30CB-***Z-S	0.4	1.27	4.5	2.8	10.8	3000	6000	0.51	1.87 (3.12)	220
MS1H4-75B30CB-***Z-S	0.75	2.39	8.4	4.8	19			0.53	2 (2.012)*2	

Note 1: The motor with an oil seal must be derated by 20% during use.

Note 2: Parameters in () are for the motors with a brake.

The parameter values in the preceding table are applicable when the motor works together with the Inovance servo drive and the armature coil temperature is 20°C.

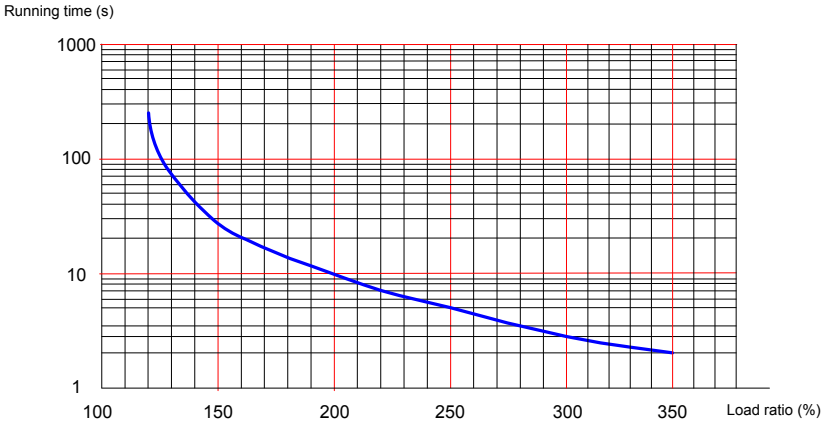
The preceding table shows the characteristic parameters of the motor after the heatsink below is installed for the motor.

MS1H1/MS1H4: 250 × 250 × 6 mm (aluminum)

3) Motor Overload Characteristics

Load Ratio (%)	Running Time (s)	Load Ratio (%)	Running Time (s)
120	230	200	10
130	80	210	8.5
140	40	220	7
150	30	230	6
160	20	240	5.5
170	17	250	5
180	15	300	3
190	12	350	2

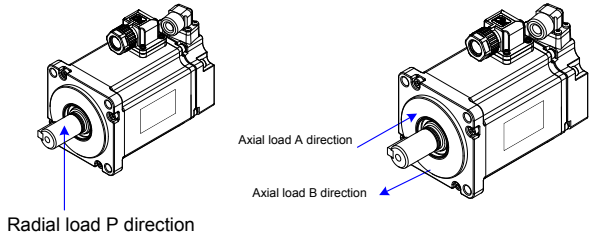
Figure 2-11 Motor overload curve



The maximum torque of H1 and H4 is 3.5 times the rated torque.

4) Motor Radial and Axial Loads

Figure 2-12 Motor radial and axial load diagram



Servo Motor Model	Allowed Radial Load (N)	Allowed Axial Load (N)
MS1H1-05B30CB-***Z-S	78	54
MS1H1-10B30CB-***Z-S	78	54
MS1H1-20B30CB-***Z-S	245	74
MS1H1-40B30CB-***Z-S	245	74
MS1H1-55B30CB-***Z-S	392	147
MS1H1-75B30CB-***Z-S	392	147
MS1H1-10C30CB-***Z-S	392	147
MS1H4-40B30CB-***Z-S	245	74
MS1H4-75B30CB-***Z-S	392	147

5) Electrical Specifications of Motors with a Brake

Servo Motor Model	Holding Torque (Nm)	Supply Voltage (V) ± 10%	Resistance at 20°C (Ω) ± 10%	Supply Current Range at 20°C (A) ± 10%	Brake Release Time (ms)	Braking Time (ms)	Rotary Clearance (°)
MS1H1-05B/10B	0.32	DC 24	94.4	0.254	≤ 20	≤ 35	< 1.7
MS1H1-20B/40B	1.5	DC 24	75.79	0.3	≤ 20	≤ 50	< 1.5
MS1H1-75B	2.5	DC 24	72	0.333	≤ 20	≤ 60	< 1.7
MS1H4-40B	1.5	DC 24	75.79	0.3	≤ 20	≤ 50	< 1.5
MS1H4-75B	2.5	DC 24	72	0.333	≤ 20	≤ 60	< 1.7

The power supply of the brake must not be sharedwith other electrical devices. This is to prevent malfunction of the brake due to voltage or current drop that occurs when other electrical devices work.

Cables of 0.5 mm2 or greater in diameter are recommended.

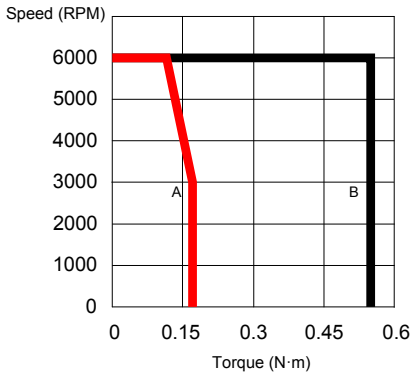
6) Motor Torque-Speed Characteristics

a) MS1H1 (low inertia, small capacity)

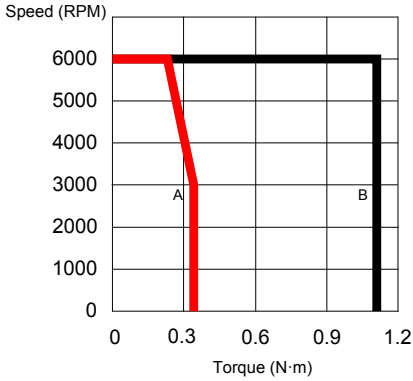
A Continuous operating area

B Short-time operating area

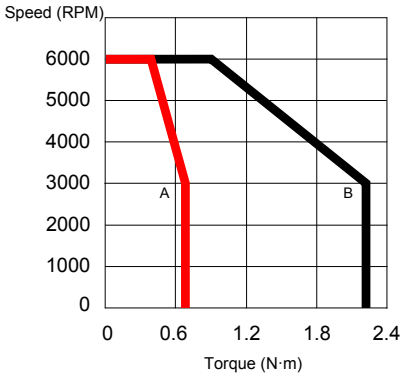
MS1H1-05B30CB



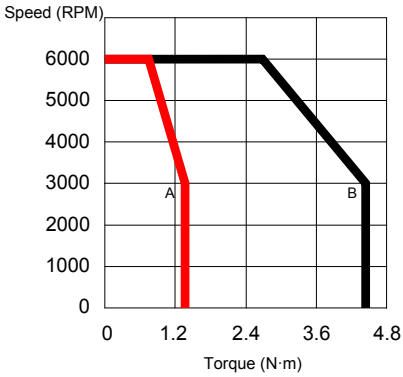
MS1H1-10B30CB

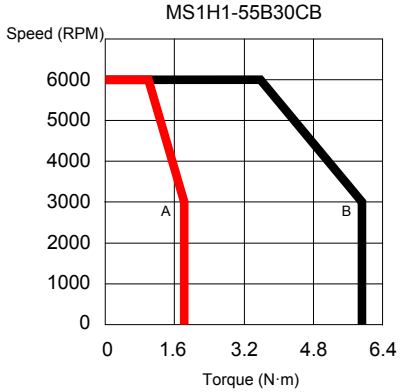


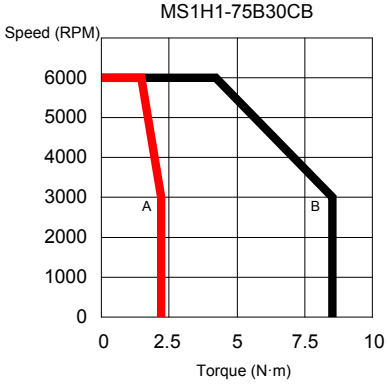
MS1H1-20B30CB

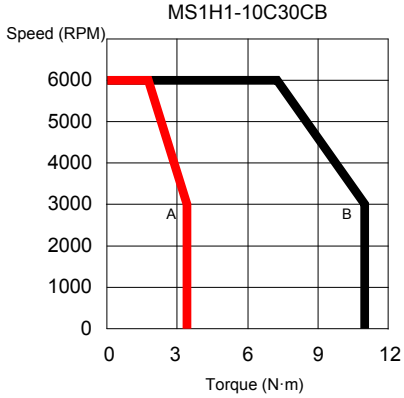


MS1H1-40B30CB

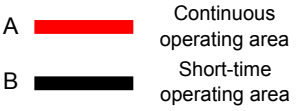


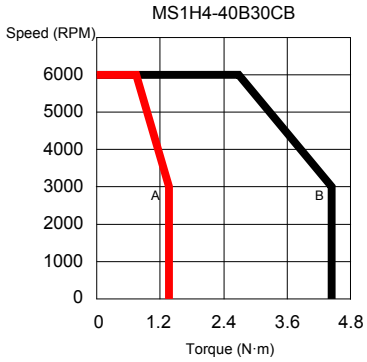


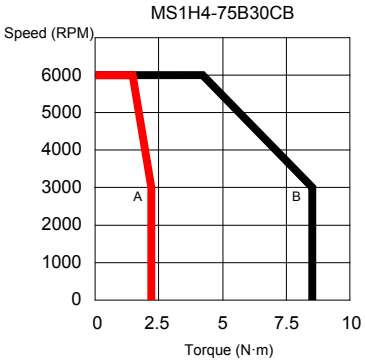




b) MS1H4 (medium inertia, small capacity)







2.3 Servo System Configuration

Rated Speed (RPM)	Max. Speed (RPM)	Capacity (kW)	Servo Motor Model	Motor Frame	Drive Model	Drive Size	Drive SN (H01-10)
1500	3000	1.8	ISMH3-18C15CD-A351B-Om19 ISMH3-18C15CD-A351B-Om24	130	IS810N50M4TD012INT	1	10004
3000	5000	2.0	ISMH2-20C30CD-A351Y-Om19 ISMH2-20C30CD-A331Y-Om19	100			
3000	3600	5.0	ISMH3-56C30CD-A351B-Om24 ISMH3-56C30CD-A331B-Om24	130			
3000	6000	0.1	ISMH1-10B30CB-***Z	40	IS810N50M4TD3R5INT		10001
		0.2	ISMH1-20B30CB-***Z	60			
		0.4	ISMH1-40B30CB-***Z				
		0.55	ISMH1-55B30CB-***Z	80	IS810N50M4TD5R4INT		10002
		0.75	ISMH1-75B30CB-***Z				
3000	6000	1.0	ISMH2-10C30CD-***Y				
3000	5000	1.5	ISMH2-15C30CD-***Y	100			
		2.0	ISMH2-20C30CD-***Y		IS810N50M4TD8R4INT		10003
		2.5	ISMH2-25C30CD-***Y				
		3.0	ISMH2-30C30CD-***Y	130	IS810N50M4TD012INT		10004
		4.0	ISMH2-40C30CD-***Y		IS810N50M4TD017INT	pins 2	10005
		5.0	ISMH2-50C30CD-***Y				
1500	3000	0.85	ISMH3-85B15CD-***Y		IS810N50M4TD3R5INT	1	10001
		1.3	ISMH3-13C15CD-***Y		IS810N50M4TD5R4INT		10002
		1.8	ISMH3-18C15CD-***Y		IS810N50M4TD8R4INT		10003
		2.9	ISMH3-29C15CD-***Z	180	IS810N50M4TD012INT		10004
		4.4	ISMH3-44C15CD-***Z		IS810N50M4TD017INT	pins 2	10005
		5.5	ISMH3-55C15CD-***Z		IS810N50M4TD021INT		10006
		7.5	ISMH3-75C15CD-***Z		IS810N50M4TD026INT		10007
3000	6000	0.4	ISMH4-40B30CB-***Z	60	IS810N50M4TD3R5INT	1	10001
		0.75	ISMH4-75B30CB-***Z	80	IS810N50M4TD5R4INT		10002
3000	6000	0.05	MS1H1-05B30CB-***Z-S	40	IS810N50M4TD3R5INT		10001
		0.1	MS1H1-10B30CB-***Z-S				
		0.2	MS1H1-20B30CB-***Z-S	60			
		0.4	MS1H1-40B30CB-***Z-S				
		0.55	MS1H1-55B30CB-**** Z-S	80	IS810N50M4TD5R4INT		10002
		0.75	MS1H1-75B30CB-***Z-S				
		1.0	MS1H1-10C30CB-***Z-S		IS810N50M4TD8R4INT		10003
		0.4	MS1H4-40B30CB-***Z-S	60	IS810N50M4TD3R5INT		10001
		0.75	MS1H4-75B30CB-***Z-S		IS810N50M4TD5R4INT		10002

Rated Speed (RPM)	Max. Speed (RPM)	Capacity (kW)	Servo Motor Model	Motor Frame	Drive Model	Drive Size	Drive SN (H01-10)
1500	1830	7.9	ISMG1-95C15CD-A331FA	200	IS810N50M4TD017INT	pins 2	10005
2000	2560	10.5	ISMG1-12D20CD-A331FA		IS810N50M4TD021INT		10006
1500	1920	11.8	ISMG1-14D15CD-A331FA		IS810N50M4TD026INT		10007
		14.5	ISMG1-17D15CD-A331FA		IS810N50M4TD032INT		10008
2000	2400	15.7	ISMG1-18D20CD-A331FA		IS810N50M4TD032INT		10008
1500	1830	18.1	ISMG1-22D15CD-A331FA		IS810N50M4TD037INT		10009
2000	2560	19.3	ISMG1-23D20CD-A331FA		IS810N50M4TD037INT		10009
		24.1	ISMG1-28D20CD-A331FA		IS810N50M4TS045INT		10010
1500	1920	23.6	ISMG1-30D15CD-A331FA				
2000	2400	31.4	ISMG1-41D20CD-A331FA		IS810N50M4TS060INT		10011
1500	1830	26.7	ISMG2-31D15CD-A331FA		IS810N50M4TS060INT		10011
2000	2560	35.6	ISMG2-42D20CD-A331FA	266	IS810N50M4TS075INT		10012
1500	1920	36.1	ISMG2-42D15CD-A331FA				
		44.8	ISMG2-52D15CD-A331FA		IS810N50M4TS091INT	3	10013
2000	2400	48.2	ISMG2-57D20CD-A331FA		IS810N50M4TS091INT		10013
1500	1830	53.4	ISMG2-60D15CD-A331FA		IS810N50M4TS112INT		
2000	2560	59.7	ISMG2-70D20CD-A331FA		IS810N50M4TS112INT		10014
		71.2	ISMG2-80D20CD-A331FA		IS810N50M4TS152INT		10015
1500	1920	69.1	ISMG2-80D15CD-A331FA				
		80.1	ISMG2-94D15CD-A331FA				
2000	2400	92.1	ISMG2-11E20CD-A331FA		IS810N50M4TS152INT		10015

2.4 Applicable Cables

2.4.1 Cables Applicable for OneCable Servo Motors (Communication Cables Included)

For specifications of OneCable servo motor cables, contact Inovance.

2.4.2 Cables Applicable for ISMH Series Servo Motors (Communication Cables Included)

Table 2-3 Cables applicable for models without a brake

Motor Model	Servo Motor Power Cable and Encoder Cable (Models Without a Brake)			
	Cable Type	L = 3.0 m	L = 5.0 m	L = 10.0 m
ISMH1-*******-U1*** ISMH1-*******-U2***	Power cable	SV82-L-M00-3.0	SV82-L-M00-5.0	SV82-L-M00-10.0
ISMH4-*******-U1*** ISMH4-*******-U2***	Incremental encoder cable	S6-L-P000-3.0	S6-L-P000-5.0	S6-L-P000-10.0
ISMH1-*******-A3*** ISMH4-*******-A3***	Power cable	SV82-L-M00-3.0	SV82-L-M00-5.0	SV82-L-M00-10.0
	Absolute encoder cable	S6-L-P020-3.0	S6-L-P020-5.0	S6-L-P020-10.0
ISMH2-*******-U1*** ISMH2-*******-U2***	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH2-*******-A3***	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1***	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
ISMH3-*******-U2*** (1.8 kW and below)	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (1.8 kW and below)	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1***	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
ISMH3-*******-U2*** (2.9 kW)	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (2.9 kW)	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1***	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
ISMH3-*******-U2*** (above 2.9 kW)	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (above 2.9 kW)	Power cable	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0

Note: The servo motor encoder cable does not include a CN1 (DB15) connector. Please purchase it separately. The model is S6-C6.

If you select Inovance matching cables, no connector kit is required.

Table 2-4 Cables applicable for models with brake

Motor Model	Servo Motor Power Cable and Encoder Cable (Models Without a Brake)			
	Cable Type	L = 3.0 m	L = 5.0 m	L = 10.0 m
ISMH1-*******-U1*** ISMH1-*******-U2*** ISMH4-*******-U1*** ISMH4-*******-U2***	Power cable	SV82-L-B00-3.0	SV82-L-B00-5.0	SV82-L-B00-10.0
	Incremental encoder cable	S6-L-P000-3.0	S6-L-P000-5.0	S6-L-P000-10.0
ISMH1-*******-A3*** ISMH4-*******-A3***	Power cable	SV82-L-B00-3.0	SV82-L-B00-5.0	SV82-L-B00-10.0
	Absolute encoder cable	S6-L-P020-3.0	S6-L-P020-5.0	S6-L-P020-10.0
ISMH2-*******-U1*** ISMH2-*******-U2***	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH2-*******-A3***	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1*** ISMH3-*******-U2*** (1.8 kW and below)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (1.8 kW and below)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1*** ISMH3-*******-U2*** (2.9 kW)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (2.9 kW)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
ISMH3-*******-U1*** ISMH3-*******-U2*** (above 2.9 kW)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Incremental encoder cable	S6-L-P001-3.0	S6-L-P001-5.0	S6-L-P001-10.0
ISMH3-*******-A3*** (above 2.9 kW)	Power cable	SV82-L-B11-3.0	SV82-L-B11-5.0	SV82-L-B11-10.0
	Absolute encoder cable	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0

Note: The servo motor encoder cable does not include a CN1(DB15)connector. Please purchase it separately. The model is S6-C6.

If you select Inovance matching cables, no connector kit is required.

Table 2-5 Connector kit

Motor Model	Connector Kit
ISMH1-*******-U1*** ISMH1-*******-U2*** ISMH1-*******-A3*** ISMH4-*******-U1*** ISMH4-*******-U2*** ISMH4-*******-A3*** (100 W to 1 kW)	S6-C6: CN1 terminal (DB15) S81-C1: CN2 terminal, 6-pin connector, 9-pin connector
ISMH2-*******-U1*** ISMH2-*******-U2*** ISMH2-*******-A3*** (1.0 to 2.5 kW)	S6-C6: CN1 terminal (DB15) S81-C2: CN2 terminal, 20-18 military spec. plug (elbow), 20-29 military spec. plug (elbow)
ISMH2-*******-U1*** ISMH2-*******-U2*** ISMH2-*******-A3*** (3.0 to 5.0 kW)	S6-C6: CN1 terminal (DB15) S81-C3: CN2 terminal, 20-22 military spec. plug (elbow), 20-29 military spec. plug (elbow)
ISMH3-*******-U1*** ISMH3-*******-U2*** ISMH3-*******-A3*** (0.85 to 1.8 kW)	S6-C6: CN1 terminal (DB15) S81-C2: CN2 terminal, 20-18 military spec. plug (elbow), 20-29 military spec. plug (elbow)
ISMH3-*******-U1*** ISMH3-*******-U2*** ISMH3-*******-A3*** (2.9 to 7.5 kW)	S6-C6: CN1 terminal (DB15) S81-C3: CN2 terminal, 20-22 military spec. plug (elbow), 20-29 military spec. plug (elbow)

If you prepare cables yourself rather than using Inonvace matching cables, connector kits are required. If you select Inovance matching cables, no connector kit is required.

Battery Kit of Absolute Encoder Motor

If an Inovance absolute encoder motor is used, the optional battery kit S6-C4 (battery and battery box) is required besides the applicable cables.

Table 2-6 Communication cable

Cable Model	Description
S6N-L-T00-3.0	Servo drive to PC communication cable
S6-L-T04-0.3 S6-L-T04-3.0	Communication cable for multi-drive parallel connection Servo drive to host controller communication cable

2.4.3 Cables Applicable for ISMG Series Servo Motors (Communication Cables Included)

Table 2-7 Servo motor cable

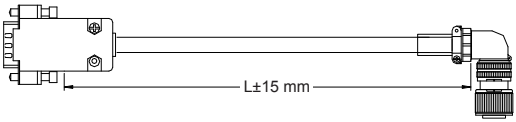
Item	Servo motor encoder cable		
	L = 3.0m	L = 5.0m	L = 10.0m
ISMG1(G2)-*******-A3***	S6-L-P021-3.0	S6-L-P021-5.0	S6-L-P021-10.0
Appearance of the servo motor encoder cable			
			

Table 2-8 Connector kit

Motor Model	Connector Kit
ISMG1(G2)-*******-A3***	S6-C6: CN1 terminal (DB15) S81-C3: CN2 terminal, 20-22 military spec. plug (elbow), 20-29 military spec. plug (elbow)

Note: The servo motor encoder cable does not include a CN1 connector.

Table 2-9 Communication cable

Model	Description
S6-L-T00-3.0	Servo drive to PC communication cable
S6-L-T01-1.0	Communication cable for multi-drive parallel connection
S6-L-T02-2.0	Servo drive to PLC communication cable
S6-L-T03-0.0	Plug for the termination resistor for servo drive communication

Table 2-10 Mounting options

Model	Description
ISMG1-B01	Mounting bracket for the ISMG1 natural ventilation motor
ISMG2-B01	Mounting bracket for the ISMG2 natural ventilation motor
ISMG1-B02	Mounting bracket for the ISMG1 forced air ventilation motor
ISMG2-B02	Mounting bracket for the ISMG2 forced air ventilation motor
MD500-AZJ-T5	Through-hole mounting bracket for the SIZE-G servo drive
MD500-AZJ-T6	Through-hole mounting bracket for the SIZE-H servo drive
MD500-AZJ-T7	Through-hole mounting bracket for the SIZE-I servo drive

2.4.4 Cables Applicable for MS1H Series Servo Motors (Communication Cables Included)

Table 2-11 Cables applicable for models without a brake

Motor Model	Servo Motor Power Cable and Encoder Cable (Models Without a Brake)			
	Cable Type	L = 3.0 m	L = 5.0 m	L = 10.0 m
MS1H1-*******-****Z-S MS1H4-*******-****Z-S	Power cable	SV82-L-M00-3.0	SV82-L-M00-5.0	SV82-L-M00-10.0
	Incremental encoder cable	S6-L-P000-3.0	S6-L-P000-5.0	S6-L-P000-10.0
	Absolute encoder cable	S6-L-P020-3.0	S6-L-P020-5.0	S6-L-P020-10.0

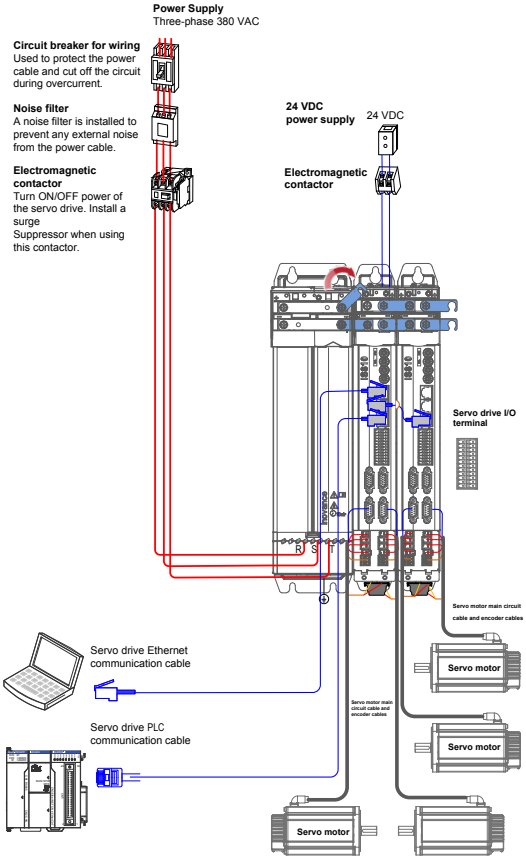
If you select Inovance matching cables, no connector kit is required.

Table 2-12 Cables applicable for models with a brake

Motor Model	Servo Motor Power Cable and Encoder Cable (Models Without a Brake)			
	Cable Type	L = 3.0 m	L = 5.0 m	L = 10.0 m
MS1H1-*******-****Z-S MS1H4-*******-****Z-S	Power cable	SV82-L-B00-3.0	SV82-L-B00-5.0	SV82-L-B00-10.0
	Incremental encoder cable	S6-L-P000-3.0	S6-L-P000-5.0	S6-L-P000-10.0
	Absolute encoder cable	S6-L-P020-3.0	S6-L-P020-5.0	S6-L-P020-10.0

2.5 Servo System Wiring

Figure 2-13 Wiring of a three-phase 380 V system



The servo drive is directly connected to an industrial power supply, with no isolation such as transformers. In this case, a fuse or circuit breaker must be connected to the input power supply to prevent cross electric accidents in the servo system. The servo drive is not configured with a built-in protective grounding circuit. Connect a residual current device (RCD) against both overload and short-circuit, or a specialized RCD combined with protective grounding.

Do not use magnetic contactors for running or stopping the servo motor. As a high-inductance device, the motor generates instantaneous high voltage, which may damage the contactor.

Pay attention to the power capacity when connecting an external control power supply or a 24 VDC power supply, especially when the power supply is for powering up multiple drives or brakes. Insufficient power supply will lead to current insufficiency, thus causing a drive or brake failure. The brake shall be powered up by a 24 VDC power supply. The power must match the motor model and meets the brake requirements.

Note 1: Remove the jumper between terminals $P_{\oplus}$ and C of the servo drive when connecting a regenerative resistor.

Note 2: CN3 is a communication output port. CN4 is a communication input port.

Chapter 3 Installation

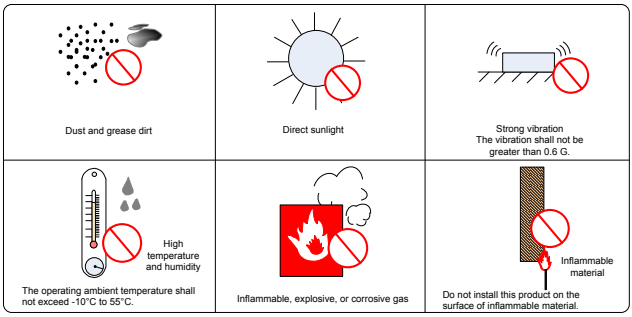
3.1 Power Supply/Drive Unit Installation

3.1.1 Installation Environment

- Installation location

1) Ambient temperature: Ambient temperature has a great effect on the AC drive life. The operating temperature of the AC drive shall not exceed the allowable temperature range (-10°C to 50°C).
2) Altitude: When the installation altitude exceeds 1000 m, the IS810 drive device must be derated according to any recommended capacitance value.
3) Installation surface requirements: The installation surface of the IS810 drive device must be flame retardant. Its structural strength must meet the strength requirements for device transportation, storage and running under normal conditions to avoid AC drive device damages due to vibration or excessive deformation of the installation surface. The installation surface must remain vertical to the horizontal ground and be secured to the cabinet properly. The installation surface must be able to withstand no less than four times the total weight of the installed device.
4) Cooling requirements: A large amount of heat may be generated during the operation of the AC drive. There must be plenty of cooling space in the installation area. Ensure that the cooling holes of the AC drive cabinet are not blocked.
5) Vibration requirements: Install the servo drive in a place with little vibration. Vibration shall not be greater than 0.6 g. Keep the servo drive away from devices such as punch presses.
6) Other requirements: Install the servo drive in an environment free from a) direct sunlight, moisture, and water drops; b) corrosive, inflammable, or explosive gases; and c) grease dirt and dust.

Figure 3-1 Installation environment requirements



7) The drive units must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.

- Environmental conditions

Table 3-1 Installation environment

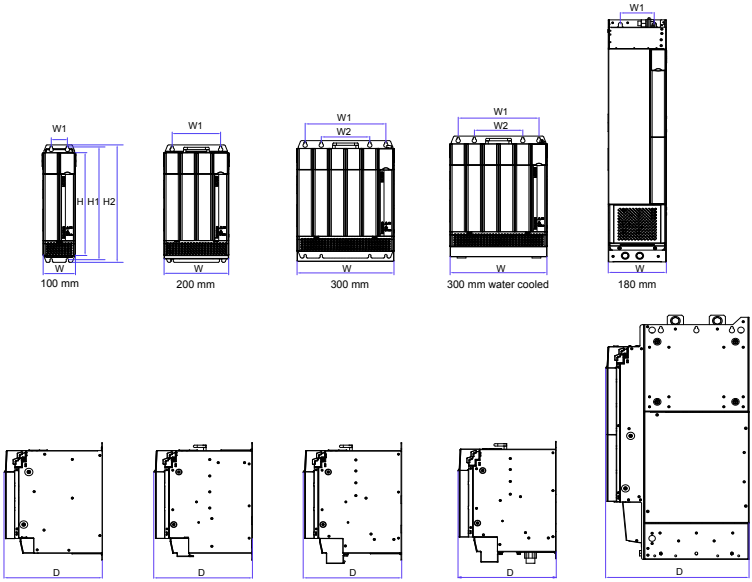
Item	Description
Ambient temperature	Operating temperature: -10 to 50°C, air temperature change: less than 0.5°C/min; derated when the temperature is higher than 40°C, 1.5% deration of rated current per 1°C temperature rise; maximum temperature: 50°C Storage temperature: -25°C to 70°C Transportation temperature: -25°C to 70°C Operating humidity: 5% to 95%, standard
Relative operating humidity	Operating humidity: 5% to 95%. A standard servo drive is not applicable in an environment or place with corrosive gas. Please purchase a special servo drive with corrosion resistant casing and protective coating. Storage humidity: 5% to 95% Transportation humidity: below 95% at 40 °C.
Degree of protection	IP20
Altitude	1000 m; derated when above 1000 m; 1% deration per 100 m rise; maximum: 3000 m.

3.1.2 Product Dimensions and Installation Space Requirements

I. Product Dimensions (mm)

1) Power Supply Unit

Figure 3-2 MD810-20M4T**G*** overall dimensions



Model MD810-20M4T***G***(W)	Dimensions	Voltage class
45	[H]: 350 mm [H1]: 384 mm [H2]: 400 mm [W]: 100 mm [W1]: 50 mm [D]: 305 mm	380-480 VAC
110	[H]: 350 mm [H1]: 384 mm [H2]: 400 mm [W]: 200 mm [W1]: 150 mm [D]: 305 mm	
160 (Air cooled)	[H]: 350 mm [H1]: 384 mm [H2]: 400 mm [W]: 300 mm [W1]: 250 mm [W2]: 150 mm [D]: 305 mm	
160 (Water cooled)	[H]: 350 mm [H1]: 384 mm [H2]: 415.5 mm [W]: 300 mm [W1]: 250 mm [W2]: 150 mm [D]: 305 mm	
355	[H]: 800 mm [H1]: 795 mm [H2]: 832 mm [W]: 180 mm [W1]: 105 mm [D]: 445 mm	

2) Drive unit

Figure 3-3 IS810N50M4T****INT (SIZE 1) overall dimensions

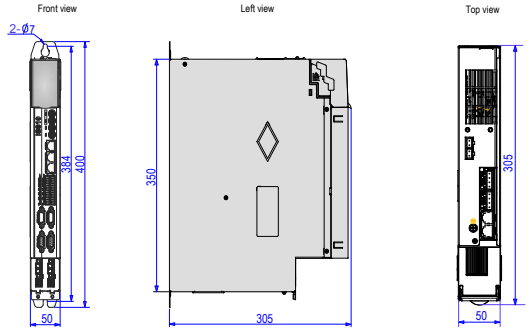


Figure 3-4 IS810N50M4T****INT (SIZE 2) overall dimensions

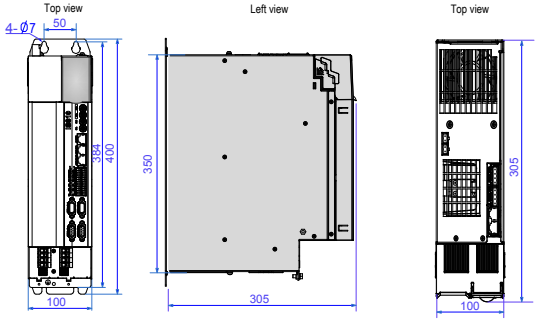
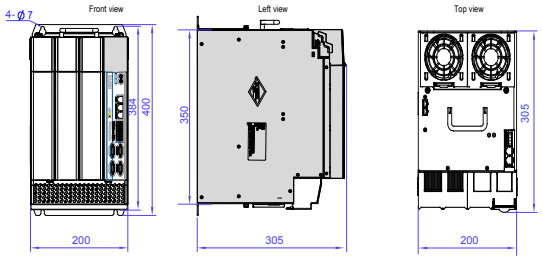


Figure 3-5 IS810N50M4T****INT (SIZE 3) overall dimensions



II. Space Requirements

Power supply units are divided into book-type units (100 mm, 200 mm and 300 mm wide) and vertical units (180 mm wide). The recommended installation methods are single-layer installation and two-layer installation. The following table shows the minimum clearance between two layers during two-layer installation. An insulation deflector must be installed in the lower layer.

Table 3-1 Minimum clearance for power supply unit installation

Item	100 mm wide unit	200 mm wide unit	300 mm wide unit	180 mm wide unit
	Book-type unit			Vertical unit
S1	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 300 mm
S2	≥ 300 mm	≥ 300 mm	≥ 300 mm	≥ 500 mm
S3	≥ 300 mm	≥ 300 mm	≥ 300 mm	-

Figure 3-6 Space for two-layer installation of a book-type power supply unit

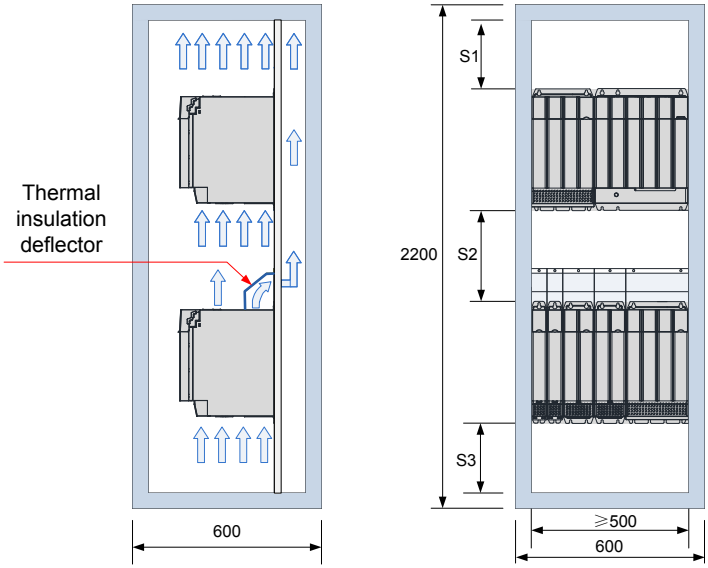
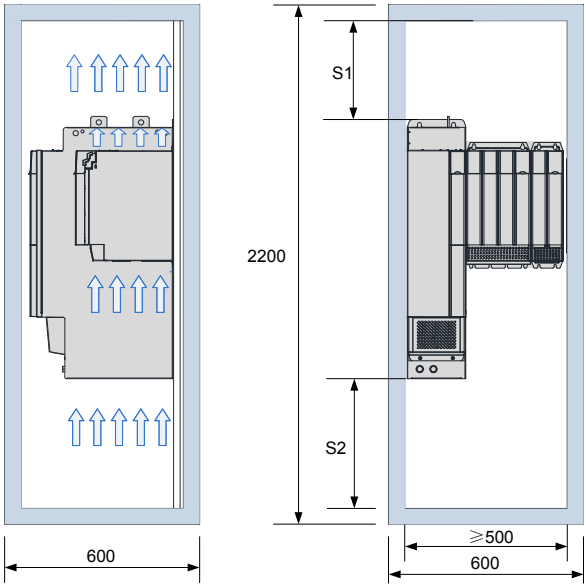


Figure 3-7 Space for two-layer installation of a vertical power supply unit



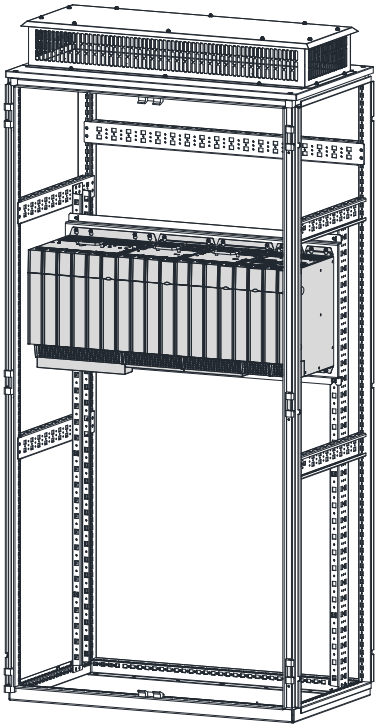
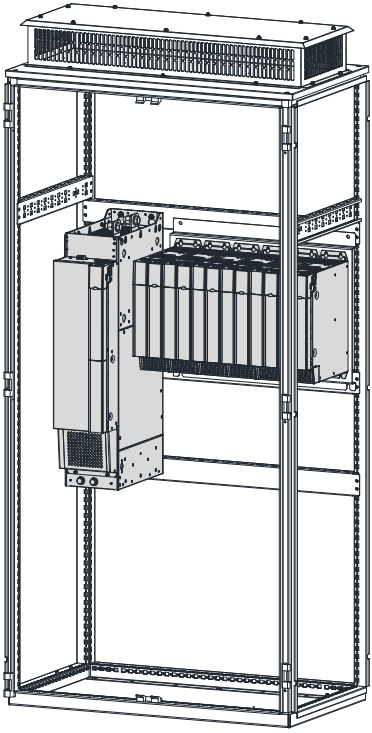
Installation direction: The product must be installed vertically.

3.2 Servo Drive Installation

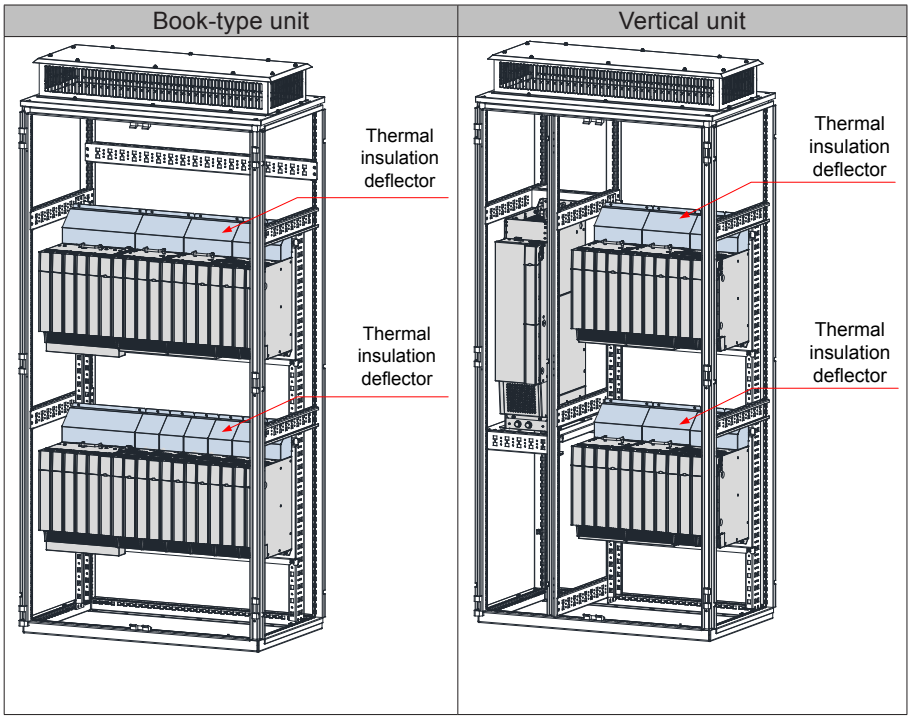
3.2.1 Cabinet-mounted Installation

This product can be installed in a cabinet in a single-row or two-row installation manner. A book-type unit must be installed closely to avoid product damages during transportation. Do not install merely two or less servo drives. An insulation deflector may be installed on the upper unit layer in two-row installation. The through-hole mounting method supports only single-row installation.

Single-row installation

Book-type unit	Vertical unit
	

Two-row installation



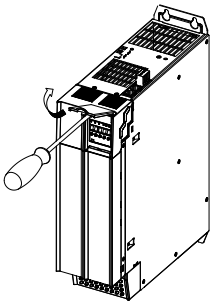
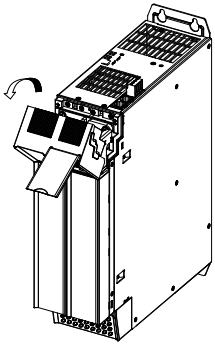
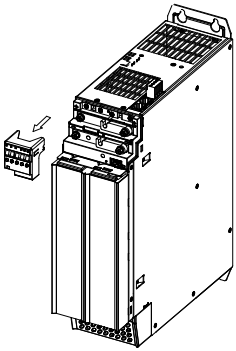
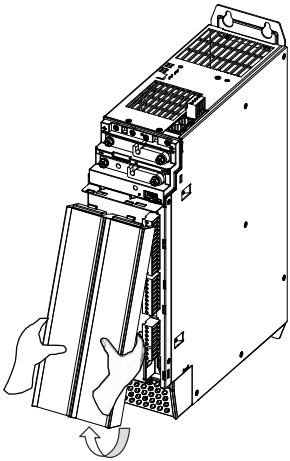
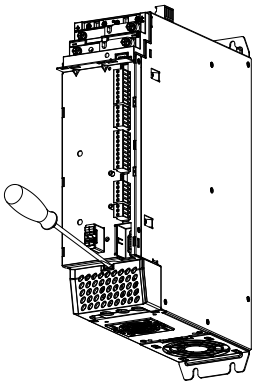
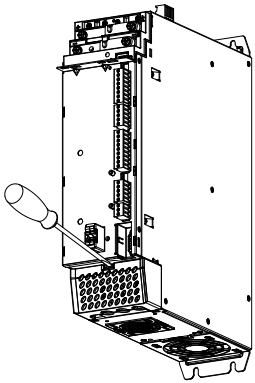
Note:

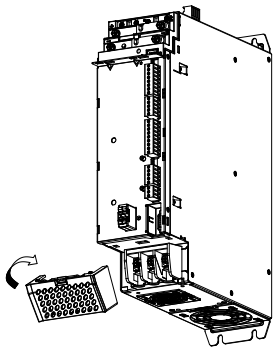
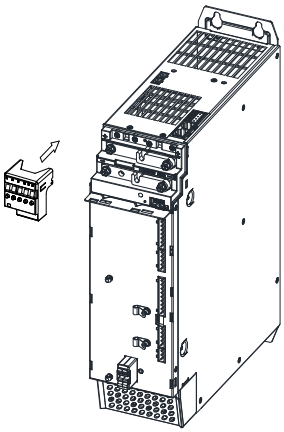
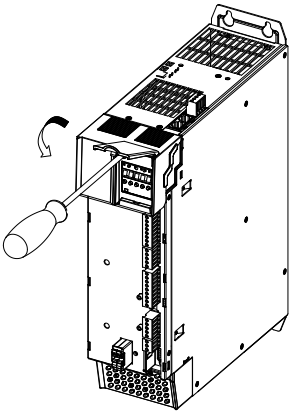
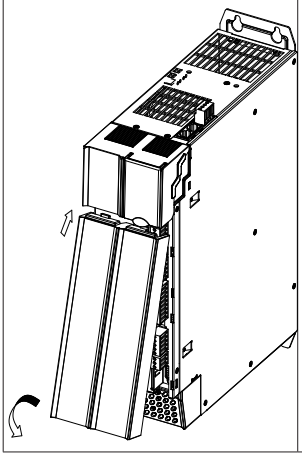
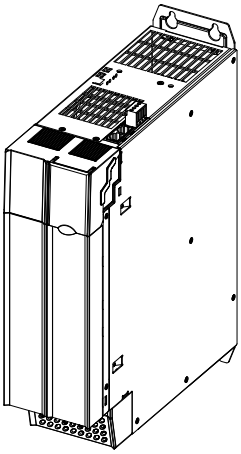
An insulation deflector may be installed on the upper unit layer in two-row installation.

Do not merely install two or less servo drives.

The through-hole mounting method supports only single-row installation.

3.2.2 Removal and Installation of a Power Supply Unit Cover

<table>
<tr><th colspan="3">Cover Removal</th></tr>
<tr>
<td>Lift the translucent keypad cover. Loosen the screws in the upper cover with a screwdriver.
  </td>
<td>Remove the upper cover by rotating it forward.
  </td>
<td>Pull the whole keypad box forward.
  </td>
</tr>
<tr>
<td>Hold the bottom of the lower cover with your hands. Remove the lower cover by rotating it forward.
  </td>
<td>Insert a tool (screwdriver) into the clip of the power terminal cover. Pry the clip.
  </td>
<td>Remove the power terminal cover.
  </td>
</tr>
</table>

<table>
<tr><th colspan="3">Cover Removal</th></tr>
<tr><td>Align the power terminal cover with the clip of the bus seat. Press the power terminal cover to fix it.
  </td><td>Insert the keypad.
  </td><td>Align the upper cover with the clip. Press the upper cover to fix it. Tighten the screw with a screwdriver.
  </td></tr>
<tr><td>Insert the top end of the lower cover into the bottom end of the upper cover. Rotate the bottom end of the lower cover to fix it.
  </td><td>The installation is completed.
  </td><td></td></tr>
</table>

3.2.3 Wall-Mounted Installation

Recommended torque (N.m) for installation:

Item	M3	M4	M5	M6	M8	M10	M12
Electric connection	0.55	1.2	2.8	4.8	13	20	35

Ensure that there is enough product installation space on the left of the power supply unit.

A multi-axis system requires units to be lined up along the top.

Mark the position of tapped holes for installation on the base plate. Drill the holes for fixing the screws on the base plate.

This product must be installed on the base plate vertically.

Below is the installation diagram:

Figure 3-8 Wall-mounted installation of a power supply unit

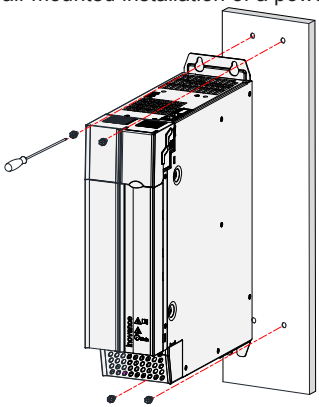
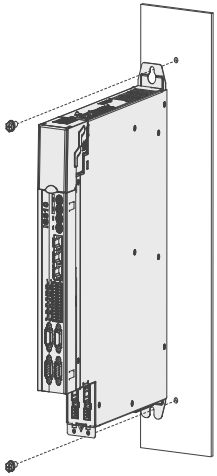


Figure 3-9 Wall-mounted installation of a drive unit



● Cooling

Make sure that the servo drive is installed vertical to the wall. Cool the servo drive with natural convection or a cooling fan.

As shown in the preceding figure, keep sufficient space around the servo drive to ensure cooling by fans or natural convection. Install the cooling fans above the servo drive to avoid an excessive temperature rise and maintain an even temperature inside the control cabinet.

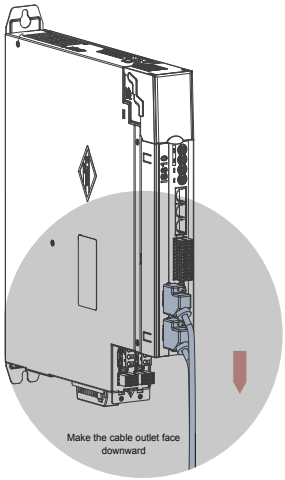
● Grounding

The grounding terminal must be properly grounded. Failure to comply may cause electric shocks or malfunction due to interference.

● Cable routing requirements

When cabling the servo drive, route the cables downward (refer to the following figure) to prevent liquid from flowing into the servo drive along the cables.

Figure 3-10 Cable routing requirements



3.3 Servo Motor Installation

3.3.1 Installation Precautions

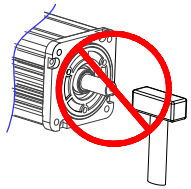
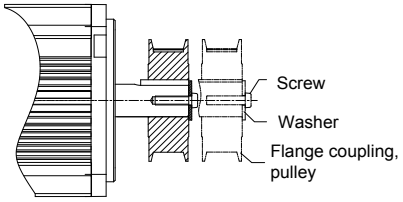
Install the servo drive in an environment free from corrosive or inflammable gas or combustible goods, such as hydrogen sulfide, chlorine, ammonia, sulphur gas, chlorinated gas, acid, soda and salt;

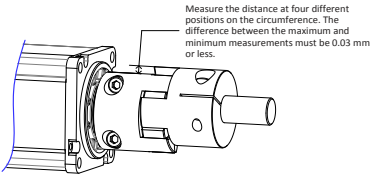
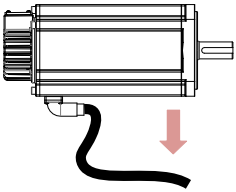
Use a servo motor with an oil seal when the motor is to be used in a place with grinding fluid, oil spray, iron powder, or cuttings;

Keep the servo motor away from heat sources such as a heating stove;

Do not use the servo motor in an enclosed environment. Working in the enclosed environment will lead to high temperature of the servo motor, which will shorten its service life.

Table 3-2 Installation precautions

Item	Description
Rust-proof treatment	Wipe up the antirust agent at the motor shaft extension before installing the servo motor, and then apply rust-proof treatment.
Encoder	◆ Prevent shaft extension impact during installation. Failure to comply will lead to damages to the internal encoder.  ◆ Use the screw hole at the shaft end to mount a pulley to the servo motor shaft with a keyway. To fit the pulley, insert a double-end screw into the screw hole of the shaft, put a washer against the coupling end, and then use a nut to push the pulley in. ◆ If there is a keyway on the servo motor shaft, mount the pulley by using the screw holes at the axle head. For the servo motor shaft without a keyway, use friction coupling or other similar installation methods. ◆ When removing the pulley, use a pulley remover to protect the shaft against damages from the load. ◆ To ensure safety, install a protective cover or similar device on the rotary part such as the pulley mounted on the shaft. 

Item	Description
Alignment	◆ Use the shaft coupling for mechanical connection and align the axis of the servo motor with the axis of the equipment. When installing the servo motor, make sure that alignment accuracy satisfies the requirements as described in the figure to the left. If the axes are not properly aligned, vibration will be generated and may damage the bearings and encoder. 
Installation direction	◆ The servo motor can be installed horizontally or vertically.
Oil and moisture countermeasures	1) Do not immerse the servo motor and cables into oil or water during use. 2) Confirm the IP class of the servo motor when using it in a place with water drops (Except the shaft-through portion) 3) Mount the motor with the cable outlet facing downwards to prevent water/oil from flowing into the motor (as shown in the following figure).  4) In the environment where the shaft-through portion is exposed to oil drops, use a servo motor with oil sealing. 5) Observe the following conditions when using the servo motor with oil sealing: Make sure that the oil level is lower than the oil seal lip during use; Avoid oil accumulation at the oil seal lip when the motor is installed vertically upward.
Stress of cables	◆ Do not bend or apply tension to the cables, especially the signal cables whose core wire is 0.2 or 0.3 mm in diameter. Do not exert too much tension on the cables during wiring.

Item	Description
Connector treatment	Observe the following precautions: ◆ When connecting the connectors, make sure that there is no foreign matter such as waste or sheet metal inside the connectors. ◆ Connect the connectors to the main circuit side of the servo motor first, and make sure that the grounding cable of the power cables is properly connected. If the connectors are first connected to the encoder cable side, the encoder may become faulty due to the potential differences between PEs. ◆ Make sure that the pins are correctly arranged during wiring. ◆ The connectors are made up of resins. Avoid impacts with the connectors to prevent connector damages. ◆ Hold the servo motor body instead of the cables during transportation when the cables are well connected. Otherwise, the connectors may be damaged or the cables may be broken. ◆ Do not apply stress to the connectors during wiring if bent cables are used. Failure to comply may cause damages to the connectors.

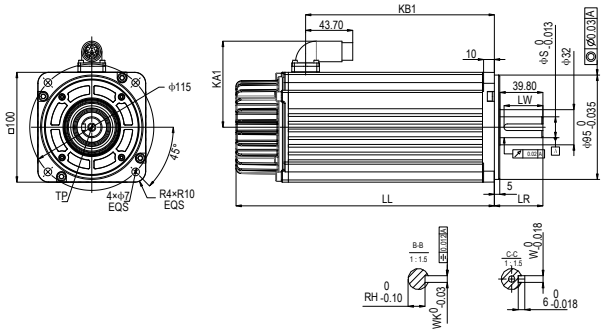
3.3.2 Installation Environment

Table 3-3 Installation environment

<table>
<tr><th>Item</th><th>OneCable Servo Motor</th><th colspan="2">ISMH Series Motor</th><th>MS1H Series Motor</th></tr>
<tr><td>Operating temperature</td><td colspan="4">0°C to 40°C (non-freezing). Please perform deration at over 40°C based on the following coefficients:
<table>
<tr><td>Ambient temperature (°C)</td><td>40</td><td>45</td><td>50</td><td>55</td><td>60</td></tr>
<tr><td>Derating coefficient</td><td>1</td><td>0.952</td><td>0.901</td><td>0.855</td><td>0.781</td></tr>
</table></td></tr>
<tr><td>Operating humidity</td><td colspan="4">20%–90% RH (non-condensing)</td></tr>
<tr><td>Storage temperature</td><td colspan="4">-20°C to 60°C (Peak temperature and storage period: 80°C for 72 hours)</td></tr>
<tr><td>Storage humidity</td><td colspan="4">20%–90% RH (non-condensing)</td></tr>
<tr><td>Vibration</td><td colspan="4">Below 49 m/s^2</td></tr>
<tr><td>Impact</td><td colspan="4">Below 490 m/s^2</td></tr>
<tr><td>Degree of protection</td><td>IP65</td><td colspan="2">H1 and H4: IP65 (except for the shaft-through portion and connection terminals of motor connectors)
Other: IP67 (except for the shaft-through portion and motor connectors)</td><td>H1 and H4: IP67 (except for the shaft-through portion and connection terminals of motor connectors)</td></tr>
<tr><td>Altitude</td><td colspan="4">Please perform deration at over 40°C based on the following coefficients:
<table>
<tr><td>Altitude (m)</td><td>1000</td><td>2000</td><td>3000</td><td>4000</td><td>5000</td></tr>
<tr><td>Derating coefficient</td><td>1</td><td>0.947</td><td>0.887</td><td>0.824</td><td>0.645</td></tr>
</table></td></tr>
</table>

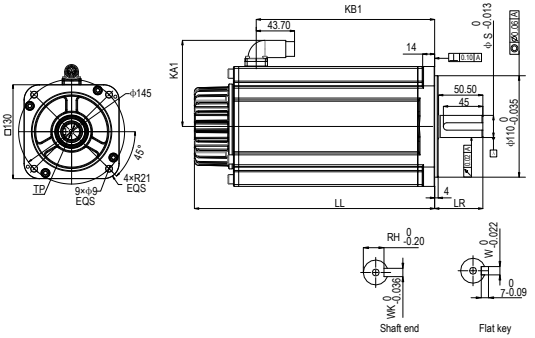
3.3.3 Overall Dimensions of OneCable Servo Motor

1) Dimensions of ISMH2-20C30CD- A***Y-Om19 Servo Motor



Model	LL (mm)	LR (mm)	LW (mm)	S (mm)	RH (mm)	WK (mm)	W (mm)	TP (mm)	KA1 (mm)	KB1 (mm)	Weight (kg)
ISMH2-20C30CD-A351Y-Om19	239.5	45	/	19	/	/	/	M6×18	78.4	175	7.5
ISMH2-20C30CD-A331Y-Om19	239.5	45	36	19	15.5	6	6	M6×18	78.4	175	7.5

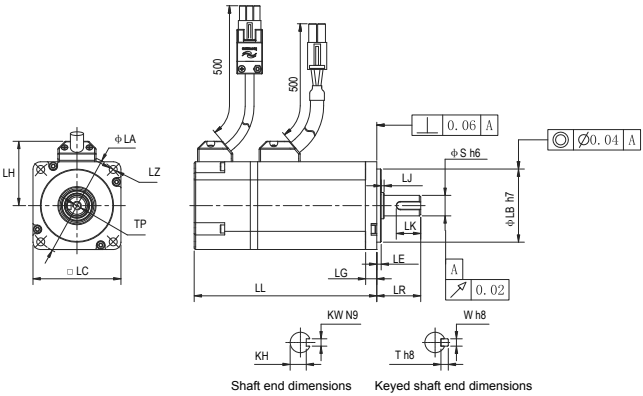
2) Dimensions of ISMH3-18C15CD-****B-Om19/Om24 and ISMH3-56C30CD-****B- Om24 Servo Motor



Model	LL (mm)	LR (mm)	LW (mm)	S (mm)	RH (mm)	WK (mm)	W (mm)	TP (mm)	KA1 (mm)	KB1 (mm)	Weight (kg)
ISMH3-18C15CD-A351B-Om19	214	55	/	19	/	/	/	M6×18	94	143.5	10.5
ISMH3-18C15CD-A351B-Om24	214	55	/	24	/	/	/	M8×20	94	143.5	10.5
ISMH3-56C30CD-A351B-Om24	274	55	/	24	/	/	/	M8×20	94	203.5	14.5
ISMH3-56C30CD-A331B-Om24	274	55	45	24	20	8	8	M8×20	94	203.5	14.5

3.3.4 Overall Dimensions of the ISMH Servo Motor Series

1) Overall Dimensions of the ISMH1 Servo Motor Series (100 W, 200 W, 400 W, 550 W, 750 W, 1.0 kW)



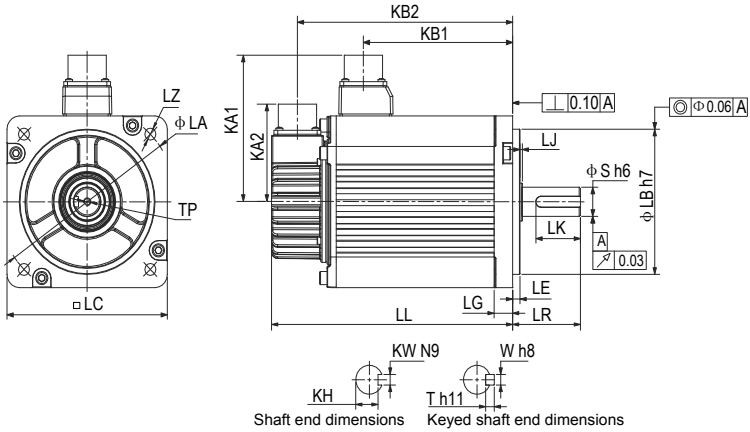
Motor Model	LC	LL	LR	LA	LZ	LH	LG	LE	LJ
ISMH1-10B30CB-***Z	40	103 (136)	25±0.5	46	2-φ4.5	34	5	2.5±0.3	0.5±0.35
ISMH1-20B30CB-***Z	60	98 (138)	30±0.5	70	4-φ5.5	44	7.8	3±0.3	0.5±0.35
ISMH1-40B30CB-***Z	60	118	30±0.5	70	4-φ5.5	44	7.8	3±0.3	0.5±0.35
ISMH1-55B30CB-***Z	80	126	35±0.5	90	4-φ7	54	8	3±0.3	0.5±0.35
ISMH1-75B30CB-***Z	80	135.5	35±0.5	90	4-φ7	54	8	3±0.3	0.5±0.35
ISMH1-10C30CB-***Z	80	153.5	35±0.5	90	4-φ7	54	8	3±0.3	0.5±0.35

Motor model	LB	S	TP	LK	KH	KW	W	T	Weight (kg)
ISMH1-10B30CB-***Z	30	8	M3×6	16	6.2 $^{0}_{-0.1}$	3	3	3	0.59 (0.77)
ISMH1-20B30CB-****Z	50	14	M5×8	16.5	11 $^{0}_{-0.1}$	5	5	5	1.1 (1.4)
ISMH1-40B30CB-****Z	50	14	M5×8	16.5	11 $^{0}_{-0.1}$	5	5	5	1.6
ISMH1-55B30CB-****Z	70	19	M6×20	25	15.5 $^{0}_{-0.1}$	6	6	6	2.3
ISMH1-75B30CB-****Z	70	19	M6×20	25	15.5 $^{0}_{-0.1}$	6	6	6	2.7
ISMH1-10C30CB-****Z	70	19	M6×20	25	15.5 $^{0}_{-0.1}$	6	6	6	3.2

Note: The dimension unit is mm. The values shown in () are values of servo motor with a holding brake.

Connector Model	Power Side (Power Brake Side Included)	Encoder Side
Plastic housing	MOLEX-50361672	AMP172169-9
Terminal	MOLEX-39000059	AMP1473226-1

2) Overall Dimensions of the ISMH2 Servo Motor Series (1.0 kW, 1.5 kW, 2.0 kW, 2.5 kW, 3.0 kW, 4.0 kW, 5.0 kW)



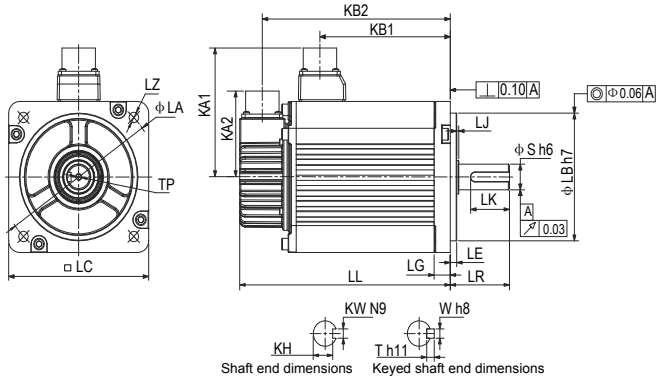
Motor Model	LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG
ISMH2-10C30CB-**3*Y	100	164 (213.5)	45±1	115	4-φ7	88	94.5 (101)	74	143.5 (192.5)	10
ISMH2-15C30CB-**3*Y	100	189 (239)	45±1	115	4-φ7	88	119.5 (128)	74	168.5 (219.5)	10
ISMH2-10C30CD-**3*Y	100	164 (213.5)	45±1	115	4-φ7	88	94.5 (101)	74	143.5 (192.5)	10
ISMH2-15C30CD-**3*Y	100	189 (239)	45±1	115	4-φ7	88	119.5 (128)	74	168.5 (219.5)	10
ISMH2-20C30CD-**3*Y	100	214	45±1	115	4-φ7	88	144.5	74	193.5	10
ISMH2-25C30CD-**3*Y	100	240.5	45±1	115	4-φ7	88	169.5	74	218.5	10
ISMH2-30C30CD-**3*Y	130	209.5	63±1	145	4-φ9	103	136	74	188.5	14
ISMH2-40C30CD-**3*Y	130	252	63±1	145	4-φ9	103	178.5	74	231	14
ISMH2-50C30CD-**3*Y	130	294.5	63±1	145	4-φ9	103	221	74	273.5	14

Motor Model	LE	LJ	LB	S	TP	LK	KH	KW	W	T	Weight (kg)
ISMH2-10C30CB-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	5.11 (6.41)
ISMH2-15C30CB-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	6.22 (7.52)
ISMH2-10C30CD-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	5.11 (6.41)
ISMH2-15C30CD-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	6.22 (7.52)
ISMH2-20C30CD-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	7.39
ISMH2-25C30CD-**3*Y	5±0.3	2.5±0.75	95	24	M8×16	36	$20^{0}_{-0.2}$	8	8	7	8.55
ISMH2-30C30CD-**3*Y	6±0.3	0.5±0.75	110	28	M8×20	54	$24^{0}_{-0.2}$	8	8	7	10.73
ISMH2-40C30CD-**3*Y	6±0.3	0.5±0.75	110	28	M8×20	54	$24^{0}_{-0.2}$	8	8	7	15.43
ISMH2-50C30CD-**3*Y	6±0.3	0.5±0.75	110	28	M8×20	54	$24^{0}_{-0.2}$	8	8	7	16.2

Note: The dimension unit is mm. The values shown in () are values of servo motor with a holding brake.

Connector	Power Side (Power Brake Side Included)	Encoder Side
Military spec.	MI-DTL-5015 series 3102E20-18P	MI-DTL-5015 series 3102E20-29P

3) Overall Dimensions of the ISMH3 Servo Motor Series (850 W, 1.3 kW, 1.8 kW)



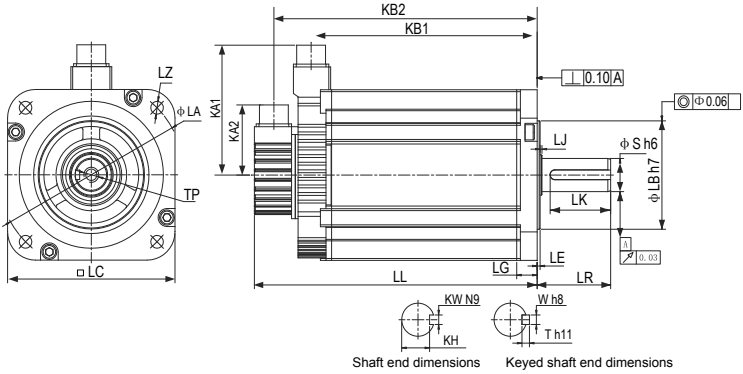
Motor Model	LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG
ISMH3-85B15CB-**3*Y	130	168.5 (227.5)	55±1	145	4-φ9	103	95 (97)	74	147.5 (206.5)	14
ISMH3-13C15CB-**3*Y	130	194.5 (253.5)	55±1	145	4-φ9	103	121 (124)	74	173.5 (232.5)	14
ISMH3-18C15CD-**3*Y	130	220.5 (279.5)	55±1	145	4-φ9	103	147 (150)	74	199.5 (258.5)	14
ISMH3-85B15CD-**3*Y	130	168.5 (227.5)	55±1	145	4-φ9	103	95 (97)	74	147.5 (206.5)	14
ISMH3-13C15CD-**3*Y	130	194.5 (253.5)	55±1	145	4-φ9	103	121 (124)	74	173.5 (232.5)	14

Motor Model	LE	LJ	LB	S	TP	LK	KH	KW	W	T	Weight (kg)
ISMH3-85B15CB-**3*Y	6±0.3	0.5±0.75	110	22	M6×20	36	$18^{0}_{-0.2}$	8	8	7	8.23 (10.73)
ISMH3-13C15CB-**3*Y	6±0.3	0.5±0.75	110	22	M6×20	36	$18^{0}_{-0.2}$	8	8	7	10.57 (13)
ISMH3-18C15CD-**3*Y	6±0.3	0.5±0.75	110	22	M6×20	36	$18^{0}_{-0.2}$	8	8	7	12.7 (15.2)
ISMH3-85B15CD-**3*Y	6±0.3	0.5±0.75	110	22	M6×20	36	$18^{0}_{-0.2}$	8	8	7	8.23 (10.73)
ISMH3-13C15CD-**3*Y	6±0.3	0.5±0.75	110	22	M6×20	36	$18^{0}_{-0.2}$	8	8	7	10.57 (13)

Note: The dimension unit is mm. The values shown in () are values of servo motor with a holding brake.

Connector	Power Side (Power Brake Side Included)	Encoder Side
Military spec.	MI-DTL-5015 series 3102E20-18P	MI-DTL-5015 series 3102E20-29P

4) Overall Dimensions of the ISMH3 Servo Motor Series (2.9 kW, 4.4 kW, 5.5 kW, 7.5 kW)



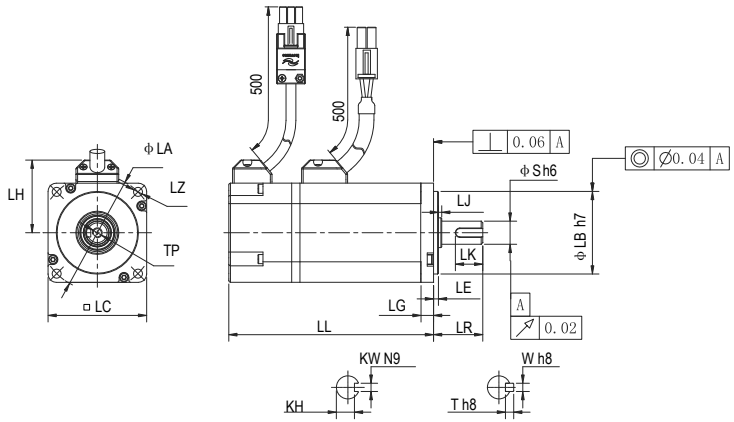
Motor Model	LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG
ISMH3-29C15CD-****Z	180	197 (273)	79±1	200	4-φ13.5	138	136 (134)	74	177 (253)	18
ISMH3-44C15CD-****Z	180	230 (307)	79±1	200	4-φ13.5	138	169 (167)	74	210 (286)	18
ISMH3-55C15CD-****Z	180	274 (350)	113±1	200	4-φ13.5	138	213 (211)	74	254 (330)	18
ISMH3-75C15CD-****Z	180	330 (407)	113±1	200	4-φ13.5	138	269 (267)	74	310 (386)	18

Motor Model	LE	LJ	LB	S	TP	LK	KH	KW	W	T	Weight (kg)
ISMH3-29C15CD-****Z	3.2±0.3	0.3±0.75	114.3	35	M12×25	65	$30^{0}_{-0.2}$	10	10	8	15 (25)
ISMH3-44C15CD-****Z	3.2±0.3	0.3±0.75	114.3	35	M12×25	65	$30^{0}_{-0.2}$	10	10	8	19.5 (30)
ISMH3-55C15CD-****Z	3.2±0.3	0.3±0.75	114.3	42	M16×32	96	$37^{0}_{-0.2}$	12	12	8	28 (38)
ISMH3-75C15CD-****Z	3.2±0.3	0.3±0.75	114.3	42	M16×32	96	$37^{0}_{-0.2}$	12	12	8	32 (42)

Note: The dimension unit is mm. The values shown in () are values of servo motor with a holding brake.

Connector	Power Side (Power Brake Side Included)	Encoder Side
Military spec.	MI-DTL-5015 series 3102E20-29P	MI-DTL-5015 series 3102E20-29P

5) Overall Dimensions of the ISMH4 Servo Motor Series (400 W, 750 W)



Shaft end dimensions Keyed shaft end dimensions

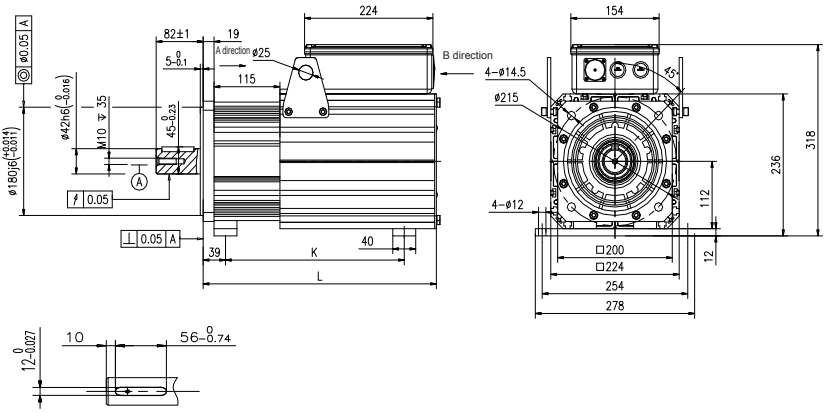
Motor Model	LC	LL	LR	LA	LZ	LH	LG	LE	LJ
ISMH4-40B30CB-****Z	60	125 (165)	30±0.5	70	4-φ5.5	44	7.8	3±0.3	0.5±0.35
ISMH4-75B30CB-****Z	80	146.5 (184.5)	35±0.5	90	4-φ7	54	8	3±0.3	0.5±0.35
Motor model	LB	S	TP	LK	KH	KW	W	T	Weight (kg)
ISMH4-40B30CB-****Z	50	14	M5×8	16.5	$11^{0}_{-0.1}$	5	5	5	1.7 (2.0)
ISMH4-75B30CB-****Z	70	19	M6×20	25	$15.5^{0}_{-0.1}$	6	6	6	2.9 (3.3)

Note: The dimension unit is mm. The values shown in () are values of servo motor with a holding brake.

Connector	Power Side (Power Brake Side Included)	Encoder Side
Plastic housing	MOLEX-50361672	AMP172169-9
Terminal	MOLEX-39000059	AMP1473226-1

3.3.5 Overall Dimensions of the ISMG Servo Motor Series

1) Solid shaft, forced ventilation motor (ISMG1) (Unit: mm)



Standard accessories: Type A round parallel key 12 * 8 * 56
Refer to GB/T1096-2003

Connector	Encoder Side
Military spec.	MIL-DTL-5015 series 3102E20-29P

Motor Model	L (mm)	K (mm)	Weight (kg)
ISMG1-95C15CD-A331FA ISMG1-12D20CD-A331FA	415	285	45.2
ISMG1-14D15CD-A331FA ISMG1-18D20CD-A331FA	450	312	51.9
ISMG1-17D15CD-A331FA ISMG1-23D20CD-A331FA	485	354	59
ISMG1-22D15CD-A331FA ISMG1-28D20CD-A331FA	520	396	66
ISMG1-30D15CD-A331FA ISMG1-41D20CD-A331FA	590	471	79.8

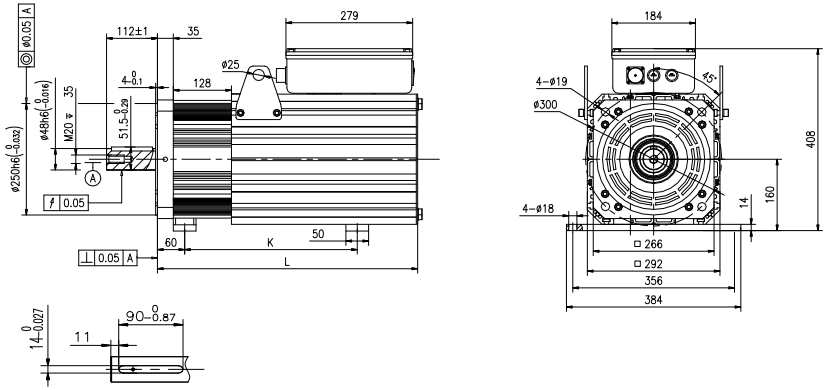
Note:

The standard is A3 series. If you require R1 or U1 series, contact Inovance for customization.

The mounting baseplate is optional, and used only for ISMG1-22D15CD-A331FA and ISMG1-30D15CD-A331FA or when required. A K value indicates the mounting baseplate clearance.

The mounting baseplate is optional, and used only when required.

2) Solid shaft, forced ventilation motor (ISMG2) (Unit: mm)



Standard accessories: Type A Round parallel key 12 * 8 * 56
Refer to GB/T1096-2003

Connector	Encoder Side
Military spec.	MIL-DTL-5015 series 3102E20-29P

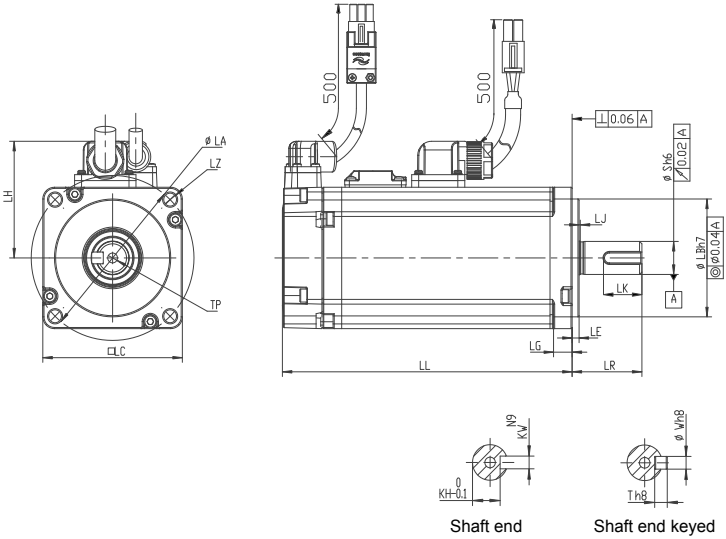
Motor Model	L (mm)	K (mm)	Weight (kg)
ISMG2-31D15CD-A331FA ISMG2-42D20CD-A331FA	575	360	122
ISMG2-42D15CD-A331FA ISMG2-57D20CD-A331FA	625	370	141.3
ISMG2-52D15CD-A331FA ISMG2-70D20CD-A331FA	675	476	158.4
ISMG2-60D15CD-A331FA ISMG2-80D20CD-A331FA	725	476	175.4
ISMG2-80D15CD-A331FA ISMG2-11E20CD-A331FA	825	583	217
ISMG2-94D15CD-A331FA	950	590	267

Note:

The standard is A3 series. If you require R1, U1 or U2 series, contact Inovance for customization.

The mounting baseplate is optional, and used only when required.

3.3.6 Overall Dimensions of the MS1H Servo Motor Series



Shaft end Shaft end keyed

Motor Model	LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2
MS1H1-05B30CB-A330Z-S	65	40	25±5.5	46	2-φ-.5	40	5	2.5H1-0.	0.5±0.35
MS1H1-05B30CB-A332Z-S	97	40	251H1-	46	2-1H1-	40	5	2.5H1-0.	0.5±0.35
MS1H1-10B30CB-A330Z-S	77.5	40	25±5.5	46	2-φ-.5	40	5	2.551-1:	0.5±0.35
MS1H1-10B30CB-A332Z-S	109	40	259H1-	46	2-9H1-	40	5	2.5H1-1.	0.5±0.35
MS1H1-20B30CB-A331Z-S	72.5	60	30±0.5	70	4-φ-.5	49.5	7.5	3.551	0.5±0.35
MS1H1-20B30CB-A334Z-S	Over 100	60	300H1-	70	4-0H1-	49.5	7.5	3.551	0.5±0.35
MS1H1-40B30CB-A331Z-S	91	60	301H1-	70	4-1H1-	49.5	7.5	3.551	0.5±0.35
MS1H1-40B30CB-A334Z-S	119	60	309H1-	70	4-9H1-	49.5	7.5	3.551	0.5±0.35
MS1H4-40B30CB-A331Z-S	105	60	305H4-	70	4-5H4-	49.5	7.5	3.554	0.5±0.35
MS1H4-40B30CB-A334Z-S	128	60	308H4-	70	4-8H4-	49.5	7.5	3.554	0.5±0.35
MS1H1-55B30CB-A331Z-S	96	80	351H1-	90	4-1H	59.5	7.7	3.751	0.5±0.35
MS1H1-75B30CB-A331Z-S	108	80	358H1-	90	4-8H	59.5	7.7	3.751	0.5±0.35
MS1H1-75B30CB-A334Z-S	140.5	80	350.5-	90	4-0.	59.5	7.7	3.755	0.5±0.35
MS1H1-10C30CB-A331Z-S	119	80	359H1-	90	4-9H	59.5	7.7	3.751	0.5±0.35
MS1H4-75B30CB-A331Z-S	118.5	80	358.5-	90	4-8.	59.5	7.7	3.755	0.5±0.35
MS1H4-75B30CB-A334Z-S	148	80	358H4-	90	4-8H	59.5	7.7	3.754	0.5±0.35

Motor model	S	LB	TP	LK	KH	KW	W	T	Weight (kg)
MS1H1-05B30CB-A330Z-S	8	30	M3×3	15.5	$6.2^{0}_{-0.1}$	3	3	3	/
MS1H1-05B30CB-A332Z-S	8	30	M31H	15.5	$6.2^{0}_{-0.1}$	3	3	3	/
MS1H1-10B30CB-A330Z-S	8	30	M3×3	15.5	$6.2^{0}_{-0.1}$	3	3	3	/
MS1H1-10B30CB-A332Z-S	8	30	M31H	15.5	$6.2^{0}_{-0.1}$	3	3	3	/
MS1H1-20B30CB-A331Z-S	14	50	M5×5	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H1-20B30CB-A334Z-S	14	50	M51H	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H1-40B30CB-A331Z-S	14	50	M5×5	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H1-40B30CB-A334Z-S	14	50	M51H	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H4-40B30CB-A331Z-S	14	50	M518	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H4-40B30CB-A334Z-S	14	50	M51H	16.5	$11^{0}_{-0.1}$	5	5	5	/
MS1H1-55B30CB-A331Z-S	19	70	M61H1	25	$15.5^{0}_{-0.1}$	6	6	6	/
MS1H1-75B30CB-A331Z-S	19	70	M61H1	25	$15.5^{0}_{-0.1}$	6	6	6	/
MS1H1-75B30CB-A334Z-S	19	70	M61H1	25	$15.5^{0}_{-0.1}$	6	6	6	/
MS1H1-10C30CB-A331Z-S	19	70	M61H1	25	$15.5^{0}_{-0.1}$	6	6	6	/
MS1H4-75B30CB-A331Z-S	19	70	M61H4	25	$15.5^{0}_{-0.1}$	6	6	6	/
MS1H4-75B30CB-A334Z-S	19	70	M61H4	25	$15.5^{0}_{-0.1}$	6	6	6	/

Chapter 4 Wiring

DANGER

Wiring must be performed by authorized and qualified personnel.

Before removing or installing the drive, turn off the power, wait five minutes until the power indicator becomes off, and verify that the voltage between and Θ is zero using a multimeter.

Perform wiring after the servo drive and motor are installed properly. Failure to comply will result in electric shocks.

Do not damage the cables, lay them under large tension or pressure, or hang them. Failure to comply may result in electric shock.

Insulate the power terminal connectors to prevent electric shocks.

The specifications and installation methods of external cables must comply with the applicable local regulations.

The cables described in Table 4-5 must be made of copper and the grounding cables must be yellow-green cables.

The entire system must be grounded.

CAUTION

Carry out wiring correctly. Failure to comply will result in abnormal actions of the servo motor and personal injuries.

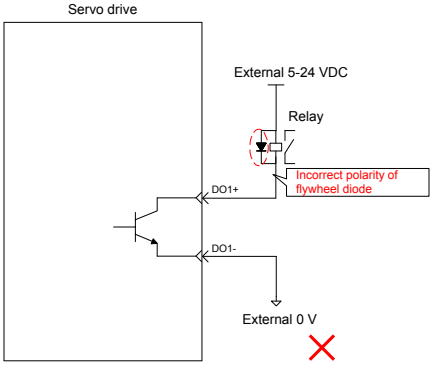
Prevent incorrect terminal connection. Failure to comply may result in damages to the terminals.

Connect the electromagnetic contactor between the power supply and main circuit of the drive (L1, L2 for single-phase, R, S, T for three-phase). If no electromagnetic contactor is connected, a fire may occur when a fault occurs and continuous large current flows through the product.

Use the ALM (fault signal) to cut off the main circuit power supply. When the braking transistor becomes faulty, the regenerative resistor may become overheated, causing a fire.

Before power-on, check the voltage specifications of the drive. Check whether the input power supply is correct (380 VAC to 480 VAC, 50/60 Hz).

Do not reverse the flywheel diode. Failure to comply will damage the product and affect signal output.



Use a noise filter to reduce electromagnetic interference on electronic devices around the product.

For the power supply and the main circuit connection, make sure that the main circuit power supply is cut off and the servo changes from the ON state to the OFF state after the alarm signal is detected.

Connect the U, V, and W cables of the servo drive to the U, V, and W terminals of the motor directly. Do not connect an electromagnetic contactor. Failure to comply may result in abnormalities and faults.

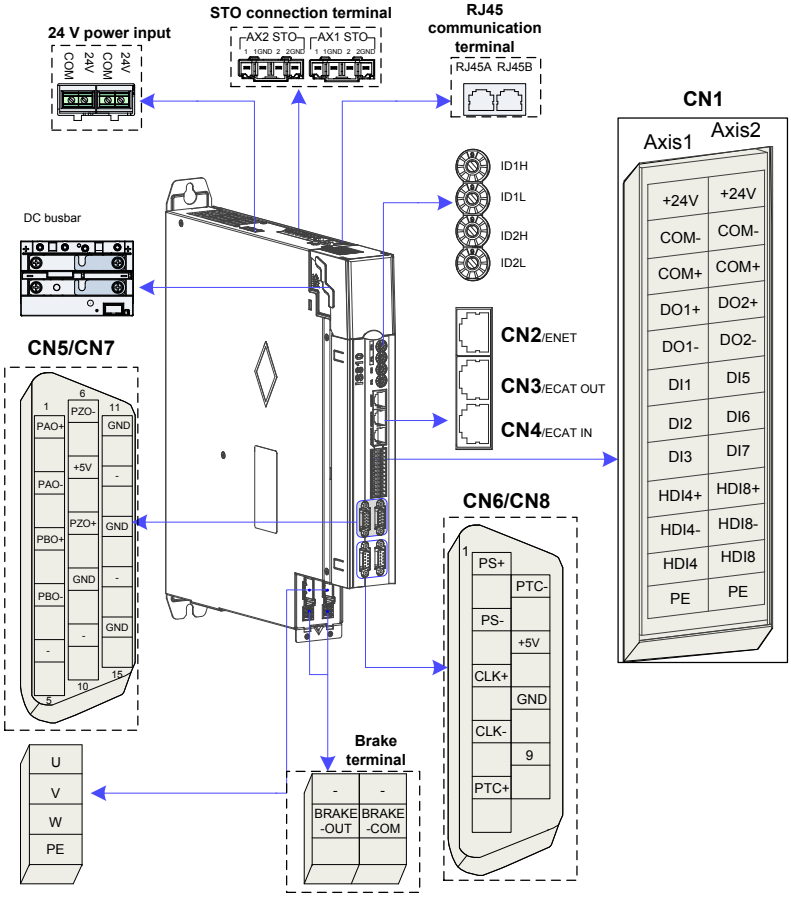
4.1 Terminals in a Power Supply Unit

An MD810 power supply unit must be purchased before the use of this product. For the terminal specifications of the power supply unit, refer to the User Guide MD810 Series AC Drive Multi-axis System.

4.2 Terminals in a Drive Unit

4.2.1 Terminal Arrangement in a Drive Unit

Figure 4-1 Terminal arrangement in a drive unit



4.2.2 Function Description of Terminals in Drive Unit

Table 4-1 Terminal names and functions

Terminal Symbol	Terminal Name	Terminal Function
+, -	Power input terminals	Bus input
U, V, W	Servo motor connection terminals	Connected to the U, V and W phases of the servo motor.
PE	Ground	Two grounding terminals of the servo drive are respectively connected to those of the power supply and the servo motor.
CN1	Control signal terminal	Digital signal input/output
CN2	EtherNET communication terminal	Connected for transmitting background communication signals and online upgrade signals
CN3/CN4	EtherCAT communication terminal	EtherCAT network ports for connecting CN3(OUT) to the next slave and CN4(IN) to the host controller or previous slave
CN5/CN7	Encoder 1 terminal (DB15)	Encoder signal frequency division output and full closed-loop signal input (port 1)
CN6/CN8	Encoder 2 terminal (DB9)	Connected for transmitting servo motor encoder signals (port 2)
BRAKE-OUT BRAKE-COM	Brake terminal	Connected to the servo motor brake terminal
RJ45A/RJ45B	RJ45 communication port	RJ45B: Connected to the external LCD keypad
STO AX1/AX2	STO connection terminal	Safety function terminal
24 V/COM	24 V power port	External 24 V control power and brake power input ports. For usage details, refer to section 4.3.3.
24 V/COM	24 V power port	External 24 V control power and brake power input ports. For usage details, refer to section 4.3.3.

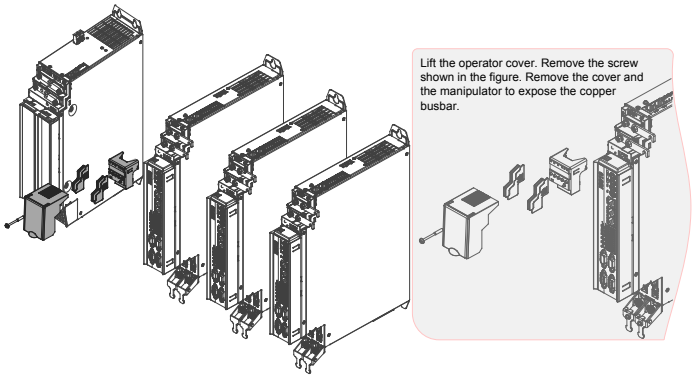
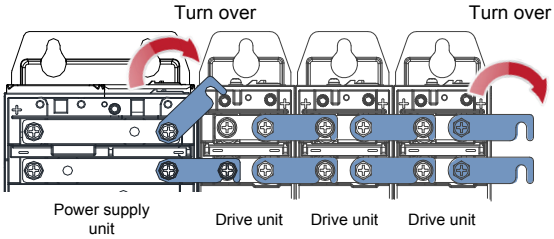
4.3 Connection of the Power Supply Unit to the Drive Unit

4.3.1 Power Connection Through the DC Bus

Remove the display cover of the drive unit. Connect the power supply unit to the drive unit with the DC busbar.

Caution!

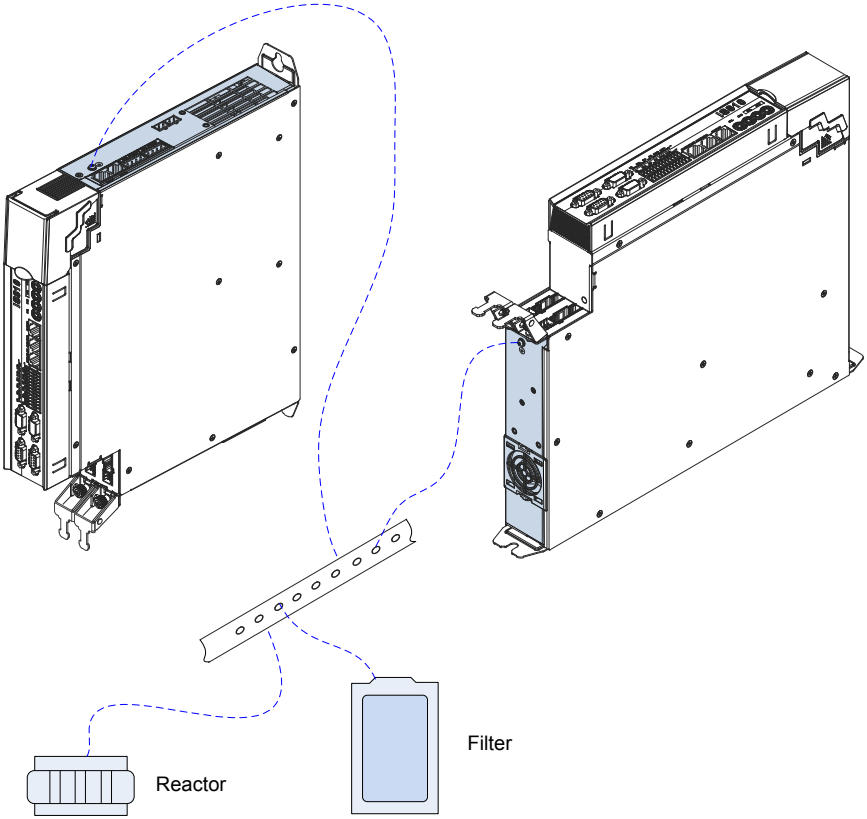
The preinstalled connector (busbar) is used for electrical connection of the device. Connection with a wire other than the busbar cannot guarantee device stability and safety.

Busbar Connection
(1) Loosen the screw of the manipulator. Remove the cover and the manipulator, as shown in the following figure:    Caution! Before removing the cover, ensure that the machine is powered off for over 10 minutes.
(2) Loosen the screw of the DC busbar. Turn over the DC link bridge. Note: For the 50 mm wide model, the rotationally-connected busbar is not pre-installed on the complete machine, but put in the packaging box. Remove the busbar terminal screws before busbar installation. 
(3) Tighten the screws. Calibrate the torques of all screws. Recommended torque: 2.6-3 N·m.

4.3.2 PE Connection

Properly ground every device in the system! Connect the power supply unit, drive unit, and components such as the filter and reactor to the PE copper bar in the cabinet using the star connection method, as shown in the following figure:

Figure 4-2 PE connection

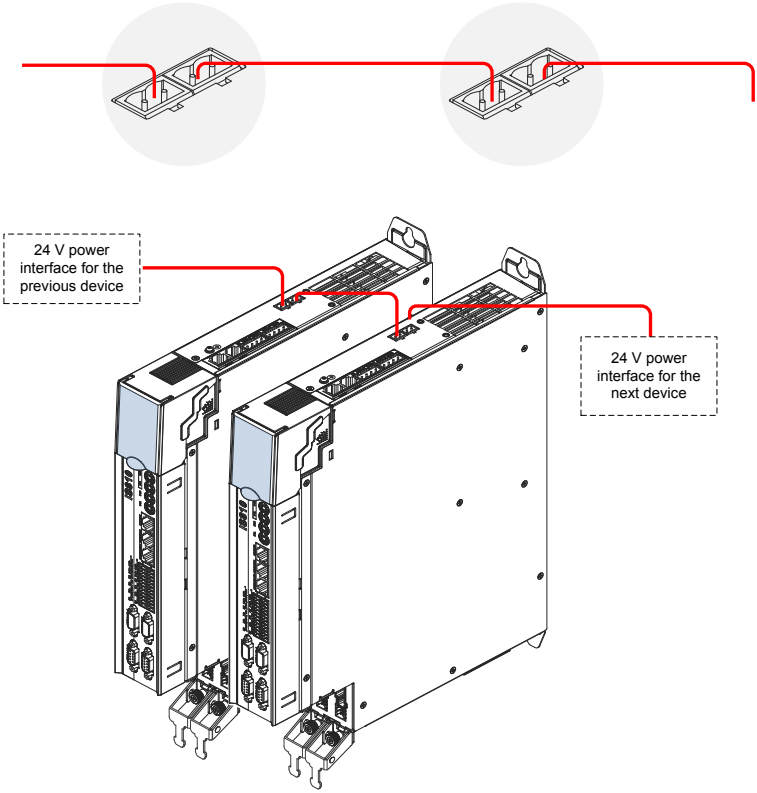


4.3.3 24 V Control Power Supply

The power supply of the drive unit is divided into the control part and the power part. The control part is preferentially powered by the DC busbar that is connected to the power supply unit. It is recommended to synchronously connect the 24 V switch-mode power supply of the drive unit to an external power supply. This ensures that power supply to the control part of the drive unit is not affected after stop due to any fault of the power supply unit.

Note that the 24 V terminal in the drive unit must be correctly connected as shown in the following figure:

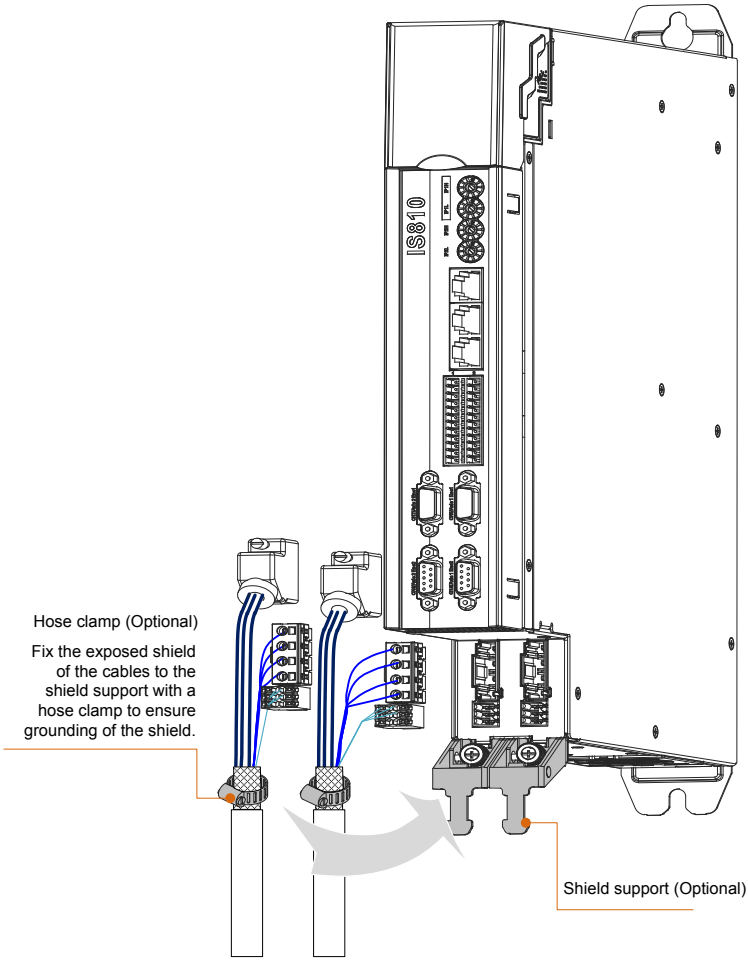
Figure 4-3 Cascade of multiple 24 V control power supplies



4.3.4 Shield Grounding and Hose Clamp

To ensure device stability, fix the exposed shield of cables to the shield support with a hose clamp to ensure grounding of the shield, as shown in the following figure.

Figure 4-4 Shield grounding and hose clamp application



4.4 Connection of the Drive Unit to the Motor

4.4.1 Grounding Requirements

Properly ground the PEs of the servo drive and servo motor.

4.4.2 Connection to a OneCable Series Servo Motor

Figure 4-5 Example of drive unit output connection to the servo motor

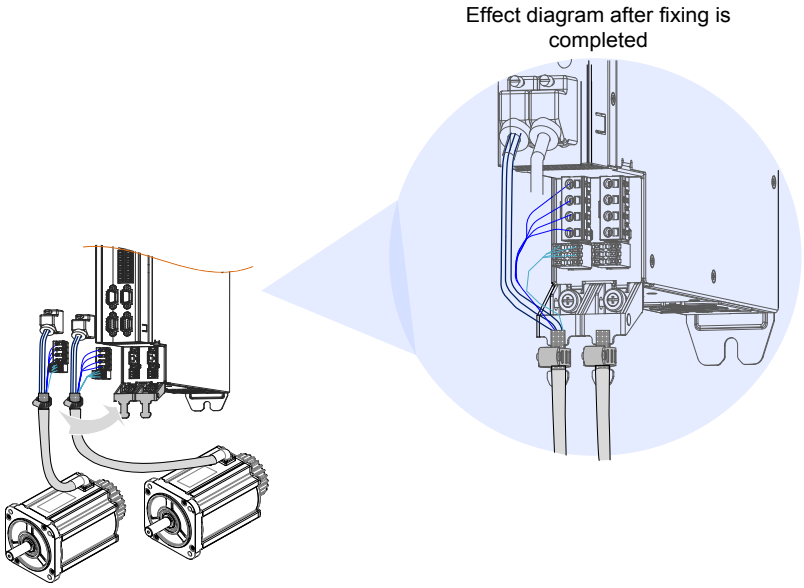
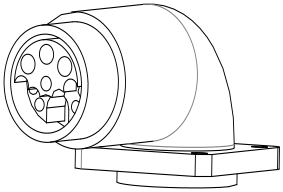
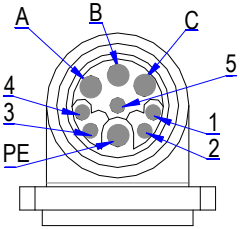


Table 4-2 Connectors of OneCable cables on the servo motor side

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr>
<td>  </td>
<td>


<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th></tr>
<tr><td>A</td><td>U</td><td>Blue</td></tr>
<tr><td>B</td><td>V</td><td>Black</td></tr>
<tr><td>C</td><td>W</td><td>Red</td></tr>
<tr><td>PE</td><td>PE</td><td>Yellow/ Green</td></tr>
<tr><td>1</td><td>+5 V</td><td>Red</td></tr>
<tr><td>2</td><td>0 V</td><td>Black</td></tr>
<tr><td>3</td><td>PS+</td><td>Yellow</td></tr>
<tr><td>4</td><td>PS-</td><td>Yellow and black</td></tr>
<tr><td>5</td><td>Shield Schermo</td><td>White</td></tr>
</table>
</td>
<td>100
130</td>
</tr>
</table>

Frame size of motor: indicates the width of the installation flange.

The cable colors are subject to the actual cables. The cable colors mentioned in this user guide are colors of Inovance cables.

4.4.3 Connection to an ISMH Series Servo Motor

1. Power Cable Connection

Figure 4-6 Example of servo drive output connection to the servo motor

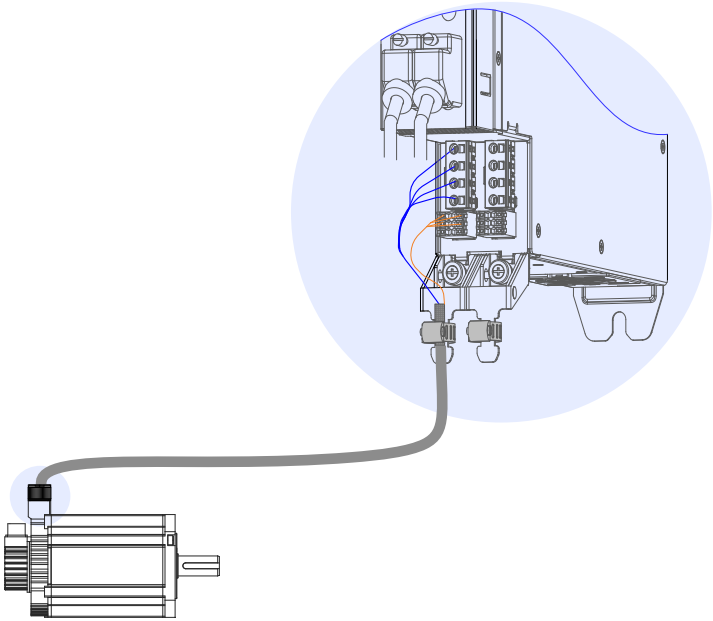
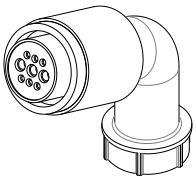
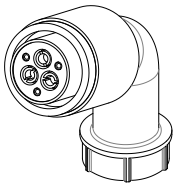
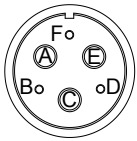
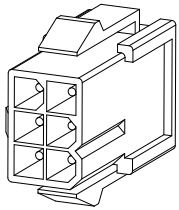
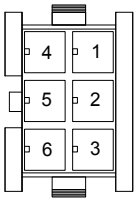


Table 4-3 Connectors of power cables on the servo motor side

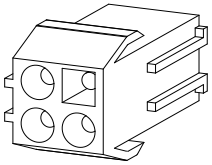
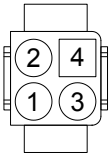
<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td>  </td><td>MIL-DTL-5015 series 3108E20-18S military spec.
20-18 military spec.
 

<table>
<tr><th colspan="2">New Structure</th><th colspan="2">Old Structure</th><th rowspan="2">Color</th></tr>
<tr><th>Pin No.</th><th>Signal</th><th>Pin No.</th><th>Signal</th></tr>
<tr><td>B</td><td>U</td><td>B</td><td>U</td><td>Blue</td></tr>
<tr><td>I</td><td>V</td><td>I</td><td>V</td><td>Black</td></tr>
<tr><td>F</td><td>W</td><td>F</td><td>W</td><td>Red</td></tr>
<tr><td>G</td><td>PE</td><td>G</td><td>PE</td><td>Yellow/ Green</td></tr>
<tr><td>C</td><td rowspan="2">Brake (without positive and negative)</td><td></td><td></td><td></td></tr>
<tr><td>E</td><td></td><td></td><td></td></tr>
</table></td><td>100
130</td></tr>
</table>

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td>  </td><td>MIL-DTL-5015 series 3108E20-22S military spec.
20-22 military spec.
 

<table>
<tr><th colspan="2">Y Series Terminal Definition</th><th colspan="2">Z Series Terminal Definition</th><th rowspan="2">Color</th></tr>
<tr><th>Pin No.</th><th>Signal</th><th>Pin No.</th><th>Signal</th></tr>
<tr><td>A</td><td>U</td><td>A</td><td>U</td><td>Blue</td></tr>
<tr><td>C</td><td>V</td><td>C</td><td>V</td><td>Black</td></tr>
<tr><td>E</td><td>W</td><td>E</td><td>W</td><td>Red</td></tr>
<tr><td>F</td><td>PE</td><td>F</td><td>PE</td><td>Yellow/ Green</td></tr>
<tr><td colspan="2" rowspan="2"></td><td>B</td><td rowspan="2">Brake (without positive and negative)</td><td></td></tr>
<tr><td>D</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>  </td><td>Black 6-pin connector
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th></tr>
<tr><td>1</td><td>U</td><td>White</td></tr>
<tr><td>2</td><td>V</td><td>Black</td></tr>
<tr><td>4</td><td>W</td><td>Red</td></tr>
<tr><td>5</td><td>PE</td><td>Yellow/Green</td></tr>
<tr><td>3</td><td rowspan="2">Brake (without positive and negative)</td><td rowspan="2"></td></tr>
<tr><td>6</td></tr>
</table>
Recommendation:
Plastic housing: MOLEX-50361736; terminal: MOLEX-39000061</td><td></td></tr>
</table>

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr>
<td>  </td>
<td>4-pin connector
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th></tr>
<tr><td>1</td><td>U</td><td>Blue</td></tr>
<tr><td>2</td><td>V</td><td>Black</td></tr>
<tr><td>3</td><td>W</td><td>Red</td></tr>
<tr><td>4</td><td>PE</td><td>Yellow/Green</td></tr>
</table>
Recommendation:
Plastic housing: Zhejiang CWB EL-4A; terminal: Zhejiang CWB 421.6003.0</td>
<td>40 (X series)
60 (X series)
80 (X series)</td>
</tr>
</table>

NOTE

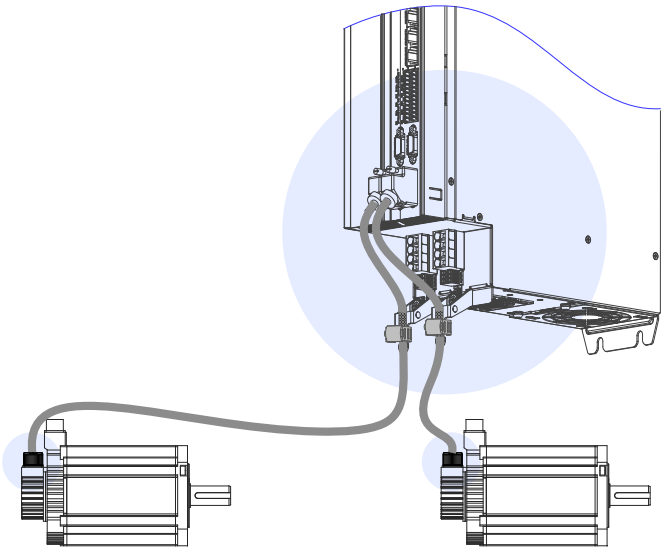
Frame size of motor: indicates the width of the installation flange.

The motor cable colors are subject to the actual cables. The cable colors mentioned in this user guide are Inovance cables.

2. Encoder Cable Connection

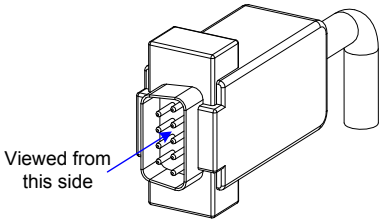
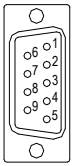
● Connection of the bus incremental encoder

Figure 4-7 Example of connecting encoder signal cables



The encoder cable colors are subject to the actual cables. The cable colors mentioned in the user guide are Inovance cables.

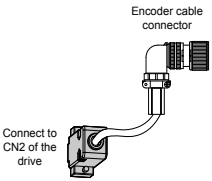
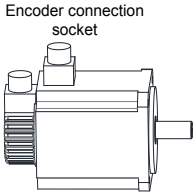
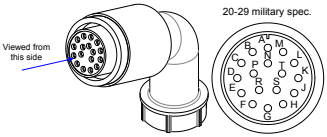
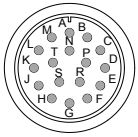
Table 4-4 Connectors of IS810N series 20-bit encoder cables on servo drive side

Connector Appearance	Terminal Pin Layout
	

Pin No.	Signal
1	PS+
2	PS-
7	+5 V
8	GND
Housing	PE

Recommendation:
Plastic housing of plug on cable side: DB9P (SZTDK), black housing
Core: DB9P soldering plug (SZTDK), blue rubber

Table 4-5 Connectors of IS810N series 20-bit encoder cables (MIL-DTL-5015 series 3108E20-29S military spec.)

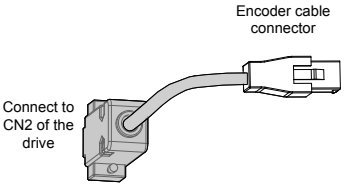
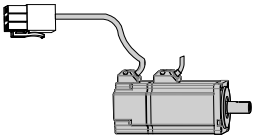
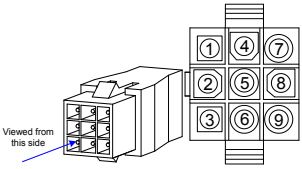
Connector Appearance and Pin Layout		Frame Size of Applicable Motor
		100 130 180
		

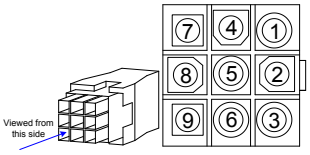
Pin No.	Signal	
A	PS+	Twisted-pair
B	PS-	
G	+5 V	
H	GND	
J	Shield	

Pin No.	Signal	Color	
A	PS+	Yellow	Twisted-pair
B	PS-	Blue	
G	+5 V	Red	
H	GND	White	
J	Shield		

Frame size of motor: indicates the width of the installation flange.

Table 4-6 Connectors of IS810N series 20-bit encoder cables (9-pin connector)

<table>
<tr><th colspan="2">Connector Appearance and Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td> 
</td><td> 
</td><td>40
60
80</td></tr>
<tr><td>9-pin connector
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th></th></tr>
<tr><td>3</td><td>PS+</td><td rowspan="2">Twisted-pair</td></tr>
<tr><td>6</td><td>PS-</td></tr>
<tr><td>9</td><td>+5 V</td><td rowspan="3"></td></tr>
<tr><td>8</td><td>GND</td></tr>
<tr><td>J</td><td>Shield</td></tr>
</table>
Recommendation:
Plastic housing: AMP 172161-1;
Terminal: AMP 170359</td><td> 

<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th></tr>
<tr><td>3</td><td>PS+</td><td>Yellow</td></tr>
<tr><td>6</td><td>PS-</td><td>Blue</td></tr>
<tr><td>9</td><td>+5 V</td><td>Red</td></tr>
<tr><td>8</td><td>GND</td><td>White</td></tr>
</table></td><td></td></tr>
</table>

Frame size of motor: indicates the width of the installation flange.

Table 4-7 Pin relationship of IS810N series 20-bit encoder cables

DB9 on Servo Drive Side		Function Description	Motor Side	
			9-pin	20-29 Aviation Plug
Signal	Pin No.		Pin No.	Pin No.
PS+	1	Serial communication signal +	3	A
PS-	2	Serial communication signal -	6	B
+5 V	7	Encoder +5 V power supply	9	G
GND	8	Encoder +5 V power ground	8	H
PE	Housing	Shield	7	J

It is recommended that the 22–26AWG cables and matching AMP170359-1 terminals be used for the 10B, 20B, 40B, and 75B series motors. If longer cables are required, cables with a larger diameter should be used, as described in the following table.

Table 4-8 Recommended cable sizes

Cable Size	Ω/km	Allowed Cable Length (m)
26AWG (0.13 mm2)	143	10.0
25AWG (0.15mm2)	89.4	16.0
24AWG (0.21mm2)	79.6	18.0
23AWG (0.26mm2)	68.5	20.9
22AWG (0.32mm2)	54.3	26.4

If cables sized greater than 22AWG are required, contact Inovance.

● Absolute Encoder Installation

Installation of the Battery Box for the Absolute Encoder

Battery box model (optional): S6-C4

This model includes:

One sheet metal bracket

One plastic box

One 3.6 V/2600 mAh battery

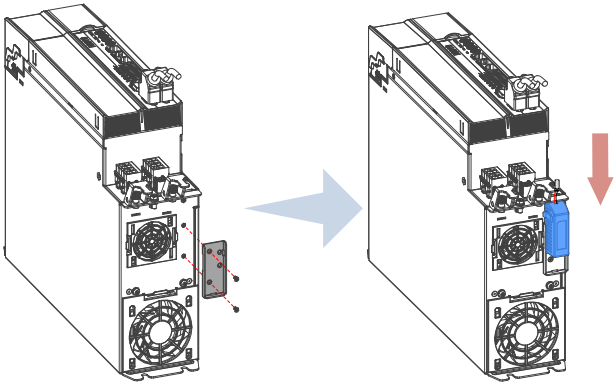
Two M3x10 flat-head screws

One M3x10 pan-head screw

Terminal block and crimping terminal

Installing the battery box:

Figure 4-8 Installation diagram of a battery box for a size-A absolute encoder



Step 1 Step 2

Fasten the battery box with two flat-head screws (refer to Figure 4-5).

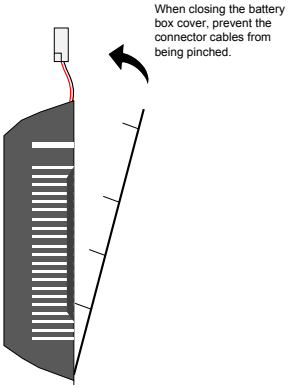
The flat-head screws correspond to the flat-head slots.

Removing the battery box:

The battery may encounter leakage after being used for a long time. Replace it every two years.

Remove the battery box in procedure reverse to the preceding installation procedure.

When closing the battery box cover, prevent squeezing the connector cables.



Note: Improper use of a battery may result in battery leakage which will corrode the components or cause the battery to explode. Observe the following precautions during use:

- Ensure correct battery polarity when installing the battery;
- Leaving a battery that has been used for a long time or is no longer useful inside a device can cause battery leakage. The electrolyte inside the battery is highly corrosive, not only corroding nearby components, but also increasing the short circuit possibility. Replace the battery periodically (recommended period: 2 years).
- Do not disassemble the battery as electrolyte spray may cause personal injuries.
- Do not throw a battery into fire as this may cause the battery to explode.
- Prevent battery short circuits, and do not strip the battery tube. It is dangerous for a metal item to contact both electrodes of the battery, as it may cause a high current, weakening the battery power and probably causing explosion of the battery due to severe heating.
- Do not charge the battery.
- Dispose the battery according to local regulations.

Selecting a battery:

Select an appropriate battery according to the following table.

Table 4-9 Battery description for absolute encoders

Battery Spec.	Item	Rating			Condition
		Min.	Typical	Max.	
Output: 3.6 V, 2500 mAh Recommended manufacturer and model: Shenzhen Jieshun, LS14500	External battery voltage (V)	3.2	3.6	5	In standby mode*2
	Circuit fault voltage (V)		2.6		In standby mode
	Battery alarm voltage (V)	2.85	3	3.15	
	Battery current consumption (uA)	-	2	-	During normal operation*1
		-	10	-	In standby mode, axis static
		-	80	-	In standby mode, axis rotation
	Battery operating temperature (°C)	0	-	40	Same as motor ambient temperature
	Battery storage temperature (°C)	-20	-	60	

The preceding data is measured at the ambient temperature of 20°C.

Note 1: During normal operation, the absolute encoder supports one-turn or multiturn data counting and transmitting/receiving. After connecting the absolute encoder properly, turn on the power to the servo drive, and the encoder enters normal operation state and transmits/receives data after a delay of 5s. When the encoder switches from standby state to normal operation state (power turned on), the motor speed must not exceed 10 RPM. Otherwise, the servo drive reports Er.740, and you need to power on the servo drive again.

Note 2: Standby state: The servo drive is not powered on, and the external battery is used for multi-turn data counting. In this case, data transmitting/receiving is not performed.

Battery service life:

The calculation below only considers the encoder's current consumption and does not cover current consumption of the battery.

Assume that:

Normal operation time of servo drive: T1

Motor rotating time after power-off of servo drive: T2

Motor rotating stop time after power-off: T3 (unit: hour)

Example:

Table 4-10 Theoretical battery service life of an absolute encoder

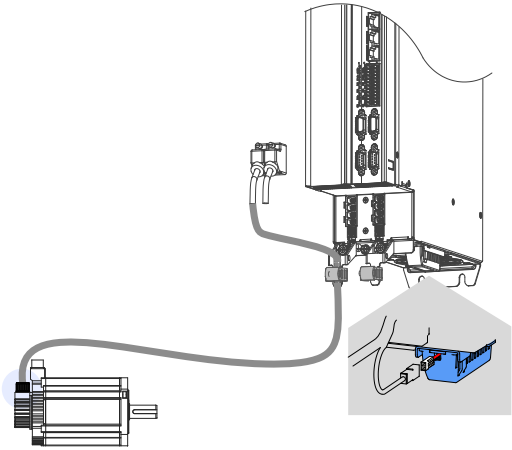
Item	Time Arrangement 1	Time Arrangement 2
Number of days the battery works under different working conditions in 1 year	313	52
T1 (hour)	8	0
T2 (hour)	0.1	0
T3 (hour)	15.9	24

Yearly consumption = (8H x 2uA + 0.1H x 80uA + 15.9H x 10uA) x 313 + (0H x 2uA + 0H x 80uA +24H x 10uA) x 52 ≈ 70 mAH

Theoretical battery service life = Battery capacity/Yearly consumption = 2600 mAH/70 mAH = 37.1 years

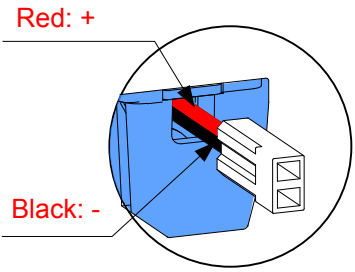
2. Wiring of Battery Box and Signal Wires

Figure 4-9 Example of wiring of the battery box and signal wires for an absolute encoder



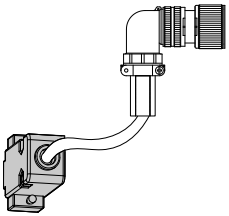
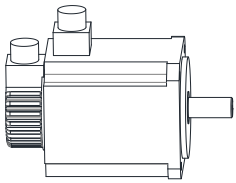
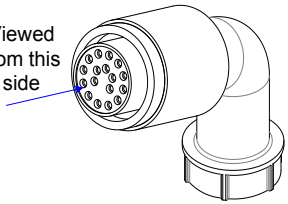
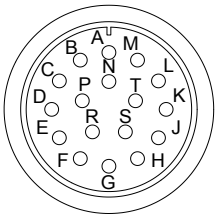
Color of the battery box outer lead:

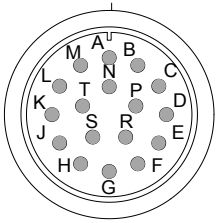
Figure 4-10 Battery box outer lead of the absolute encoder



Store the battery box at the required ambient temperature and ensure the battery is in reliable contact and has sufficient capacity. Otherwise, position information loss may occur in the encoder.

Table 4-11 Connectors of IS810N series absolute encoder cables (MIL-DTL-5015 series 3108E20-29S military spec.)

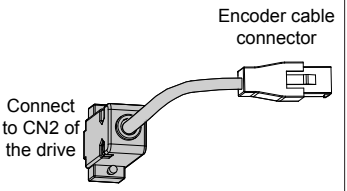
<table>
<tr><th>Connector Appearance and Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td>
Encoder cable connector

Connect to CN2 of the drive
Encoder connection socket

MIL-DTL-5015 series 3108E20-29S military spec.
9-pin connector
Viewed from this side

20-29 military spec.


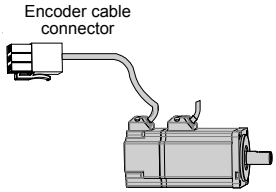
<table>
<tr><th>Pin No.</th><th>Signal</th><th>Remarks</th></tr>
<tr><td>A</td><td>PS+</td><td rowspan="2">Twisted-pair</td></tr>
<tr><td>B</td><td>PS-</td></tr>
<tr><td>E</td><td>Battery +</td><td rowspan="3">-</td></tr>
<tr><td>F</td><td>Battery -</td></tr>
<tr><td>G</td><td>+5 V</td></tr>
<tr><td>H</td><td>GND</td><td rowspan="2">-</td></tr>
<tr><td>J</td><td>Shield</td></tr>
</table>
20-29 military spec.


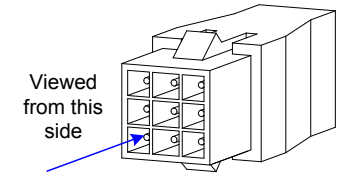
<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th><th>Remarks</th></tr>
<tr><td>A</td><td>PS+</td><td>Yellow</td><td rowspan="2">Twisted-pair</td></tr>
<tr><td>B</td><td>PS-</td><td>Yellow and black</td></tr>
<tr><td>E</td><td>Battery +</td><td>Blue</td><td rowspan="3">-</td></tr>
<tr><td>F</td><td>Battery -</td><td>Blue and black</td></tr>
<tr><td>G</td><td>+5 V</td><td>Red</td></tr>
<tr><td>H</td><td>GND</td><td>Black</td><td rowspan="2">-</td></tr>
<tr><td>J</td><td>Shield</td><td></td></tr>
</table>
</td><td>100
130
180</td></tr>
</table>

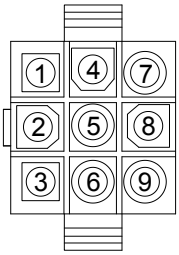
Frame size of motor: indicates the width of installation flange.

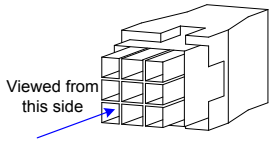
Table 4-12 Connectors of IS810N series absolute encoder cables (9-pin connector)

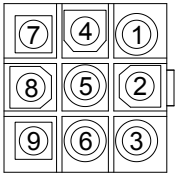
<table>
<tr><th>Connector Appearance and Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td>




9-pin connector




<table>
<tr><th>Pin No.</th><th>Signal</th><th>Remarks</th></tr>
<tr><td>1</td><td>Battery +</td><td rowspan="2">-</td></tr>
<tr><td>4</td><td>Battery -</td></tr>
<tr><td>3</td><td>PS+</td><td rowspan="3">Twisted-pair</td></tr>
<tr><td>6</td><td>PS-</td></tr>
<tr><td>9</td><td>+5 V</td></tr>
<tr><td>8</td><td>GND</td><td rowspan="2">-</td></tr>
<tr><td>7</td><td>Shield</td></tr>
</table>
Recommendation:
Plastic housing: AMP 172161-1;
Terminal: AMP 770835-1




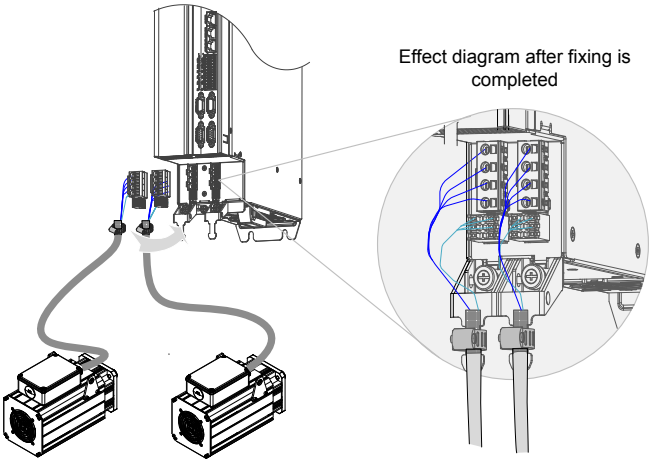
<table>
<tr><th>Pin No.</th><th>Signal</th><th>Color</th><th>Remarks</th></tr>
<tr><td>A</td><td>PS+</td><td>Yellow</td><td rowspan="2">-</td></tr>
<tr><td>B</td><td>PS-</td><td>Yellow and black</td></tr>
<tr><td>E</td><td>Battery +</td><td>Blue</td><td rowspan="3">Twisted-pair</td></tr>
<tr><td>F</td><td>Battery -</td><td>Blue and black</td></tr>
<tr><td>G</td><td>+5 V</td><td>Red</td></tr>
<tr><td>H</td><td>GND</td><td>Black</td><td rowspan="2">-</td></tr>
<tr><td>J</td><td>Shield</td><td></td></tr>
</table>
</td><td>40
60
80</td></tr>
</table>

Frame size of motor: indicates the width of the installation flange.

4.4.4 Connection to an ISMG Series Servo Motor

1. Power Cable Connection

Figure 4-11 Example of drive unit output connection to an ISMG series servo motor



The specifications and connections of external main circuit cables must comply with local regulations and related IEC requirements.

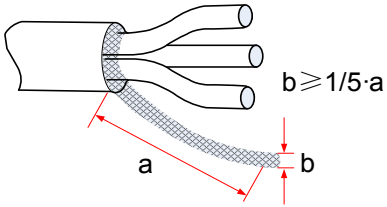
To avoid equipment damages or operating faults, do not connect a capacitor or surge absorber to the output side of the servo drive.

Long motor cables can contribute to electrical resonance caused by distributed capacitance and inductance. In some cases, this might cause equipment damages in the drive, motor, or cables. To avoid these problems, install an AC output reactor close to the drive if the cable is longer than 100 m.

It is recommended to use shielded cable as the output cables to the motor. Connect the shield with a grounding support fully to the ground, and connect the lead-out wire of the shield to the PE terminal.

Ensure that the lead-out wire of the motor cable shield is as short as possible, and the width b is greater than or equal to 1/5 of the length.

Figure 4-9 Lead-out wire of a motor cable shield



PE

For personal safety and reliability of the equipment, it is important to connect PE to an effective electrical grounding cable. Resistance value of the grounding cable must be less than 10 Ω.

Do not connect the PE of the drive to the neutral conductor of the power system.

Use a proper grounding cable with yellow/green insulation for protective grounding conductor.

Ground the shield correctly.

It is recommended that the drive be installed on a metal mounting surface and ensure proper contact between the conductive base of the drive and the metal mounting surface.

Install filter and drive on the same mounting surface to ensure the filtering effect.

2. Encoder Cable Connection

Figure 4-13 Example of connecting encoder signal cables

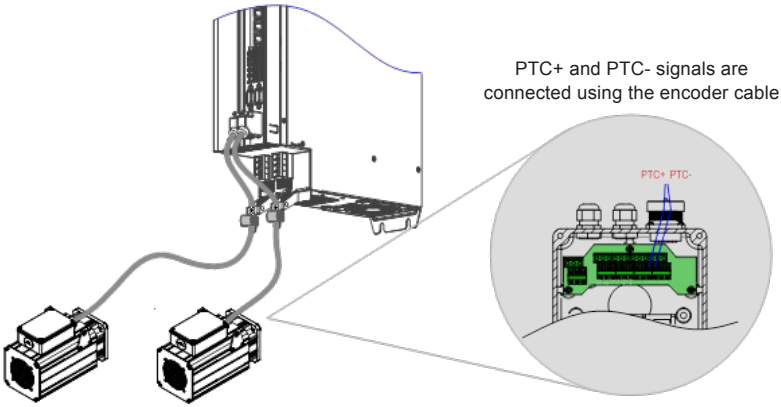


Table 4-13 Connectors of encoder cables on the servo drive side

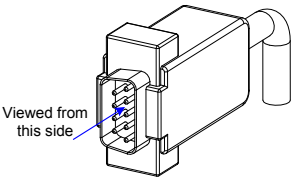
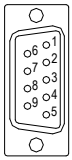
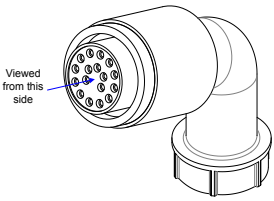
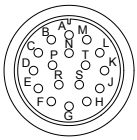
Connector Appearance	Terminal Pin Layout
	 Pin No. / Signal: 1 PS+; 2 PS-; 7 +5 V; 8 GND; Housing PE Recommendation: Plastic housing of plug on cable side: DB9P (SZTDK), black housing Core: DB9P soldering plug (SZTDK), blue rubber

Table 4-14 Connectors of encoder cables on the servo motor side

Connector Appearance	Terminal Pin Layout
	MIL-DTL-5015 series 3108E20-29S military spec. 

Pin No.	Signal	Remarks
A	PS+	Twisted-pair
B	PS-	
G	+5 V	Twisted-pair
H	GND	
J	Shield	-

Table 4-15 Pin relationship of encoder cables

DB9 on Servo Drive Side		Function Description 9-pin	Motor Side	
			9-pin	20-29 military spec.
Signal	Pin No.		Pin No.	Pin No.
PS+	1	Serial communication signal +	3	A
PS-	2	Serial communication signal -	6	B
+5 V	7	Encoder +5 V power supply	9	G
GND	8	Encoder +5 V power ground	8	H
PE	Housing	Shield	7	J

Observe the following precautions when wiring the encoder:

Ground the servo drive and shielded layer of the servo motor reliably. Otherwise, the servo drive will report a false alarm.

It is recommended to use twisted-pair cable sized 26AWG to 16AWG. The differential signals shall be connected to two corresponding core wires in the twisted-pair cable. The wiring length shall be as short as possible.

Do not connect cables to the reserved pins.

To determine the length of the encoder cable, consider voltage drop due to the cable resistance and signal attenuation caused by the distributed capacitance. It is recommended to use twisted-pair cable sized 26AWG or greater (as per the UL2464 standard) and shorter than 10 m. If the cable is very long, use the cable of a larger size, as described in the following table.

Table 4-16 Recommended cable sizes

Cable Size	Ω/km	Allowed Cable Length (m)
26AWG (0.13 mm^2)	143	10.0
25AWG (0.15 mm^2)	89.4	16.0
24AWG (0.21 mm^2)	79.6	18.0
23AWG (0.26 mm^2)	68.5	20.9
22AWG (0.32 mm^2)	54.3	26.4
21AWG (0.41 mm^2)	42.7	33.5

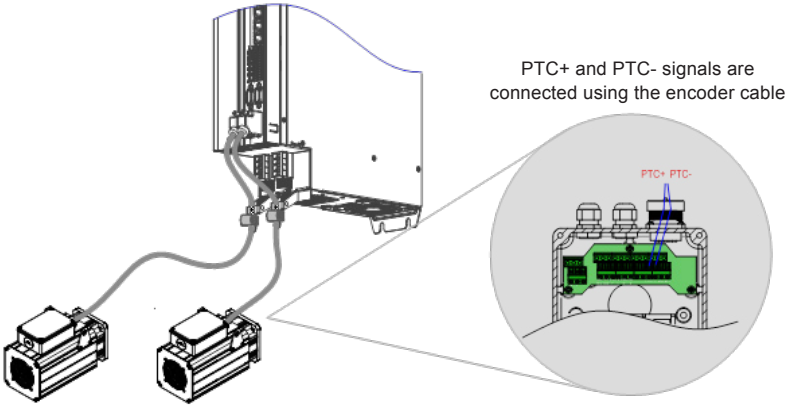
To determine the length of the signal cable, consider voltage drop caused by the cable resistance, and pay attention to the power capacity during power distribution, to ensure that the strength of signals and power arriving at the drive input side is sufficient. Twisted-pair shield cables sized greater than 26AWG are recommended.

The encoder cable and signal cable must be separated by at least 30 cm.

If the encoder cable is too short and an extension cable is to be added, make sure the shielded layers of two separate cables are well connected for reliable grounding.

Wiring for Motor Temperature Detection:

Figure 4-14 Example of connecting the PTC+/PTC- signal cables



4.4.5 Connection to an MS1H Series Servo Motor

1. Power Cable Connection

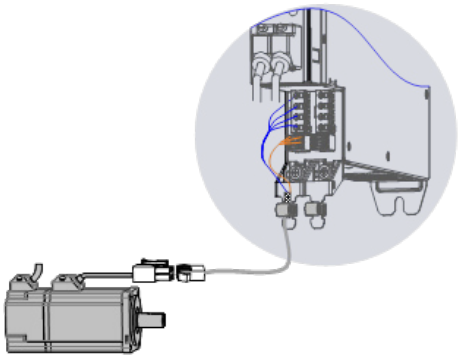
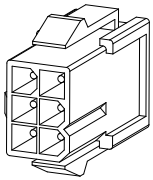
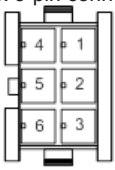


Table 4-17 Connectors of power cables on the servo motor side

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Applicable Motor</th></tr>
<tr><td>  </td><td>Black 6-pin connector
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th>Remarks</th></tr>
<tr><td>1</td><td>U</td><td>White</td></tr>
<tr><td>2</td><td>V</td><td>Black</td></tr>
<tr><td>4</td><td>W</td><td>Red</td></tr>
<tr><td>5</td><td>PE</td><td>Yellow/ Green</td></tr>
<tr><td>3</td><td rowspan="2">Brake
(without positive and negative)</td><td rowspan="2"></td></tr>
<tr><td>6</td></tr>
</table>
Recommendation:
Plastic housing: MOLEX-50361736
Terminal: MOLEX-39000061</td><td>40 (Z series)
60 (Z series)
80 (Z series)</td></tr>
</table>

Note: Frame size of the motor indicates the width of the installation flange.

The power cable colors are subject to the actual cables. The cable colors mentioned in this user guide are colors of Inovance cables.

2. Absolute Encoder Cable Connection

Refer to section 4.4.3 "2 Encoder Cable Connection".

4.5 Brake Wiring

A brake is used to lock the motor in position when the servo drive is shut down to prevent the moving part of the machine from falling by gravity or being moved by external force.

Figure 4-15 Positions of brake wiring terminals

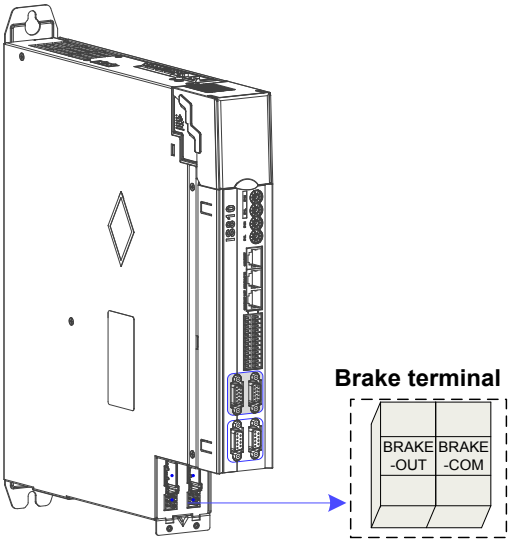
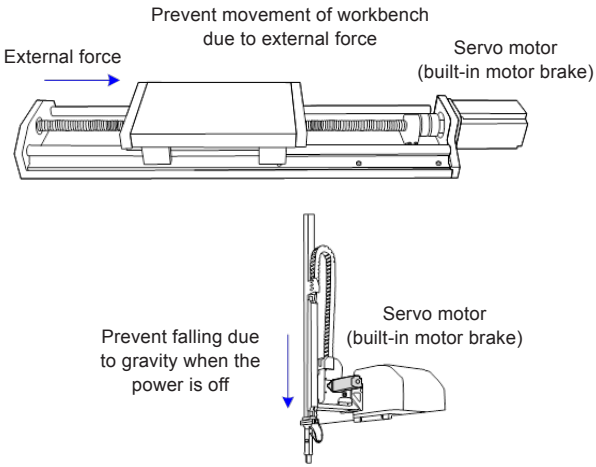


Figure 4-16 Application of a motor brake



Caution

Use this built-in brake to keep the stalling status only. Never use this for "Brake" to stop the load in motion.

Brake coils are of no polarity.

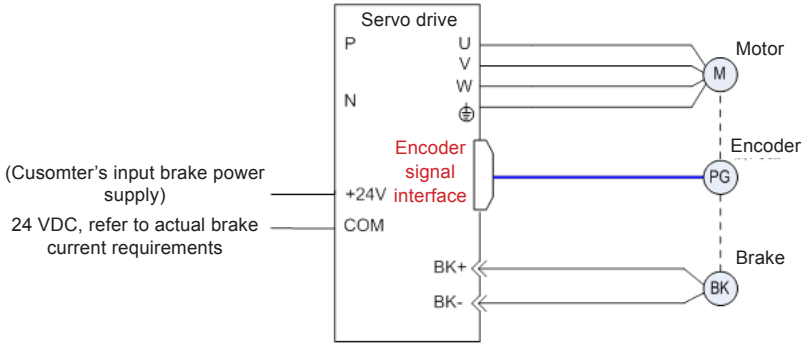
Turn off S-ON after the servo motor stops.

When the servo motor with a brake runs, the brake may generate a click sound, which does not affect its functions.

When brake coils are energized (the brake is released), magnetic flux leakage may occur at the shaft end. Thus, pay special attention when using magnetic sensors around the servo motor.

The connector of the motor brake has no polarity. Users need to prepare a 24 V external power supply. The following figure shows the standard wiring of the brake signal (BK) and brake power supply.

Figure 4-17 Wiring for a motor brake

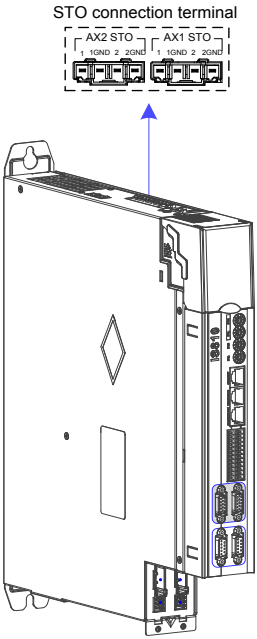


Pay attention to the following precautions during wiring:

To decide the length of the cable on the motor brake side, consider voltage drop caused by cable resistance. The input voltage of the brake must be at least 21.6 V.

4.6 STO Connection

When a fault is detected in the safety circuit, the STO function immediately cuts off the output current of the controller and stops the output torque of the motor.



STO connection terminal definition (Refer to the STO terminal definition of MD810):

Port Type	Interface Name	Function
AX1STO	1	Shaft 1 STO channel 1 power+
	1GND	Shaft 1 STO channel 1 power-
	2	Shaft 1 STO channel 2 power+
	2GND	Shaft 1 STO channel 2 power-
AX2STO	1	Shaft 2 STO channel 1 power+
	1GND	Shaft 2 STO channel 1 power-
	2	Shaft 2 STO channel 2 power+
	2GND	Shaft 2 STO channel 1 power-

Note: If an external power supply is used, it shall be an SELV circuit power supply with the following specifications: 24 VDC ±10%, 50 mA.

4.6.1 Application Example of the STO Function

Figure 4-18 Example 1

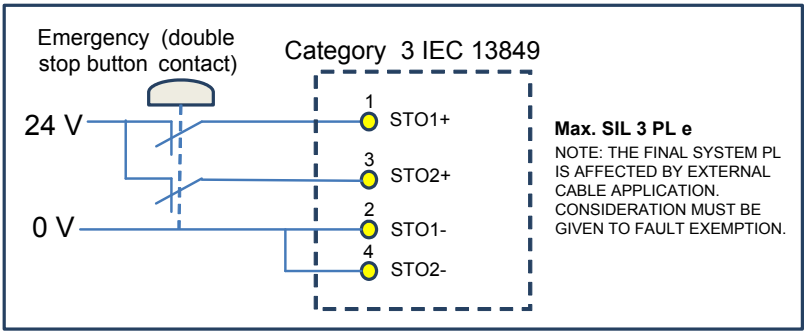


Figure 4-19 Example 2

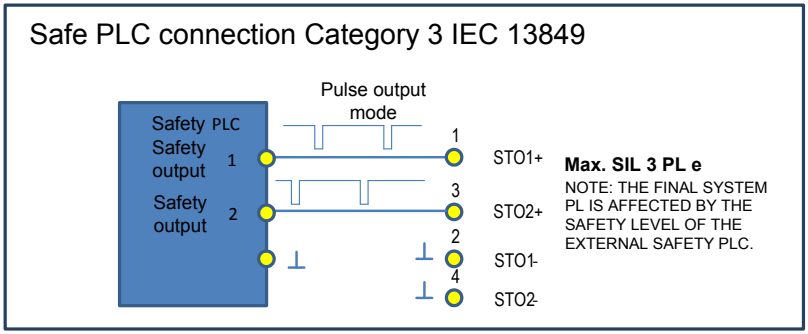
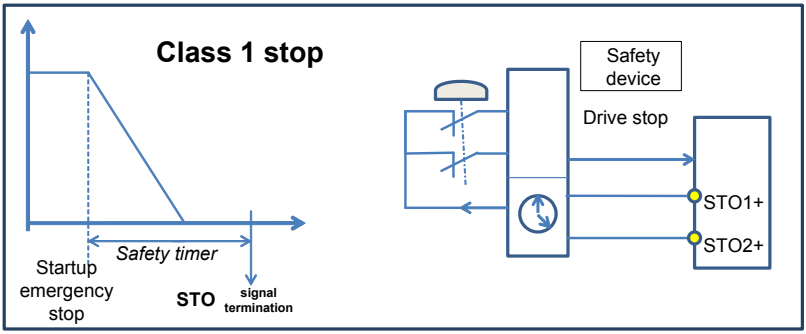


Figure 4-20 Example 3



4.6.2 Disabling the STO Function

When the STO function is not used, an external 24 V power supply must be connected. The following figure shows the specific wiring method of every drive. If multiple drives provide the STO function, the STO terminal of every drive must be connected to an external 24 V switching-mode power supply.

Figure 4-21 Positions of STO wiring terminals

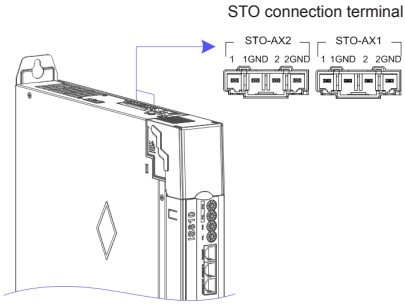
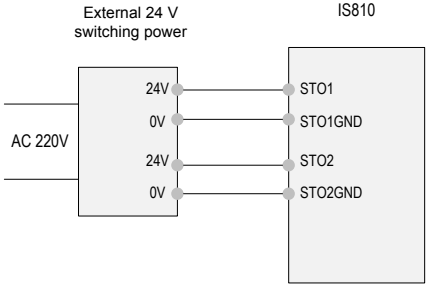
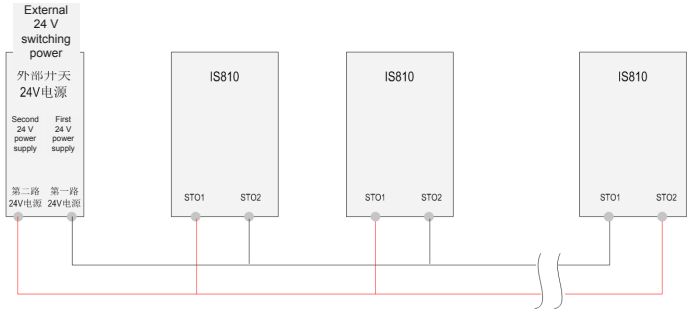


Figure 4-22 Wiring of STO terminal



The following figure shows the case where the STO terminals of multiple drives are cascaded to share one external switching-mode power supply.

Figure 4-23 Wiring case where the STO terminals of multiple drives are cascaded to share one 24 V power supply



4.7 RJ45 Communication Connection

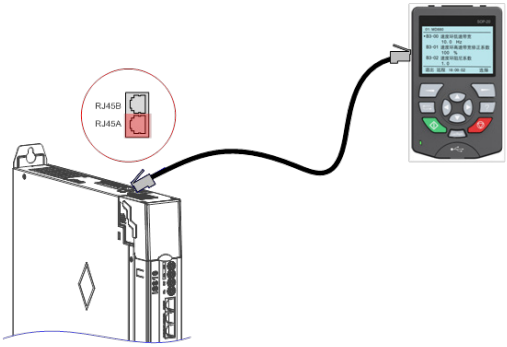
RJ45 communication interfaces (RJ45A/RJ45B):

RJ45 communication interfaces (RJ45A/RJ45B)	CANH	CAN_H of CANopen/CANlink communication signal	CANopen/CANlink communication protocol supported.
	CANL	CAN_L of CANopen/CANlink communication signal	
	CGND	Ground of CANopen/CANlink communication signal	
	RS485+	Positive of RS485 communication signal	Used for RS485 internal bus, external keypad, and PC commissioning (INoDriveShop)
	RS485-	Negative of RS485 communication signal	
	CGND	Ground of RS485 communication signal	
	7 V	Power supply to an external LCD keypad	Connect an external LCD keypad.

The commissioning operation can be performed by connecting the RJ45 interface at the back of the external LCD keypad to the RJ45B interface at the top of IS810 using a standard network cable. The figure shows the interface of IS810.

The smart operating keypad (model SOP-20) is Inovance's new-generation commissioning assistant for the frequency control system and supports products such as IS810, MD810, MD880 and HE series and vehicle electronic drives. The smart operating keypad has a wide power supply range and LCD display, supports multibus and applies to the single-motor/multi-motor drive. The keypad provides the functions such as parameter settings, state monitoring, simple oscilloscope, parameter copy, fault analysis and locating, program download and USB relay.

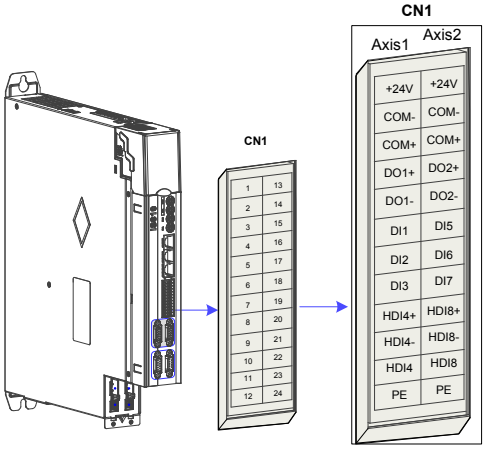
Figure 4-24 Connection to SOP-20 using an RJ45A interface



For usage details, refer to the *SOP-20 Smart Operation Panel User Manual*.

4.8 Control Signal Connection (CN1)

Figure 4-25 Pin layout of the control circuit terminal connector of a servo drive



1. CN1 Terminal

Table 4-17 DI/DO signal description

Terminal Symbol		Terminal Name	Terminal Function
Axis 1	Axis 2	-	-
+24 V	+24V	Internal 24 V power supply, voltage range: 20 to 28 V, maximum output current: 200 mA	
COM-	COM-		
COM+	COM+	Power input (12 V to 24 V)	
DO1+	DO2+	S-RDY+	Servo ready
DO1-	DO2-	S-RDY-	
DI1	DI5	P-OT	Positive limit switch
DI2	DI6	N-OT	Negative limit switch
DI3	DI7	INHIBIT	Pulse input inhibited
HDI4+	HDI8+	TouchProbe	Touch probe function
HDI4-	HDI8-	TouchProbe	Touch probe function
HDI4	HDI8	TouchProbe	Touch probe function
PE	PE	Shield	Signal shielding ground

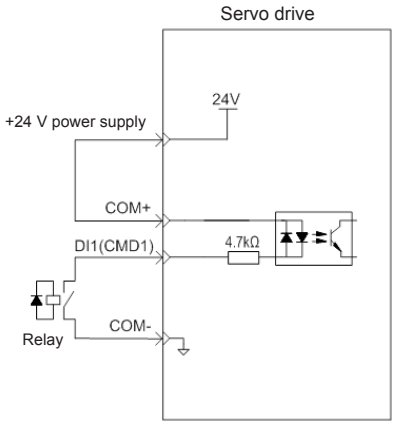
2) Wiring

1) DI circuit

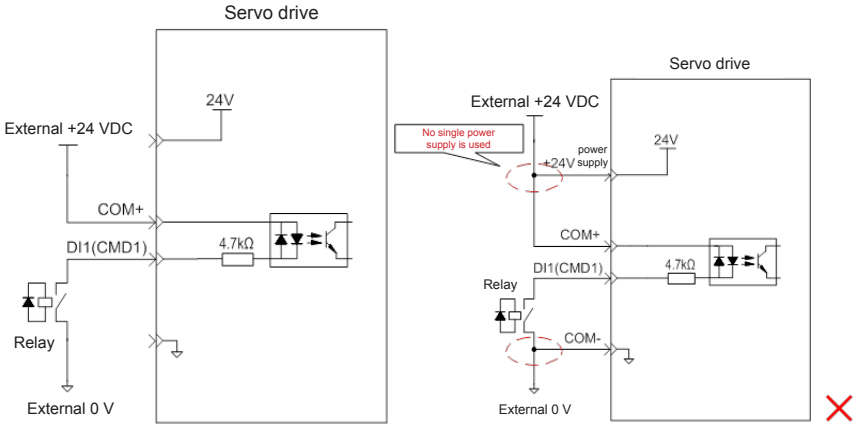
DI1 to DI3 interface circuits are the same. The following takes DI1 circuit as an example.

a) When the host controller provides relay output:

① If the internal 24 V power supply of the servo drive is used:

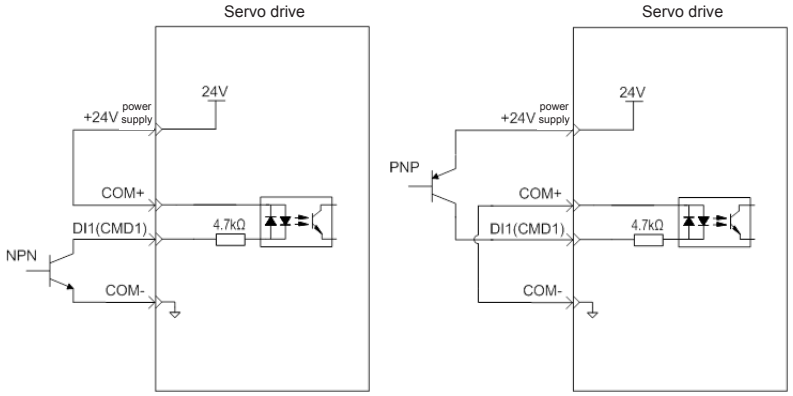


② If the external power supply is used:

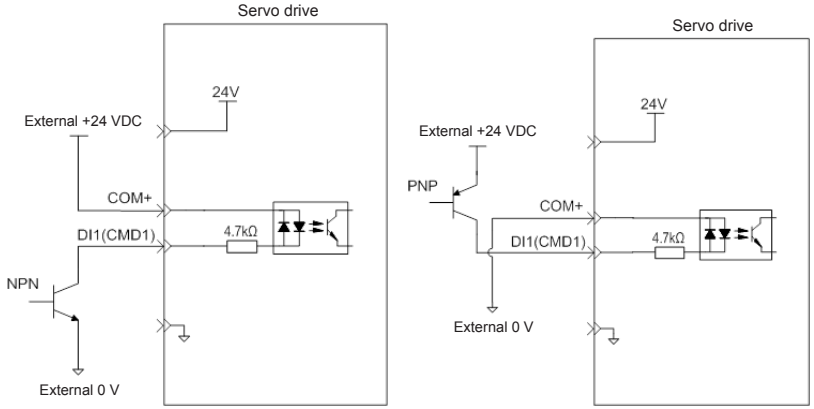


b) When the host controller provides OC output:

① If the internal 24 V power supply of the servo drive is used:



② If the external power supply is used:



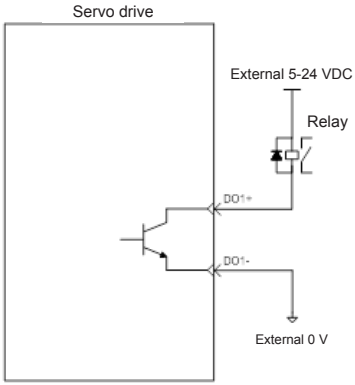
NOTE

PNP and NPN input cannot be applied in the same circuit.

2) DO circuit

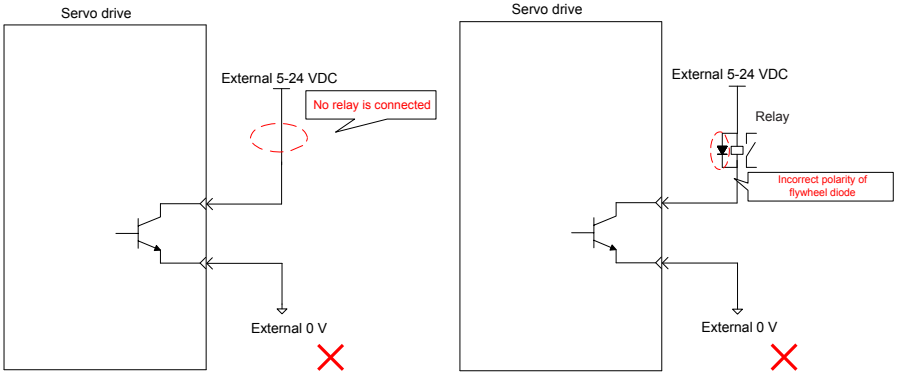
DO1–DO2 interface circuits are the same. The following takes DO1 interface circuit as an example.

a) When the host controller provides relay input:

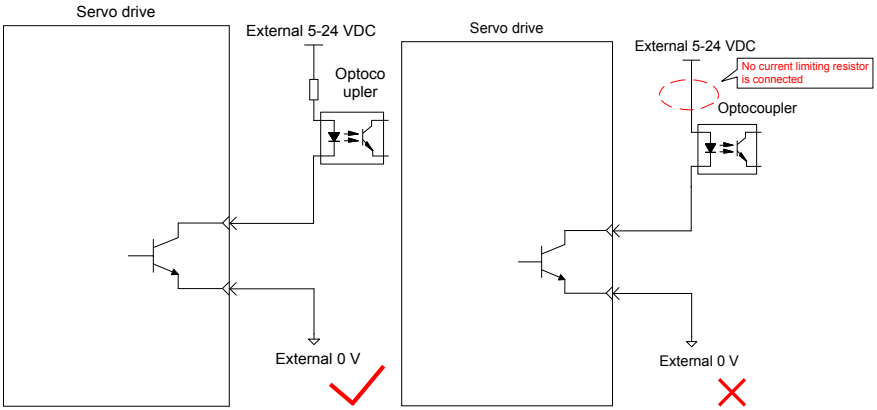


NOTE

When the host controller provides relay input, a flywheel diode must be installed; otherwise, the DO ports may be damaged.



b) When the host controller provides optocoupler input:



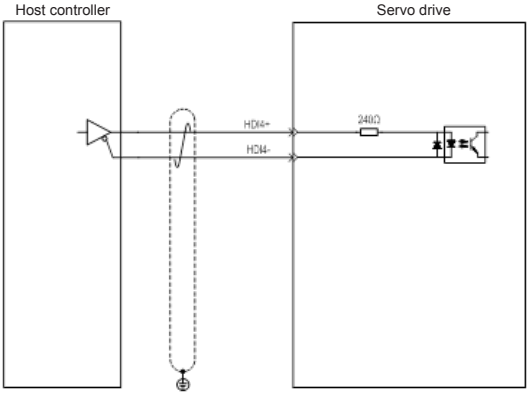
The maximum allowable voltage and current of the optocoupler output circuit inside the servo drive are as follows:

Maximum voltage: 30 V DC

Maximum current: DC 50 mA

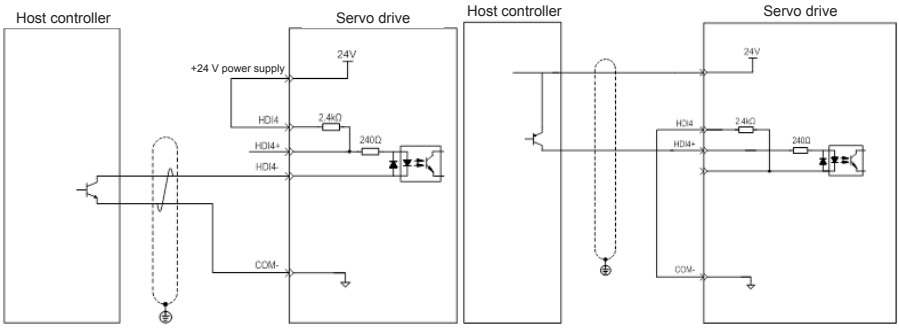
3) High-speed HDI4

a) Differential mode

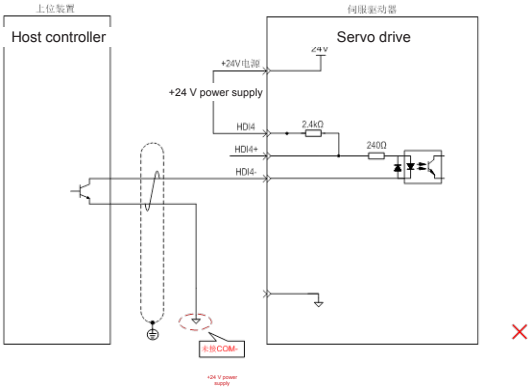


b) OC mode

① When the internal 24 V power supply of the servo drive is used:

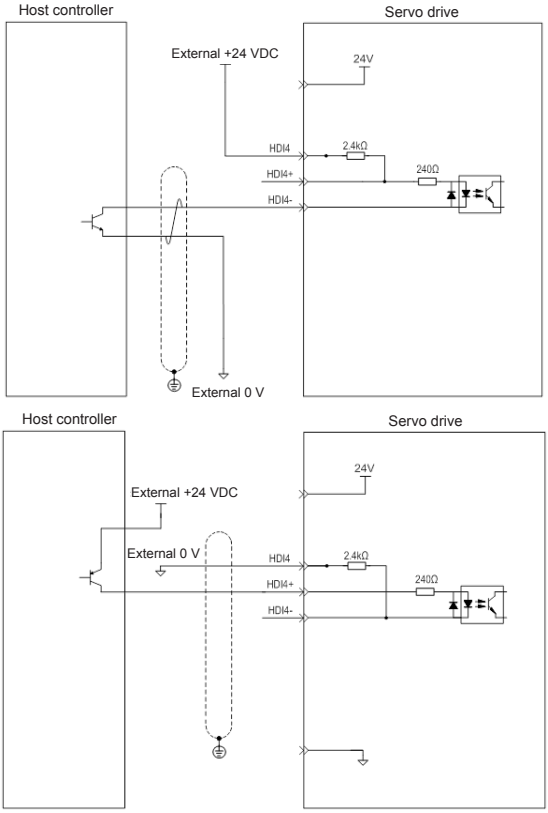


Wrong connection: Pin COM- is not connected, which causes an open circuit.

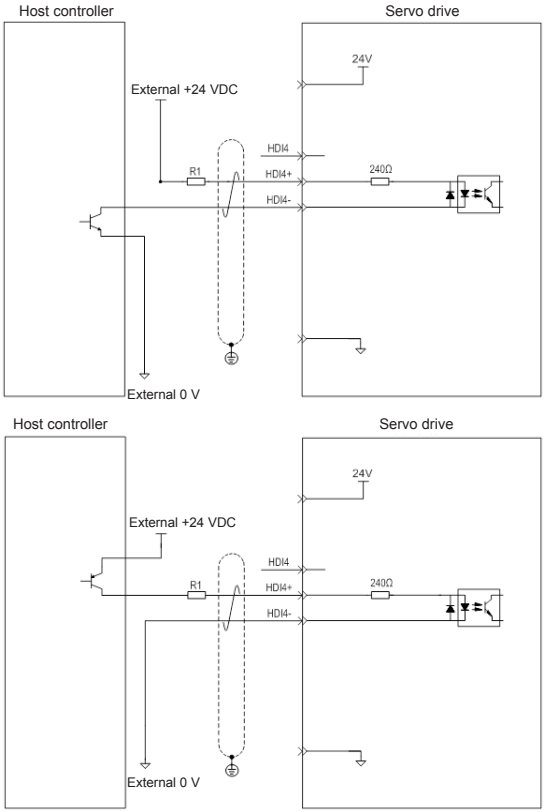


② When the external power supply is used:

Scheme 1: Using the internal resistor of the drive (recommended)



Scheme 2: Using an external resistor



Value of resistor R1 is calculated according to the following formula:

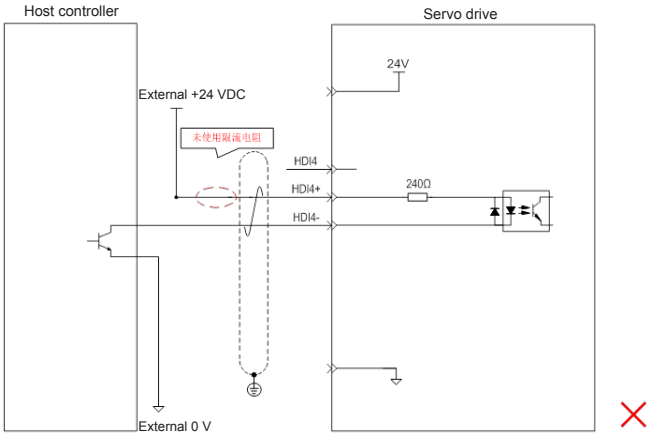
$$\frac{V_{CC}-1.5}{R1+240} = 10mA$$

Table 4-18 Recommended R1 resistance values

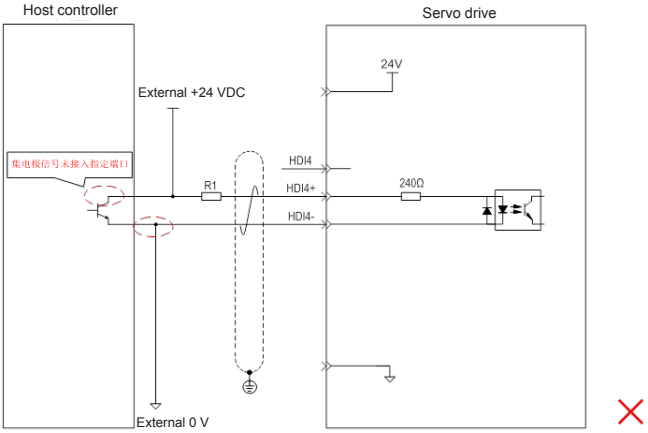
VCC Voltage	R1 Resistance Value	R1 Power
24 V	2.4 kΩ	0.5 W
12 V	1.5 kΩ	0.5 W

The following figures show wrong wiring examples.

Wrong connection 1: The current-limit resistor is not connected, resulting in terminal damages.



Wrong connection 2: Terminals are not correctly connected, resulting in terminal damages.

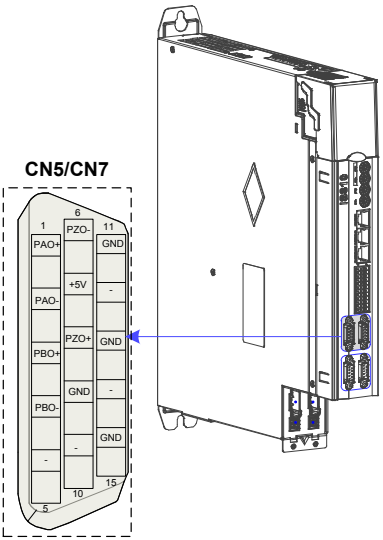


4) High-speed HDI8

The HDI8 connection method is consistent with the preceding high-speed HDI4 connection method. Refer to the preceding text.

4.9 Encoder Signal Frequency Division Output and Full Closed-loop Signal Input Connection (CN5/CN7)

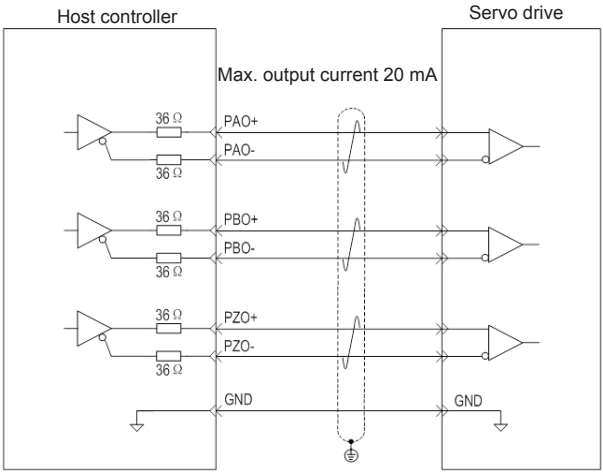
Figure 4-26 CN5/CN7 terminal



1. Terminal CN5/CN7/DB15 Definition

Signal	Default Function	Pin No.	Function	
General	PAO+ PAO-	1 2	Phase A frequency-division output signal	Phases A+B quadrature frequency-division pulse output signal
	PBO+ PBO-	3 4	Phase B frequency-division output signal	
	PZO+ PZO-	8 6	Phase Z frequency-division output signal	Home pulse output signal
	GND	9, 11, 13, 15	Home pulse OC output signal ground	
	+5 V	7	5 V internal power supply, maximum output current: 200 mA	
	Reserved	5, 10, 12, 14	Reserved	

The encoder frequency-division output circuit outputs differential signals via the differential drive. Generally, it provides feedback signals to the host controller in the closed-loop position control system. A differential or optocoupler circuit shall be used in the host controller to receive feedback signals. The maximum output current is 20 mA.



Caution

Connect the 5 V grounding terminal of the host controller to the GND terminal of the servo drive, and use shielded twisted-pair cables to reduce noise interference.

4.10 Communication Signal Connection (CN3/CN4)

1. Communication Networking and Terminals

Figure 4-27 Communication wiring

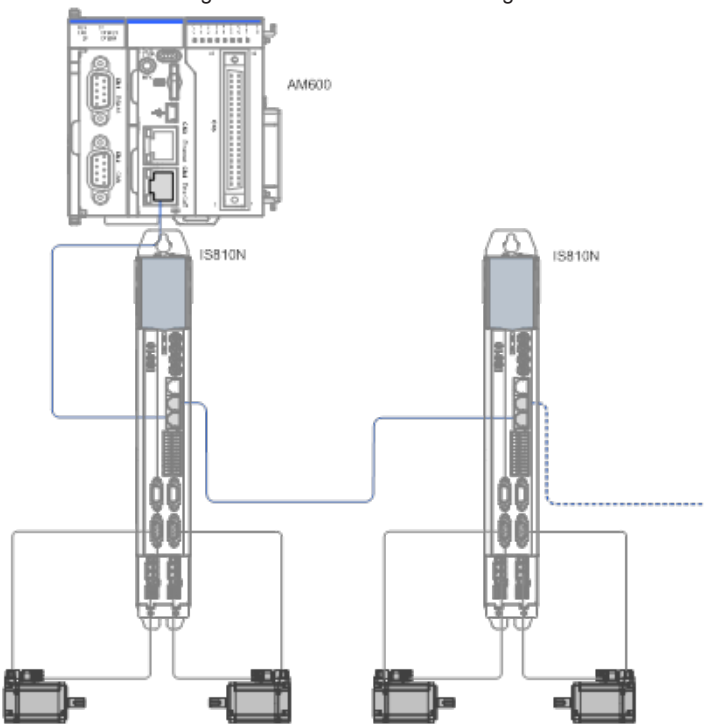
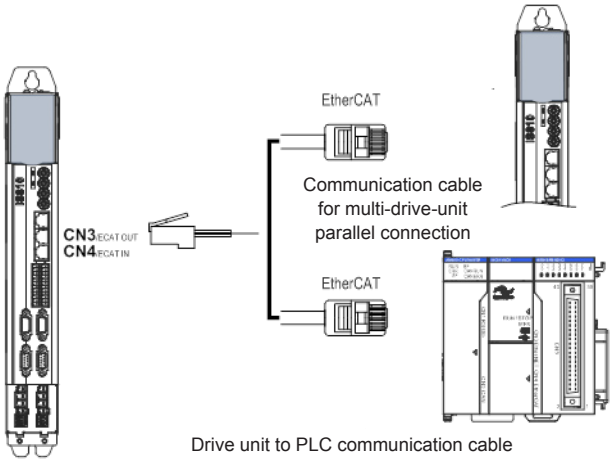


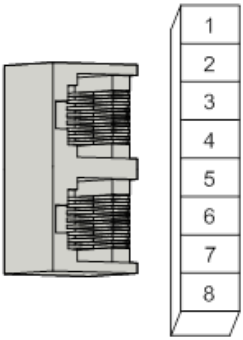
Figure 4-28 Communication wiring



Drive unit to PLC communication cable

The CN3/CN4 terminal connectors are EtherCAT network ports, where CN4(IN) is connected to the host controller, and CN3(OUT) is connected to a slave.

Table 4-19 Pin definition of communication signal terminal connectors

	Pin	Description	Pin Layout
1	TX+	Data transmit+	
2	TX-	Data transmit-	
3	RX+	Data receive+	
4	-	-	
5	-	-	
6	RX-	Data receive–	
7	-	-	
8	-	-	
Housing	PE	Shield	

2. Selection of Communication Cables

● Selection principle

Specification	Supplier
0.2 m to 10 m	Inovance
Longer than 10 m	Haituo

● Basic information about EtherCAT communication cables of Inovance

1) Cable models are as follows:

S6-L-T04-3.0

Mark	Product Series
S6	S6 series

Mark	Meaning
L	Line

Mark	Meaning
T	Communication cable

Cable Length (Unit: m)			
Mark	Length	Mark	Length
0.2	0.2m	2.0	2.0m
0.3	0.3m	3.0	3.0m
0.5	0.5m	5.0	5.0m
1.0	1.0m	10.0	10.0m

Mark	Meaning
04	EtherCAT multi-drive-unit communication cable

2) Cable ordering information:

Material Code	Cable Size	Length (m)	Price (RMB)
15040261	S6-L-T04-0.3	0.3	10
15040262	S6-L-T04-3.0	3.0	25
15041960	S6-L-T04-0.2	0.2	9
15041961	S6-L-T04-0.5	0.5	11
15041962	S6-L-T04-1.0	1.0	15
15041963	S6-L-T04-2.0	2.0	20
15041964	S6-L-T04-5.0	5.0	35
15041965	S6-L-T04-10.0	10.0	60

Cables of 10 m long or shorter must be purchased from Inovance.

Cables longer than 10 m shall be purchased from Haituo.

3) Specifications and characteristics:

Item	Detailed Description
UL certification	Comply with UL certification
CAT.5E cable	CAT.5E cable
Double shield	Braided shield (coverage 85%), aluminum foil shield (coverage 100%)
Environmental adaptability	Operating temperature: –30 to 60°C; resistant to industrial oil and corrosive acid and alkali.
EMC testing standard	GB/T 24808-2009

4.11 Communication Connection to PC (CN2)

Arrangement of Ethernet(CN2) terminals:

Figure 4-29 Ethernet connector terminal

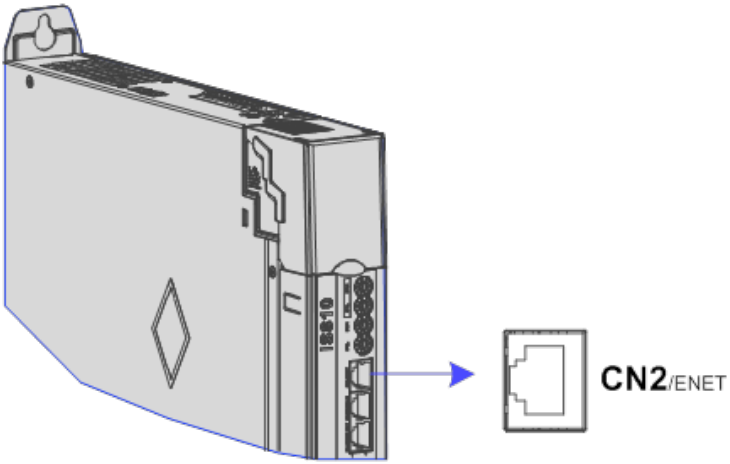
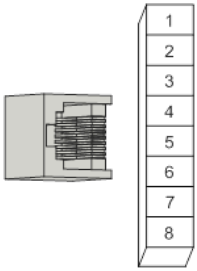


Table 4-20 Pin definition of communication signal terminal connectors

<table>
<tr><th>Terminal Symbol</th><th>Pin Description</th><th>Pin Layout</th></tr>
<tr><td>CN2</td><td>Ethernet Connection
<table>
<tr><th>No.</th><th>Definition</th><th>Function and Specification</th></tr>
<tr><td>1</td><td>TX+</td><td>Data transmit+</td></tr>
<tr><td>2</td><td>TX-</td><td>Data transmit-</td></tr>
<tr><td>3</td><td>RX+</td><td>Data receive+</td></tr>
<tr><td>4</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>RX-</td><td>Data receive–</td></tr>
<tr><td>7</td><td>-</td><td>-</td></tr>
<tr><td>8</td><td>-</td><td>-</td></tr>
</table></td><td> 
</td></tr>
</table>

Note: Communication cables are the same as cables for multi-device communication (S6-L-T04).

4.12 Anti-interference Measures for Electrical Wiring

Take the following measures to suppress interference:

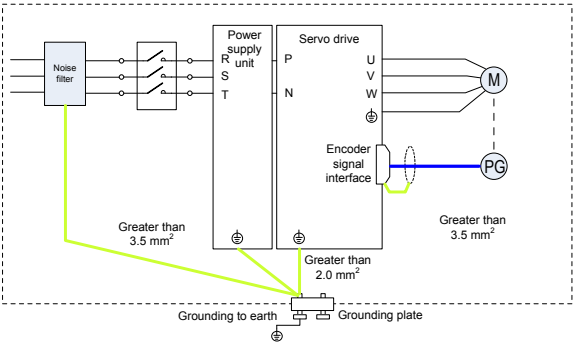
- Ensure that the length of the reference input cable is below 3 m, and the length of the encoder cable is below 20 m.
- Use a thick cable (above 2.0 mm2 in diameter) as the grounding cable.
  ① D class (or higher class) grounding is recommended (grounding resistance is below 100 Ω).
  ② Use single point grounding.
- Use a noise filter to prevent radio frequency interference. For home application or application with noise interference, install the noise filter on the input side of the power cable.
- To prevent malfunction due to electromagnetic interference, take the following measures:
  ① Install the host controller and noise filter as close to the servo drive as possible.
  ② Install a surge absorber on the relay, solenoid and electromagnetic contactor coils.
  ③ The distance between a strong-current cable and a weak-current cable must be at least 30 cm. Do not put these cables in the same duct or bundle them together.
  ④ Do not connect the servo drive to the same power supply as an electric welder or electrical discharge machine. When the servo drive is placed near a high-frequency generator, install a noise filter on the input side of the power cable.

4.12.1 Anti-interference Wiring Example and Grounding

The servo drive uses high-speed switches in the main circuit. Switching noise from these components may affect normal operation of the servo drive due to improper wiring or grounding. Thus, the servo drive must be properly wired and grounded. A noise filter can be added if necessary.

Anti-interference Wiring Example

Figure 4-30 Anti-interference wiring example



NOTE

Use a cable of at least 3.5 mm2 thick as the grounding cable connected to the cabinet housing. Plain stitch copper wires are recommended.

If a noise filter is used, observe the precautions as described in the “Using Noise Filter" section.

2) Grounding

To prevent potential magnetic interference, conduct grounding correctly according to the following instructions.

a) Grounding the motor housing

Connect the grounding terminal of the servo motor to the PE terminal of the servo drive and ground the PE terminal.

b) Grounding the shield of the encoder cable

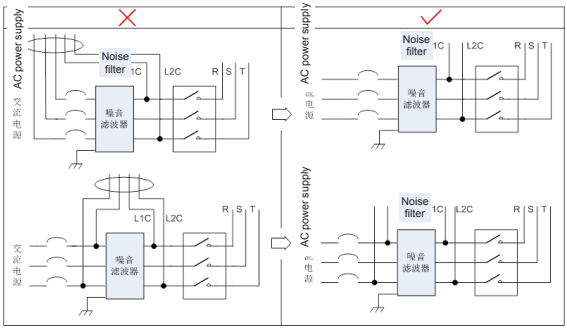
Ground both ends of the shield of the motor encoder cable.

4.12.2 Using Noise Filter

To prevent interference from power cables and reduce impact of the servo drive on other sensitive devices, install a noise filter on the input side of the power supply according to the input current. In addition, install a noise filter on the power cable of peripheral devices if necessary. Observe the following precautions when installing and wiring the noise filter.

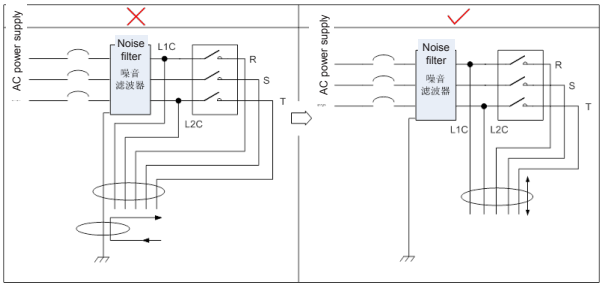
Do not put the input and output wires of the noise filter in the same duct or bundle them together.

Figure 4-31 Separation noise filter input and output cables



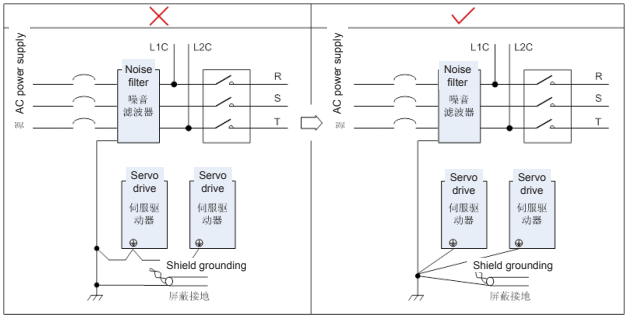
Separate the grounding wire and output power wires of the noise filter.

Figure 4-32 Separation of the noise filter grounding wire and output power wires



Use a separate grounding cable as short and thick as possible for the noise filter. Do not connect the grounding cable to other grounding devices.

Figure 4-33 Single point grounding



Grounding the noise filter inside the cabinet

If the noise filter and the servo drive are installed in the same cabinet, fix the noise filter and the servo drive on the same metal plate. Make sure that the contact part is in good conductive condition, and ground the metal plate properly.

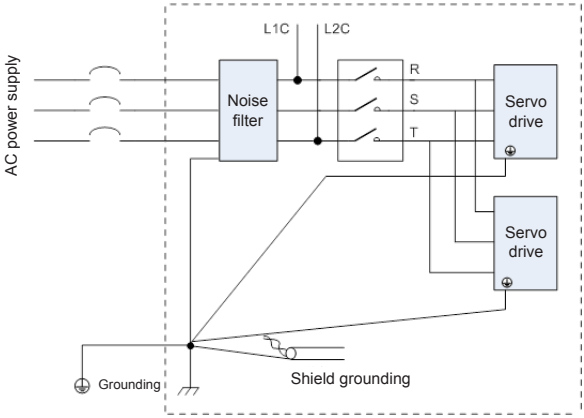


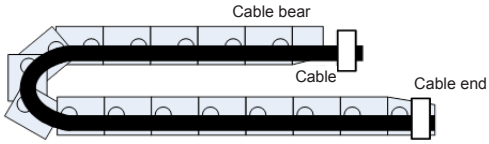
Figure 4-34 Noise filter grounding

4.13 Cablen Use Precautions

- Do not bend or apply stress to cables. The core wire of a signal cable is only 0.2 or 0.3 mm in diameter. Handle the cables carefully.
- In scenarios where cables need to be moved, use flexible cables. Ordinary cables are easily damaged after being bent for a long time. Cables configured together with low power servo motors cannot be moved.
- If a cable bear is used, make sure:

1. The bending radius of the cable must be at least 10 times of its outer diameter.
2. Do not fasten or bundle the cables inside the cable bear. The cables can be bundled or fastened only at the two non-movable ends of the cable bear.
3. Cables must not be wound or warped.
4. The space factor inside the cable bear must not exceed 60%.
5. Do not mix cables that differ greatly in size. Otherwise, thick cables may crush thin cables. If thick and thin cables need to be used together, place a spacer plate to separate them.

Figure 4-35 Cable bear



4.14 General Wiring Diagram

Refer to Appendix 2 "General Wiring Diagram".

Note 1: CAT5E double shielded or better network cables are recommended. Both direct-through and crossover Ethernet cables are allowed.

Note 2: The voltage range and maximum output current of the internal +24V power supply are 20–28 V and 200 mA.

Note 3: HDI4 and HDI8 are high-speed DIs. Use them according to their functions allocated. If they are used in low speed circumstances, the internal filtering parameters may be increased according to the function code.

Note 4: Customers need to prepare 5–24 V power supplies for DOs. The DO terminals support the maximum voltage of 30 V DC voltage and maximum current of 50 mA.

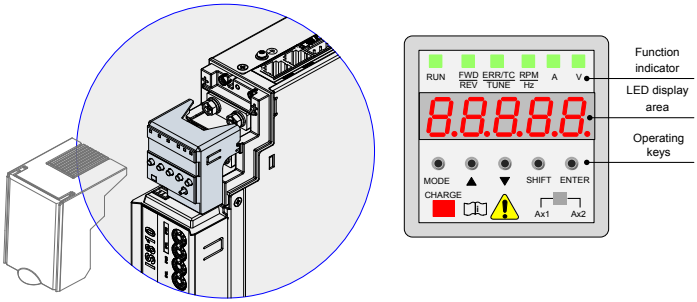
Note 5: Use shielded twisted-pair cables as encoder frequency-division cables, and tie both ends of the shield to PE. Connect GND and signal ground of the host controller reliably.

Note 6: The internal +5 V power supply supports a maximum current of 200 mA.

Chapter 5 Keypad

5.1 Introduction to LED Keypad

Figure 5-1 LED keypad appearance



The keypad consists of the 5-digit 7-segment LEDs and keys. The keypad is used for display, parameter setting, user password setting and general functions operations.

1. Function Description of Keys

Table 5-1 Functions of keys on the keypad

Key	Key Name	Function Description
MODE	MODE	Switch between modes. Return to the upper-level menu.
▲	UP	Increase the number indicated by the blinking digit.
▼	DOWN	Decrease the number indicated by the blinking digit.
SHIFT	SHIFT	Shift the blinking digit. View the high digits of the number consisting of more than 5 digits.
ENTER	ENTER	Switch to the next-level menu. Execute commands such as saving parameter values.

2. LED Display Area

There are 5-digit LEDs on the LED keypad to display status, parameters, faults, and monitoring information.

Table 5-2 LED display and actual data

LED Display	Equivalent	LED Display	Equivalent	LED Display	Equivalent	LED Display	Equivalent
	0		7		E		P
	1, I		8		F		R
	2		9, g		H		T
	3		A		J		u
	4		B		L		V
	5, S		C		N		y
	6		D		o		Axis 2

3. Function Indicator

Indicator State		State Description
RUN indicator		Off: stop or fault
		On: running
FWD/REV indicator		Off: forward running
		On: reverse running
ERR/TC/TUNE indicator		On (green): normal running
		Quick blinking (red 4 times/s): fault state
		Frequency unit: Hz
		Current unit: A
		Voltage unit: V
Ax1, Ax2		DIP switches for axis selection
		This point indicates the current operation axis: Solid off: Parameter of the operating axis Ax1 Solid on: Parameter of the operating axis Ax2

5.2 Keypad Display

- Conversion Between Keypad Display and Host Controller Operation Objects

The mapping between the parameter numbers displayed on the keypad and the object dictionary (hexadecimal index and subindex) operated on the host controller is as follows:

Object dictionary index = 0x2000 + Parameter group No.

Object dictionary subindex = Hexadecimal offset in function code group + 1

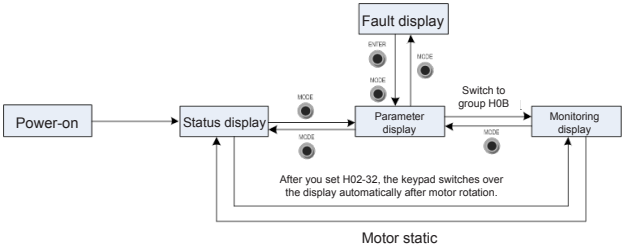
Example:

Keypad Display	Object Dictionary Operated by the Host Controller
H00-00	2000-01h
H00-01	2000-02h
…	…
H01-09	2001-0Ah
H01-10	2001-0Bh
…	…
H02-15	2002-10h

The following parts only describe parameter display and setting on the keypad, and you need to make conversion when performing operations through commissioning software on the host controller.

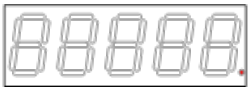
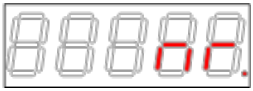
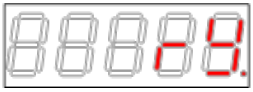
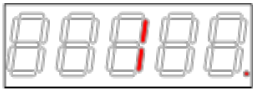
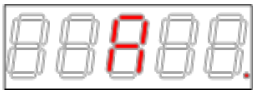
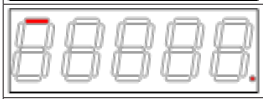
- The keypad can display status, parameters, faults, and monitoring information during running of the servo drive.
  1. Status display: Displays the current servo drive status to indicate, for example, whether the servo is ready or running.
  2. Parameter display: Displays the function codes and their values.Fault display: Displays the faults and warnings occurring in the servo drive.
  3. Monitoring display: Displays the current running parameters of the servo drive.

Figure 5-2 Switching between different displayed contents



- After the power is on, the keypad enters the status display mode.
- Press the MODE key to switch between modes, as shown in the preceding figure.
- In status display mode, set 2002-21h and select the monitored parameters. When the motor rotates, the keypad automatically switches to the monitoring display. After the motor stops, the keypad automatically returns to the status display.
- In parameter display mode, set 2002-21h and select the parameters to be monitored, and the keypad switches to the monitoring display mode.
- Once a fault occurs, the keypad enters the fault display mode, and all the 5-digit LEDs blink. Press the ENTER key to stop blinking, and then press the MODE key to switch to the parameter display mode.

1. Status Display (Take the parameter of the operating axis 2 as an example)

Display	Name	Condition	Meaning
	Operating axis (example)	Parameter display interface after selecting an axis using the axis 1 or axis 2 DIP switch	The parameters currently displayed on the operation panel are parameters of axis 2.
 (Axis number is not displayed in reset state.)	reset Servo initialization	Moment when the servo is powered on	The servo drive is in initialization or reset state. After initialization or reset is completed, the servo drive automatically switches to another state.
	nr Servo not ready	Initialization is completed, but the servo drive is not ready.	The main circuit is not powered on, and the servo drive is not ready for running. For details, refer to Chapter 9.
	ry Servo ready	The servo drive is ready.	The servo drive is ready for running, and waits for the S-ON signal from the host controller.
	rn Servo being running	The S-ON signal is active.	The servo drive is in running state.
 	1 to A Control mode		Displays the current control mode in hexadecimal. 1: PP 3: PV 4: PT 6: HM 8: CSP 9: CSV A: CST
 	1 to 8 Communication state		Displays the status of the EtherCAT state machine. 1: Initializing 2: Pre-operational 4: Safe-operational 8: Operational
	- CN3 connection indication	CN3 is connected successfully when EtherCAT is output.	Segment off: No communication connection is detected on the physical layer. Segment on: A communication connection is set up on the physical layer.
	- CN4 connection indication	CN3 is connected successfully when EtherCAT is input.	
	Here Servo online	Call a corresponding drive using InoDriveShop	A drive is online when it is called using InoDriveShop.

2. Parameter Display (Take the parameter of the operating axis 2 as an example)

The IS810N series servo drive has 14 function groups based on parameter functions. A function code can be located quickly based on the group it belongs to. For the function code table, refer to chapter 8.

1) Function code group

Display	Name	Description
HXX.YY	Function code group	XX: function code group YY: function code No.

For example, H02-00 is displayed as follows:

Display	Name	Description
	Function code H02-00	02: function code group 00: function code No.

2) Display of data of different lengths and negative number

a) Signed number with 4 digits or less and unsigned number with 5 digits or less

Such a number is displayed on a single page (5-digit LEDs). The highest digit "-" indicates the negative symbol.

For example, –9999 is displayed as follows:

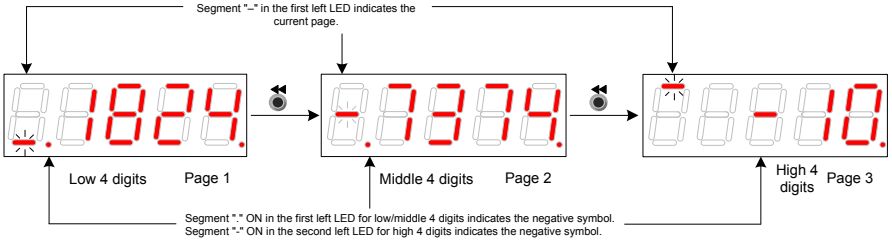
For example, 65535 is displayed as follows:

b) Signed number with more than 4 digits and unsigned number with more than 5 digits

The number is displayed in digits from low to high on pages. Each five digits are displayed on a page. The display method is: content on the current page + number of the current page. As shown in the following figure, hold down SHIFT for more than two seconds to switch to the next page.

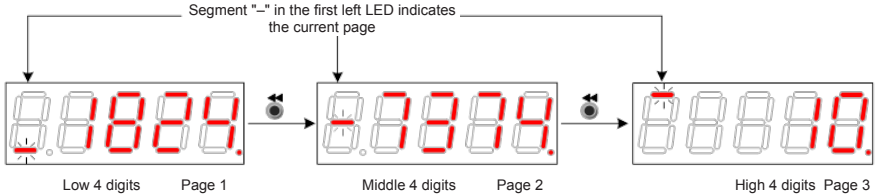
For example, -1073741824 is displayed as follows:

Figure 5-3 Display of -1073741824



For example, 1073741824 is displayed as follows:

Figure 5-4 Display of 1073741824

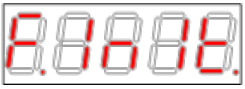


3) Decimal Point Display

Segment "." of the unit's digit indicates the decimal point, and this segment does not blink.

Display	Name	Description
	Function code H02-00	02: function code group 00: function code No.

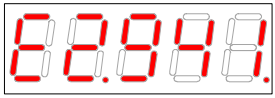
4) Parameter setting display

Display	Name	Situation	Meaning
	Done Parameter setting completed	Parameter setting is successful.	The parameter setting is completed and stored in the servo drive. Then, the servo drive can execute other operations.
	F.InIt Parameter restored to default setting	The parameter initialization function is used (H02-31=1).	The servo drive executes parameter initialization. After initialization is completed, the control power is on again.
	Error Incorrect password	When the user password function (H02-30) is used, the password entered is incorrect.	The servo drive prompts entered password error, and you need to enter the correct password.
	FAIL	One-key auto-adjustment fails.	One-key auto-adjustment fails.

3. Fault Display (Take the parameter of the current operation axis 2 as an example)

- The keypad displays the current or historical faults and warning codes. For analysis and rectification of faults and warnings, refer to Chapter 9.
- When a single fault or warning occurs, the keypad displays the fault or warning code. When multiple faults or warnings occur, the keypad displays the fault code of the highest level.
- Set in H0B-33 the historical fault to be viewed and view H0B-34. The selected fault or warning code is displayed.
- Set H02-31 to 2 to clear information about the latest 10 faults or warnings stored in the servo drive.

For example, Er.941 is displayed as follows:

Display	Name	Description
	Current warning code	E2.: indicates fault or warning in the servodrive axis 2 941: fault or warning code

4. Monitoring Display (Take the parameter of the current operation axis 2 as an example)

Group H0B: Displays the parameters for monitoring the running status of the servo drive.

Set H02-32 (Default keypad display). After the servo motor runs properly, the keypad switches from servo status display mode to parameter display mode and displays the parameters set in H02-32.

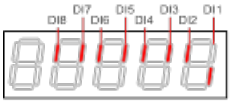
For example, if H02-32 = 00, the keypad displays the value of H0B-00 if the servo motor speed is not 0.

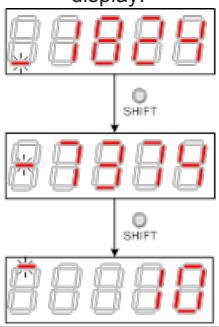
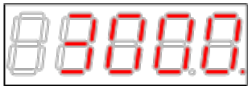
Function Code	Name	Unit	Meaning	Display Example
H0B-00	Actual motor speed	RPM	It displays the actual motor speed after round-off, in the unit of 1 RPM.	3000 RPM display:  -3000 RPM display: 

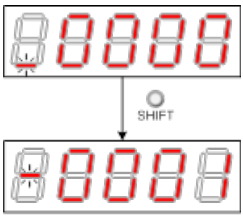
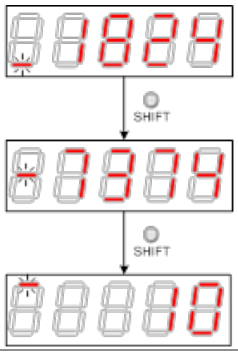
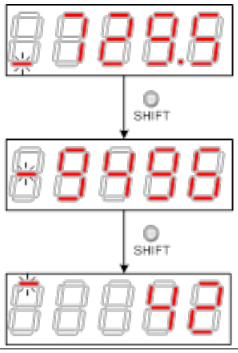
5.3 Monitoring Parameters

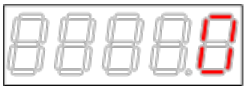
Group H0B: Displays the parameters for monitoring the running status of the servo drive.

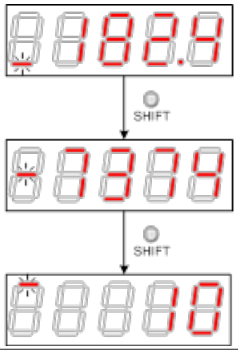
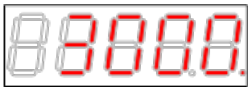
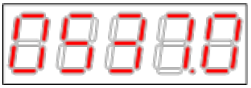
Group H0B monitoring display is described as follows **(Take the parameter of the current operation axis 2 as an example)**:

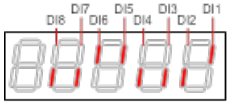
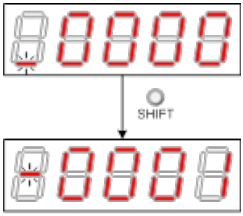
Function Code	Name	Unit	Meaning	Display Example
H0B-00	Actual motor speed	RPM	It displays the actual motor speed after round-off, in the unit of 1 RPM.	3000 RPM display:  -3000 RPM display: 
H0B-01	Speed reference	RPM	It displays the current speed reference of the servo drive.	3000 RPM display:  -3000 RPM display: 
H0B-02	Internal torque reference	0.1%	It displays the percentage of the actual motor output torque to the rated motor torque.	100.0% display:  -100.0% display: 
H0B-03	Monitored DI states	-	It displays the level states of the eight DI terminals: If the upper LED segment is on, it indicates optocoupler OFF (expressed by "1"). If the lower LED segment is on, it indicates optocoupler ON (expressed by "0"). H0B-03 value read by the background software is a hexadecimal number.	For example, if DI1 is optocoupler ON and DI2 to DI7 are optocoupler OFF: The binary value is 11111110; The value of H0B-03 read by the background software is 0xFE. The keypad display is as follows: 

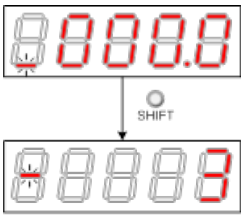
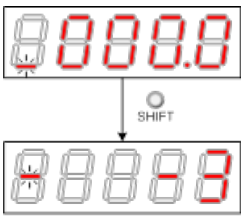
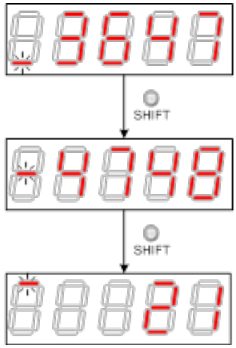
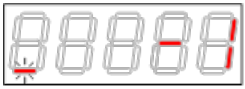
Function Code	Name	Unit	Meaning	Display Example
H0B-05	Monitored DO states	-	It displays the level states of the two DO terminals: If the upper LED segment is on, it indicates optocoupler OFF (expressed by "1"). If the lower LED segment is on, it indicates optocoupler ON (expressed by "0"). H0B-05 value read by the background software is a hexadecimal number.	For example, if DO1 is optocoupler ON and DO2 is high level: The binary value is 10; The value of H0B-05 read by the background software is 0x2. The keypad display is as follows: 
H0B-07	Absolute position counter (32-bit decimal display)	Ref	It displays the current absolute motor position (reference unit).	1073741824 reference unit display: 
H0B-09	Mechanical angle	p	It displays the current motor mechanical angle (p).	360.0° display: 
H0B-10	Rotation angle (electric angle)	°	It displays the current motor electric angle.	360.0° display: 
H0B-11	Speed corresponding to input position reference	RPM	It displays the servo drive speed corresponding to the position reference in a single control period.	000 RPM display:  -3000 RPM display: 

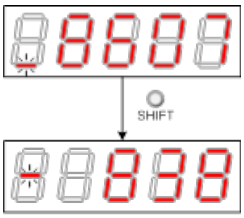
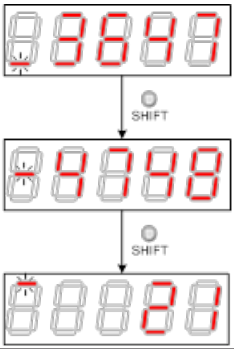
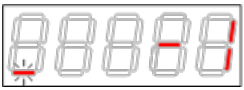
Function Code	Name	Unit	Meaning	Display Example
H0B-12	Average load ratio	0.1%	It displays the percentage of the average load torque to the rated motor torque.	100.0% display: 
H0B-15	Encoder position deviation counter (32-bit decimal display)	Enc	Encoder position deviation = Input position reference sum (encoder unit) – Total encoder feedback pulses (encoder unit)	10000 encoder unit display: 
H0B-17	Feedback pulse counter (32-bit decimal display)	Enc	It displays counts and displays the pulses fed back by the servo motor encoder (encoder unit). Note: When an absolute encoder motor is used, H0B-17 indicates only the low 32-bit data of the motor position. The actual motor position is reflected by H0B-77 and H0B-79 together.	1073741824 encoder unit display: 
H0B-19	Total power-on time (32-bit decimal display)	0.1s	It displays counts and displays the total servo drive power-on time.	429496729.5s display: 

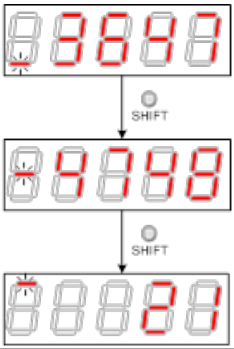
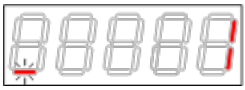
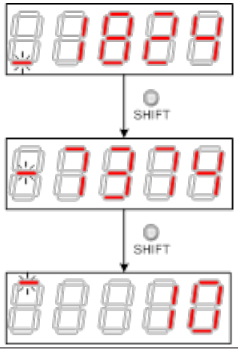
Function Code	Name	Unit	Meaning	Display Example
H0B-24	Phase current effective value	0.01 A	It displays the effective phase current value of the servo motor.	4.60 A display: 
H0B-26	Bus voltage	0.1 V	It displays the DC bus voltage of the main circuit.	540.0 V display rectified from 380 VAC: 
H0B-27	Module temperature	°C	It indicates the temperature of the power module inside the servo drive.	27°C display: 
H0B-33	Fault record	-	It sets the historical fault to be viewed. 0: Current fault 1: Last fault 2: Last 2nd fault … 9: Last 9th fault	0: Current fault display 
H0B-34	Fault code of the selected fault record	-	It displays the fault code selected by H0B-33. When there is no fault, H0B-34 display is "E+Axis No.000."	For example, when the axis number is 1: If H0B-33 = 0, H0B-34 = E1.941, the current fault code is 941. Display: 

Function Code	Name	Unit	Meaning	Display Example
H0B-35	Time stamp upon displayed fault	s	It indicates the total servo running time when the fault displayed in H0B-34 occurs. When there is no fault, H0B-35 display is "0."	If H0B-34=E2.941, H0B-35=107374182.4 , the current fault code is 941 and the total servo running time is 107,374,182.4s when this fault occurs. 
H0B-37	Motor speed upon displayed fault	RPM	It displays the servo motor speed when the fault displayed in H0B-34 occurs. When there is no fault, H0B-37 display is "0".	3000 RPM display:  -3000 RPM display: 
H0B-38	Motor phase U current upon displayed fault	0.01 A	It displays the winding current effective value of the servo motor phase U when the fault displayed in H0B-34 occurs. When there is no fault, H0B-38 display is "0".	4.60 A display: 
H0B-39	Motor phase V current upon displayed fault	0.01 A	It displays the winding current effective value of the servo motor phase V when the fault displayed in H0B-34 occurs. When there is no fault, H0B-39 display is "0."	4.60 A display: 
H0B-40	Bus voltage upon displayed fault	V	It displays the DC bus voltage of the main circuit when the fault displayed in H0B-34 occurs. When there is no fault, H0B-40 display is "0."	537.0 V display rectified from 380 VAC: 

Function Code	Name	Unit	Meaning	Display Example
H0B-41	Input terminal state upon displayed fault	-	It displays the high/low level state of the 8 DI terminals when the fault displayed in H0B-34 occurs. The viewing method is the same as that of H0B-03. When there is no fault, H0B-41 displays that all DI terminals have a low level, corresponding to the decimal value 0.	For example, the value of H0B-41 read by the background software is 0x31. The binary value is 00110001. Display: 
H0B-43	Output terminal state upon displayed fault	-	It displays the optocoupler on state of the two DO terminals when the fault displayed in H0B-34 occurs. The viewing method is the same as that of H0B-05. When there is no fault, H0B-42 displays that all DO terminals have a low level, corresponding to the decimal value 0.	H0B-42 = 3 display: 
H0B-53	Position deviation counter (32-bit decimal display)	Ref	Position deviation = Input position reference sum (reference unit) - Total encoder feedback pulses (reference unit)	10000 reference unit display: 

Function Code	Name	Unit	Meaning	Display Example
H0B-55	Actual motor speed	0.1 RPM	It displays the actual motor speed, in the unit of 0.1 RPM.	3000.0 RPM display:  -3000.0 RPM 
H0B-57	Control power voltage	0.1 V	It displays the control power DC voltage.	540.0 V display: 
H0B-58	Mechanical absolute position (low 32 bits)	Enc	It displays the low 32-bit data of the mechanical position feedback (encoder unit) when the absolute encoder is used.	Example: 2147483647 encoder unit 
H0B-60	Mechanical absolute position (high 32 bits)	Enc	It displays the high 32-bit data of the mechanical position feedback (encoder unit) when the absolute encoder is used.	Example: -1 encoder unit 

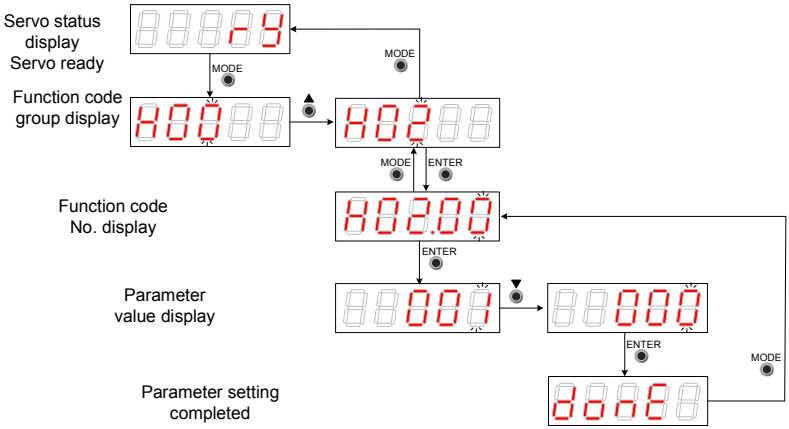
Function Code	Name	Unit	Meaning	Display Example
H0B-70	Number of the absolute encoder turns	r	It displays the current number of the absolute encoder turns.	Example: 32767 
H0B-71	Absolute encoder single-turn position feedback	Enc	It displays the single-turn position feedback of the absolute encoder.	Example: 8388607 encoder unit 
H0B-77	Absolute position (low 32 bits) of absolute encoder	Enc	It displays the low 32-bit data of the position feedback of the absolute encoder.	Example: 2147483647 encoder unit 
H0B-79	Absolute position (high 32 bits) of absolute encoder	Enc	It displays the high 32-bit data of the position feedback of the absolute encoder.	Example: -1 encoder unit 

Function Code	Name	Unit	Meaning	Display Example
H0B-81	Rotating load single-turn position feedback (low 32 bits)	Enc	It displays the low 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.	Example: 2147483647 encoder unit 
H0B-83	Rotating load single-turn position feedback (high 32 bits)	Enc	It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.	Example: 1 encoder unit 
H0B-85	Rotating load single-turn position	Reference unit	It displays the mechanical absolute position when the absolute system works in rotating mode.	Example: 1073741824 reference unit 

5.4 Parameter Setting

Parameter setting can be performed on the keypad of a servo drive. For details on the parameters, refer to Chapter 8. The following figure shows the keypad operation of switching the position control mode to the speed control mode after the power is on.

Figure 5-5 Parameter setting on the keypad



- MODE: Switch the display mode and return to the upper-level menu.
- UP/DOWN: Increase or decrease the value of the current blinking digit.
- SHIFT: Shift the blinking digit.
- ENTER: Save the current setting value or switch to the next-level menu.

After parameter setting is completed, that is, "Done" is displayed, press the MODE key to return to the parameter group display (H02-00).

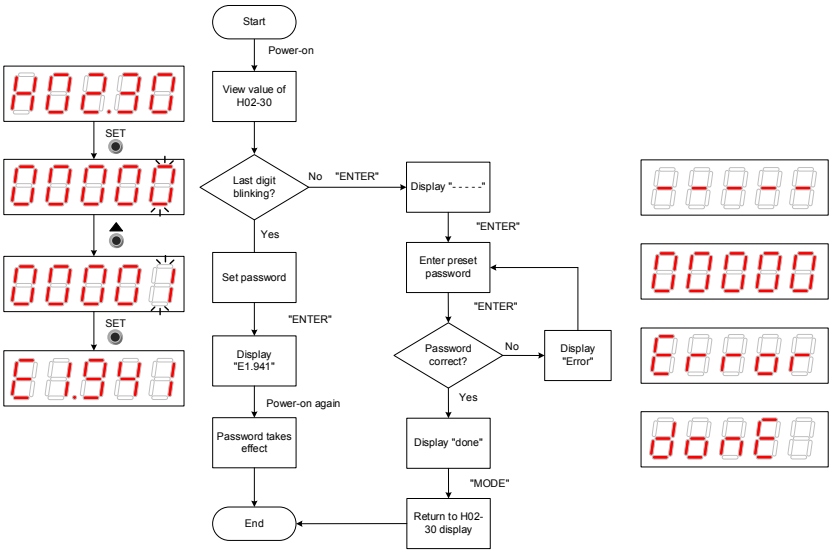
5.5 User Password

After the user password function (H02-30) is enabled, only the authorized user is allowed to set parameters; other operators can only view the parameters.

1) Setting a user password

The following figure shows the operation procedure of setting the password to "00001".

Figure 5-6 User password setting on the keypad



NOTE

*1: If the last digit does not blink, password protection is enabled. If the last digit blinks, password protection is disabled or the correct password has been entered.

When changing the user password, enter the current password so that you enable the parameter setting rights. Enter H02-30 again, and you can set a new password, according to the method described in the preceding figure.

2) Canceling user password

Enter the existing user password, and set H02-30 to "00000". Then, the user password is canceled.

5.6 Jog Running

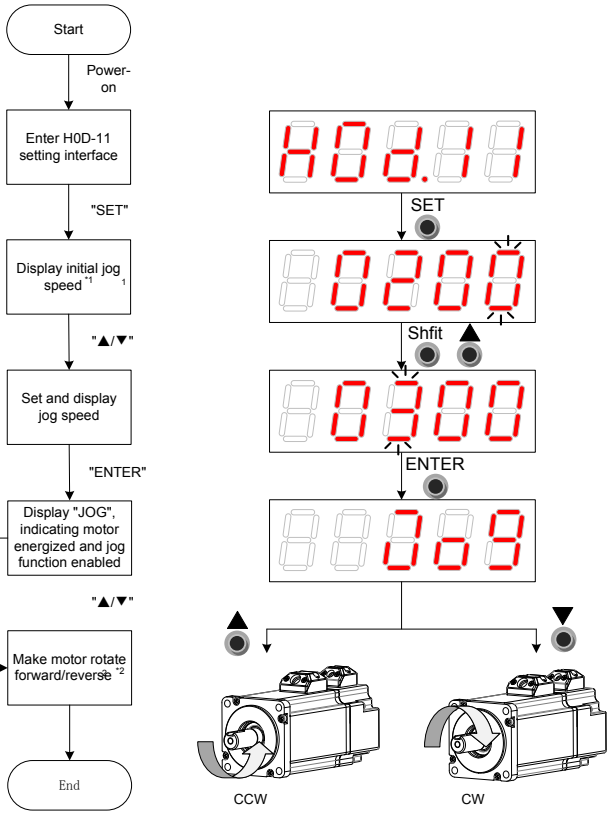
Caution

When using the jog running function, set the S-ON signal inactive. Otherwise, this function cannot be used.

Use the jog running function to perform a trial run on the servo motor and drive.

1) Operation method

Figure 5-7 Jog running setting on the keypad



NOTE

*1: Press the UP or DOWN key to increase or decrease the motor speed for jog running. If the system exits jog running, the motor speed restores to the initial value.

*2: Press the UP or DOWN key to make the servo motor rotates in forward or reverse direction. After you release the key, the servo motor stops running immediately.

2) Exiting jog running

Press the MODE key to exit jog running and return to the upper-level menu.

5.7 DI/DO Function

There are eight DI signals and two DO signals on terminal CN1 of SV820N. H03 (terminal DI function allocation and logic selection) and H04 (terminal DO function allocation and logic selection) can be used by multiple axes. On any axis, setting and modifying functions of DI and DO terminals can be performed on the keypad and the last modification prevails.

DIDO Function Definitions

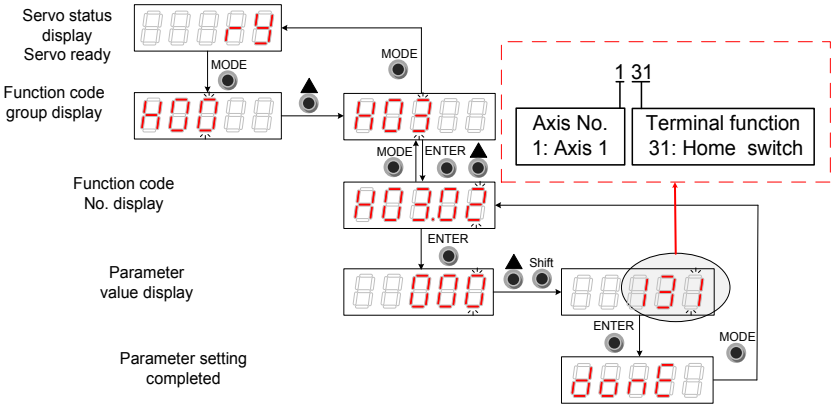
No.	Function Symbol	Function Name	Description	Remarks
Description: It consists of three digits. The first one (from left to right) indicates axis numbers and last two digits indicate terminal functions.				
Input Function Description				
01	S-ON	Servo enabled	Invalid - In local mode, servo motor is disabled. Valid - In local mode, servo motor is enabled.	S-ON function is only valid in non-bus control mode. The logic of the corresponding terminal needs to be set to level valid.
14	P-OT	Positive limit switch	Valid - Forward drive is inhibited. Invalid - Forward drive is permitted.	When the mechanical movement is out of range, the overtravel prevention function is implemented. It is recommended that the logic of the corresponding terminal be set to level valid.
15 years	N-OT	Negative limit switch	Valid - Reverse drive is inhibited. Invalid - Reverse drive is permitted.	When the mechanical movement is out of range, the overtravel prevention function is implemented. It is recommended that the logic of the corresponding terminal be set to level valid.
31	Home Switch	Home switch	Invalid - Mechanical load is out of the Home switch range. Valid - Mechanical load is within the Home switch range.	The logic selection of the corresponding terminal must be set to level valid. If the logic is set to 2 (rising edge valid), the servo drive forcibly changes it to 1 (high level valid). If the logic is set to 3 (falling edge valid), the servo drive forcibly changes it to 0 (low level valid). If the logic is set to 4 (both rising edge and falling edge valid), the servo drive forcibly changes it to 0 (low level valid).
38	Touch Probe1	Probe 1	Invalid - Probe is not triggered. Valid - Probe can be triggered.	The logic of probe is only relevant to the probe function (60B8h) regardless of the logic selection of terminal.
39	Touch Probe2	Probe 2	Invalid - Probe is not triggered; Valid - Probe can be triggered.	The logic of probe is only relevant to the probe function (60B8h) regardless of the logic selection of terminal.

No.	Function Symbol	Function Name	Description	Remarks
Output Signal Function Description				
01	S-RDY	Servo ready	Valid - Servo is ready. Invalid - Servo is not ready.	Servo is ready can can be run.
02	TGON	Motor rotation	Invalid - The absolute value of motor speed after filter is smaller than the value of function code H06-16; Valid - The absolute value of motor speed after filter reaches the value of function code H06-16	-
10	WARN	Warning	Valid - Servo drive reports a warning. Invalid - Servo drive reports no warning or the warning is reset.	-
11	ALM	Fault	Valid - A fault occurs in the servo drive. Invalid - Servo drive suffers no fault or the fault is reset.	-

DI Function Setting (Taking H03-02 Function Setting as an Example)

A function setting of H03 group consists of three digits. The first digit is for setting the axis number and the last two digits are for specific terminal functions. Refer to the red dotted box below:

Figure 5-8 DI function setting on the keypad



Example: Set DI1 and DI2 as the home signals of 2 modules respectively. The corresponding parameters can be set as follows via background software or the keypad:

H0302 = 131

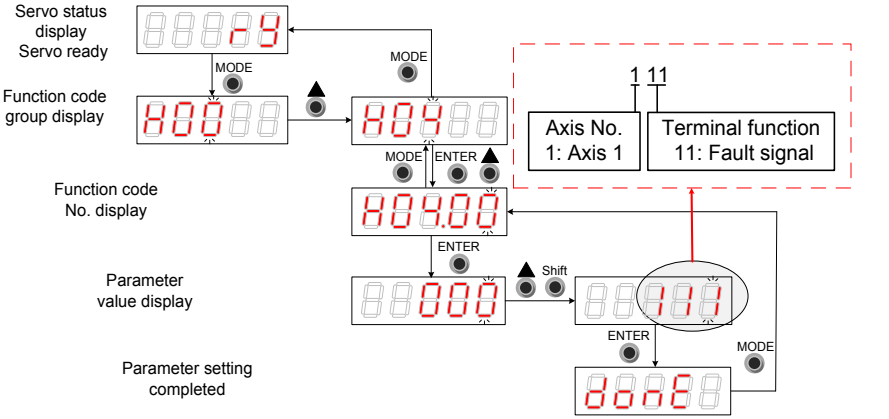
H0304 = 231

Note: Hardware switch setting can be adopted for the logic of the terminal DI based on an actual situation.

DO Function Setting (When Setting H04-00 Function)

The function number setting of H04 consists of three decimal digits. The first digit is for the setting the axis number and the last two digits are for specific terminal functions. Refer to the red dotted box below:

Figure 5-9 Keypad operation of DI function setting



Example: Set DO1 and DO2 as the fault signals of 2 modules respectively. The corresponding parameters can be set as follows via background software or the keypad.

H0400 = 111

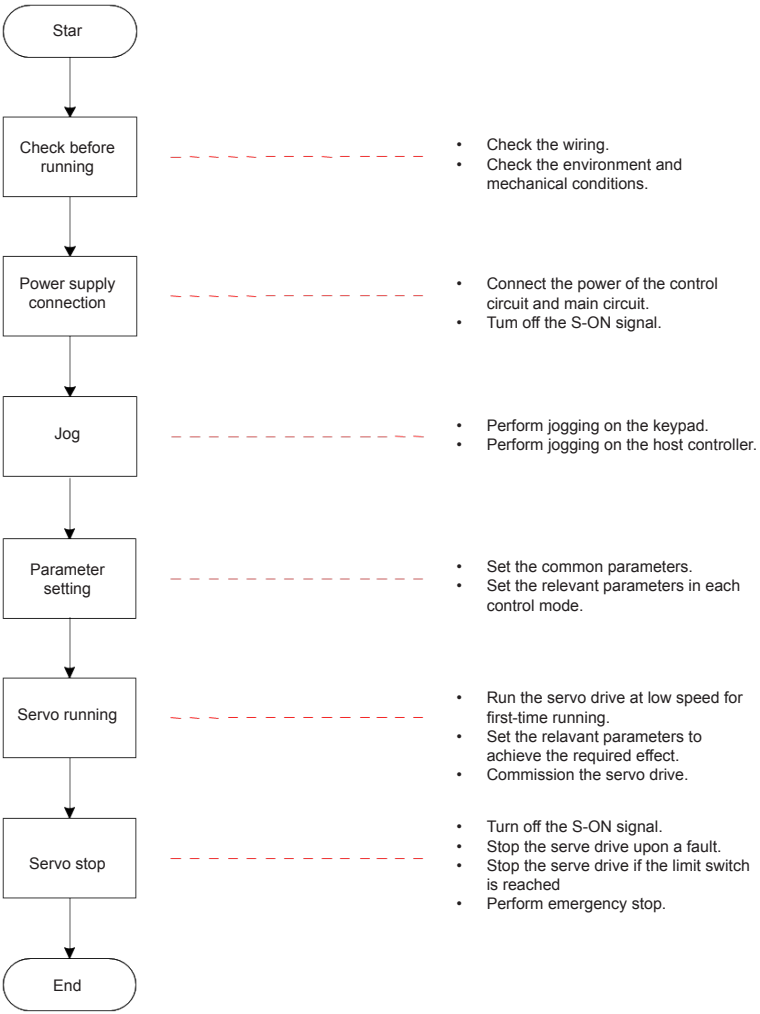
H0402 = 211

Note: The hardware switch setting can be adopted for the logic of the terminal DO based on the actual situation.

Chapter 6 Commissioning Software

6.1 Basic Setting

Figure 6-1 Servo drive setting procedure



6.1.1 Check Before Run

Check the items in the following table before running the servo drive and motor.

Table 6-1 Pre-running checklist

Applicable	No.	Activity
Wiring		
□	1	The main circuit power input terminals R, S, and T of the power supply unit are connected correctly. The input power specifications are 380 VAC to 480 VAC, 50/60 Hz.
□	2	The motor shaft main circuit output terminals U, V, and W of the drive unit are properly connected to the power cables U, V, and W of the servo motor in the correct phase sequence.
□	3	The signal wires of the servo drive are connected correctly. The external signal wires such as the brake and the limit switch wires are connected reliably.
□	4	The servo drive and motor are grounded reliably.
□	5	The cable tension is within the permissible range.
□	6	The wiring terminals have been insulated.
Environment and Mechanical Conditions		
□	1	No foreign object, such as wire heads or metal powder which may cause short circuit of the signal wires and power cables, exists inside or outside the servo drive.
□	2	The servo drive or external regenerative resistor is not placed on flammable objects.
□	3	Servo motor installation as well as shaft and mechanical connection are reliable.
□	4	The servo motor and connected machine are ready to run.

6.1.2 Power Supply Connection

Connect the power supply of the main circuit.

After connecting the power supply of the main circuit, if the bus voltage indicator is in normal display and the keypad displays “Reset”, “Nrd”, and “Rdy” in sequence, it indicates that the servo drive is ready to run and waiting for the S-ON signal from the host controller.

6.1.3 Jogging

Perform jogging to check whether the motor can rotate properly without abnormal vibration or noise. This operation can be performed via the keypad in speed mode, Inovance servo commissioning software in speed mode and keypad in position mode.

Note:

The acceleration and deceleration time constants of speed/position reference can be set through H06-12 (2006-0Dh) during jogging.

1) Jogging via the keypad in speed mode

Switch to H0D-11 on the keypad to enter the speed jogging mode, and the keypad displays the default jogging speed. Press the UP/DOWN key to set the jogging speed, and press the ENTER key to enter the jogging state. The keypad displays "JOG". Then, press the UP/DOWN key to perform forward or reverse jogging. Press the MODE key to exit the jogging mode.

2) Jogging via the Inovance servo commissioning software in speed mode

Open the Inovance servo commissioning software > Special servo function > Speed jog operating interface. Switch the drive to the non-bus control mode (H02-00 is not 9). After selecting a corresponding axis from **Axis selection**, set a jog speed. Switch the servo state to **ON**, and perform forward/reverse jogging by pressing and holding the forward/reverse running arrow.

3) Jogging via the keypad in position mode

Switch to H0D-08 on the keypad to enter the position jogging mode, and the keypad displays the default jogging speed. Press the UP/DOWN key to set the jogging speed, and press the ENTER key to enter the jogging state. The keypad displays "JOG-P". Then, press the UP/DOWN key to perform forward or reverse jogging. Press the MODE key to exit the jogging mode.

Relevant objects:

H06-12	Name	Jogging acceleration/ deceleration time constant			Setting & Effective	Any setting Immediate	Data Structure	-	Data Type	Uint16
2006-0Dh	Access	RW	Mapping	YES	Control Mode	ALL	Data Range	0 to 65535 (ms)	Default	10
Set the time constant for the servo motor to accelerate from 0 RPM to 1000 RPM.										

6.1.4 Rotating Direction Selection

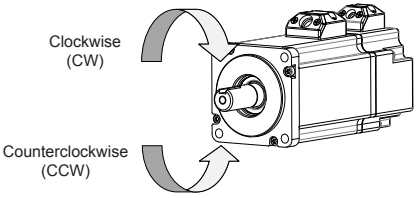
Set H02-02 (2002-03h) to change the motor rotating direction without changing the polarity of the input reference.

Relevant objects:

H02-02	Name	Rotating direction selection			Setting & Effective	At stop Power-on again	Data Structure	-	Data Type	Uint16
2002-03h	Access	RW	Mapping	-	Control Mode	ALL	Data Range	0 to 1	Default	0

It sets the motor forward direction viewed from the motor shaft side.

Value	Meaning	Description
0	CCW direction as the forward direction	When a forward command is input, the motor rotates in CCW direction viewed from the motor shaft side, that is, the motor rotates counterclockwise.
1	CW direction as the forward direction	When a forward command is input, the motor rotates in CW direction viewed from the motor shaft side, that is, the motor rotates clockwise.



The change of H02-02(2002-03h) setting does not affect the output pulse form and positive/negative attribute of monitored parameters of the servo drive.

The direction of "forward drive" in the limit switch function are the same as the direction set in H02-02(2002-03h).

6.1.5 Selection of Output Pulse Phase

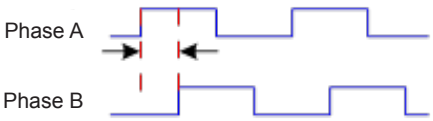
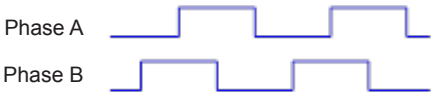
The output of the servo drive is phase A + phase B quadrature pulse.

The phase relationship between the phase A and phase B pulses can be changed by setting H02-03 (2002-04h) without changing the motor rotating direction.

Relevant objects:

H02-03	Name	Output pulse phase			Setting & Effective	At stop Power-on again	Data Structure	-	Data Type	Uint16
2002-04h	Access	RW	Mapping	-	Control Mode	ALL	Data Range	0 to 1	Default	0

It sets the relationship between the phase A and phase B pulses on the condition that the motor rotating direction remains unchanged when pulse output is enabled.

Value	Meaning	Description
0	Phase A output ahead of phase B output	Phase A output is 90° ahead of phase B output at frequency-dividing output pulses of encoder. 
1	Phase A output behind phase B output	Phase A output is 90° behind phase B output in frequency-dividing output pulses of encoder. 

6.1.6 Drive Stop

The servo stop modes include the coast to stop mode and zero-speed stop modeThe stop states include the de-energized state and position lock state. Specific information is as follows:

Table 6-5 Comparison of two stop modes

Stop Mode	Stop Description	Stop Characteristics
Coast to stop	The servo motor is de-energized and decelerates to stop gradually. The deceleration time is affected by the friction inertia and mechanical friction.	This mode features smooth deceleration and a small mechanical impact, but the deceleration process takes much time.
Stop at zero speed	From the current speed immediately stop at 0 speed as the target speed	This mode features quick deceleration but a larger impact.
Stop according to ramp	The speed reference stops smoothly to stop at 0 speed	Smooth deceleration and small mechanical impact, but the deceleration process is controllable.
Emergency torque stop	The servo drive outputs the reverse braking torque to stop	This mode features quick deceleration but a larger impact.
DB brake	The servo motor is working	This mode features quick deceleration but a larger impact.

Table 6-6 Comparison of two stop states

De-energized State	Position Lock
The motor is not energized after stopping rotation, and the motor shaft can be rotated freely.	The motor shaft is locked and cannot rotate freely after the motor stops rotation.

The servo drive stops due to the following causes:

605Ch	Name	Stop mode at S-ON off			Setting & Effective	Any setting Effective upon stop	Data Structure	-	Data Type	Uint16
	Access	RW	Mapping	NO	Control Mode	ALL	Data Range	0 to 1	Default	0

When the S-ON signal is turned off, it sets the deceleration mode of the servo motor from rotation to stop and the servo motor status after stop.

Value	Stop Mode
0	Coast to stop, keeping the de-energized state
1	Stop according to ramp, keeping the de-energized state

Set a proper stop mode according to the mechanical status and running requirement.

After the brake output is enabled, the stop mode at S-ON OFF is changed forcibly to "Stop at zero speed, keeping de-energized state."

2) Stop at fault occurrence

The stop mode varies according to the fault type. For fault classification, refer to Chapter 9.

Relevant objects:

H02-08	Name	Stop mode at NO.1 fault			Setting & Effective	At stop Effective immediately	Data Structure	-	Data Type	Uint16
2002-09h	Access	RW	Mapping	RPDO	Control Mode	ALL	Data Range	0 to 2	Default	0

It sets the deceleration mode of the servo motor from rotation to stop and the servo motor status occurrence of NO.1 fault.

Value	Stop Mode
0	Coast to stop, keeping the de-energized state
1	DB stop, de-energized state
2	DB stop, keeping the DB state

After the brake output is enabled, the stop mode at NO.1 fault is changed forcily to "DB stop, keeping the de-energized state."

605Eh	Name	Fault reaction option code			Setting & Effective	Any setting Effective upon stop	Data Structure	-	Data Type	Uint16
	Access	RW	Mapping	NO	Control Mode	ALL	Data Range	0 to 3	Default	2

It sets the deceleration mode of the servo motor from rotation to stop and the servo motor status occurrence of NO.2 fault.

Value	Stop Mode
0	Coast to stop, keeping the de-energized state
1	Stop according to ramp in 6084h/609Ah (HM), keeping de-energized state
2	Stop according to ramp in 6085h, keeping de-energized state
3	Stop at the emergency stop torque, keeping de-energized state

After the brake output is enabled, the stop mode at NO.2 fault is change forcibly to "zero speed stop, keeping the de-energized state."

3) Stop at limit switch signal active

Terms:

Limit switch signal active: The mechanical movement is beyond the designed safe movement range.

"Stop at limit switch signal active": When the mechanical movement goes beyond the safe movement range, the limit switch outputs level changes, and the servo drive forcibly stops the motor.

Relevant objects:

H02-07	Name	Stop mode at limit switch signal			Setting & Effective	At stop Effective immediately	Data Structure	-	Data Type	Uint16
2002-08h	Access	RW	Mapping	RPDO	Control Mode	ALL	Data Range	0 to 2	Default	1

When the limit switch signal is active during motor running, it sets the deceleration mode of the servo motor from rotation to stop and the servo motor status .

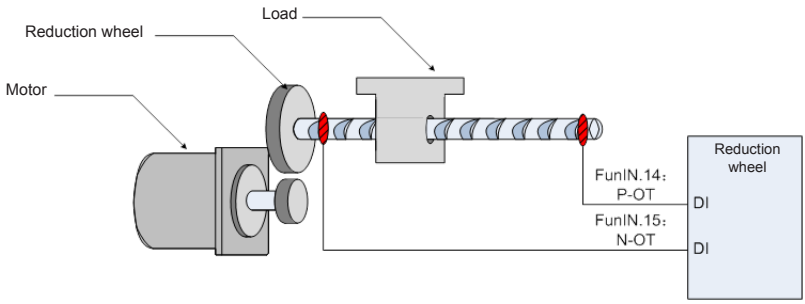
Value	Stop Mode
0	Coast to stop, keeping the de-energized state
1	DB stop, de-energized state
2	DB stop, keeping the DB state

In the vertical axis application, set 2002-08h = 1 to make the motor axis in position locking state after the limit switch signal is active to ensure safety.

After the brake output is enabled, the stop mode at limit switch signal option is changed forcibly to “Stop at zero speed, position remains locked."

To prevent the workpiece from falling when the limit switch signal is active in the vertical axis application, set 2002-08h to 1. When the workpiece moves in a linear manner, make sure to connect the limit switch to prevent mechanical damages. If the limit switch signal becomes active, enter a reverse reference to make the motor (workpiece) run in the reverse direction.

Figure 6-2 Limit switch installation



To use the limit switch function, set two DI terminals of the servo drive respectively with function 14 (FunIN.14: P-OT, positive limit switch) and function 15 (FunIN.15: N-OT, negative limit switch) to receive the limit switch input level signals, and set the terminal logics. The servo drive determines whether to enable or disable the limit switch function based on the DI terminal level.

Relevant function No.:

No.	Function Symbol	Function Name	Description
FunIN.14	P-OT	Positive limit switch	When the mechanical movement is out of range, the servo drive implements the function of preventing the motor from sensing the limit switch. Invalid: Forward drive permitted Valid: Forward drive inhibited
FunIN.15	N-OT	Negative limit switch	When the mechanical movement is out of range, the servo drive implements the function of preventing the motor from sensing the limit switch. Invalid: Reverse drive permitted Valid: Reverse drive inhibited

4) Emergency stop

Use the auxiliary: Emergency stop function.

Relevant objects:

H0D-05	Name	Emergency stop			Setting & Effective	Run settings Effective immediately	Data Structure	-	Data Type	Uint16
200D-06h	Access	RW	Mapping	-	Control Mode	-	Data Range	0 to 1	Default	0

Emergency stop operation selection:

Value	Function
0	No operation
1	Enabling emergency stop

When this function is enabled, the servo drive immediately stops according to the Stop mode at S-ON OFF 605Ch regardless of its state.

5) Quick stop

When the control word 6040h bit 2 (Quick stop) is 0 in servo drive running state, the servo drive implements Quick stop in the mode set in object dictionary 605Ah.

605Ah	Name	Fault reaction option code			Setting & Effective	Any setting Effective upon stop	Data Structure	VAR	Data Type	Uint16
	Access	RW	Mapping	NO	Control Mode	ALL	Data Range	0 to 7	Default	2

It sets the deceleration mode of the servo motor from rotation to stop and the servo motor status at quick stop of the servo drive.

Value	Stop Mode
0	Coast to stop, keeping the de-energized state
1	Stop according to ramp in 6084h/609Ah (HM), keeping de-energized state
2	Stop according to ramp in 6085h, keeping de-energized state
3	Stop at the emergency stop torque, keeping de-energized state
4	NA
5	Stop according to ramp in 6084h/609Ah (HM), maintaining the locked position
6	Stop according to ramp in 6085h, maintaining the locked position
7	Stop at the emergency stop torque, maintaining the locked position

6) Halt

When the control word 6040h bit8 = 1 in servo drive running state, a halt command is input and the servo drive performs the halt operation in the mode set in 605Dh.

605Ah	Name	Fault reaction option code			Setting & Effective	Any setting Effective upon stop	Data Structure	VAR	Data Type	Uint16
	Access	RW	Mapping	NO	Control Mode	ALL	Data Range	1 to 3	Default	1

It sets the deceleration mode of the servo motor from rotation to stop and the servo motor status at halt of the servo drive.

CSP/CST/CST/PP/HM

Value	Stop Mode
1	Stop according to ramp in 6084h/609Ah (HM), maintaining the locked position
2	Stop according to ramp in 6085h, maintaining the locked position
3	Stop at the emergency stop torque, maintaining the locked position

Profile torque (PT) mode

Value	Stop Mode
1/2/3	Stopping in accordance with the 6087h ramp, maintaining the position locked state

6.1.7 Conversion Factor Setting

Note:

For encoders with 20-bit resolution, the default value of the IS810N gear ratio 6091-01/6091-02 is 1:1.

For encoders with 23-bit resolution, the default value of the IS810N gear ratio 6091-01/6091-02 is 8:1.

6091h: Gear ratio

The gear ratio indicates the motor displacement (in encoder unit) corresponding to the driving shaft displacement by one reference unit.

The gear ratio is defined by the numerator 6091-01h and denominator 6091-02h. It determines the relationship between the driving shaft displacement (in reference unit) and the motor displacement (in encoder unit):

Motor displacement = Driving shaft displacement x Gear ratio

The motor is connected with the load through the reduction wheel and other mechanical transmission mechanisms. The gear ratio is calculated based on parameters such as the mechanical reduction ratio, mechanical size and motor resolutions. It can be calculated using the following formula:

$$\text{Gear ratio} = \frac{\text{Motor resolution}}{\text{Driving shaft resolution}}$$

605Ah	Name	Fault reaction option code			Setting & Effective	Any setting Effective upon stop	Data Structure	VAR	Data Type	Uint16
	Access	-	Mapping	YES	Control Mode	ALL	Data Range	OD Data Range	Default	OD Default Value

It sets the relationship between the number of motor shaft revolutions and the number of load shaft revolutions.

The electronic gear ratio must be within the following range:

(0.001 x Encoder resolution/10000, 4000 x Encoder resolution/10000)

If this range is exceeded, Er.B03 will be detected.

The motor position feedback (encoder unit) and driving shaft position feedback (reference unit) is in the following relationship:

Motor position feedback = Driving shaft position feedback x Gear ratio

◆ The motor speed (RPM) and the driving shaft speed (reference unit/s) is in the following relationship:

$$\text{Motor speed (RPM)} = \frac{\text{Driving shaft speed x Gear ratio 6091h}}{\text{Encoder resolution}} \times 60$$

◆ The motor acceleration (RPM/ms) and the driving shaft acceleration (reference unit/s2) is in the following relationship:

$$\text{Motor acceleration} = \frac{\text{Driving shaft acceleration x Gear ratio 6091h}}{\text{Encoder resolution}} \times \frac{1000}{60}$$

Sub-index 0h	Name	Highest sub-index supported			Setting & Effective	-	Data Structure	-	Data Type	Uint16
	Access	RO	Mapping	NO	Control Mode	-	Data Range	-	Default	2

Sub-index 0h	Name	Highest sub-index supported			Setting & Effective	During running Immediate	Data Structure	-	Data Type	Uint16
	Access	RW	Mapping	RPDO	Control Mode	-	Data Range	1 to (2^{32}-1)	Default	Set according to the encoder resolution

Sub-index 0h	Name	Highest sub-index supported			Setting & Effective	During running Immediate	Data Structure	-	Data Type	Uint16
	Access	RW	Mapping	RPDO	Control Mode	-	Data Range	1 to (2^{32}-1)	Default	1
For encoders with 20-bit resolution, the default value of the IS810N gear ratio 6091-01/6091-02 is 1:1.										
For encoders with 23-bit resolution, the default value of the IS810N gear ratio 6091-01/6091-02 is 8:1.										
The gear ratio is within the range: (0.001 x Encoder resolution/10000, 4000 x Encoder resolution/10000).										
If this range is exceeded, Er.B03 (gear ratio setting exceeding limit) will be detected.										

Take the load ball screw as an example.

Minimum reference unit fc = 1 mm

Lead PB = 10 mm/r

Reduction ratio n = 5:1

Inovance 20-bit serial encoder resolution P = 1048576(p/r)

The position factor is calculated as follows:

Position factor:

$$\text{Gear ratio} = \frac{\text{Motor resolution P*n}}{\text{PB}}$$

$$= \frac{1048576\times5}{10}$$

$$= \frac{5242880}{10}$$

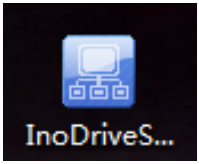
$$= 524288$$

Therefore, 6091-1h = 524288, 6091-2h = 1, which means that when the drive shaft displacement is 1 mm, the motor displacement is 524288.

The ratio of 6091-1h and 6091-2h must be reduced to without common divisor.

6.2 Background Commissioning Software

InoDriveShop is a piece of commissioning software developed for IS810. The following figure shows the software icon.



Functions such as real-time monitoring, parameter setting, real-time sampling, single-time sampling triggering, and emergency stop can be implemented on the PC using the InoDriveShop commissioning software.

- Creating/Loading items

  After the software runs, a dialog box appears.

Operation Description

1: Load device connected

The software automatically creates an item and scans/loads all the connected drives.

2: Load existing item

Manually select and load any historical items saved.

3: Create configured device

Create analog devices for presentation. One IS810 device is provided.

Note:

In the case that the drive has been connected, you are recommended to select **Load device connected** to ensure that the drive information in the software is consistent with the actual site situations.

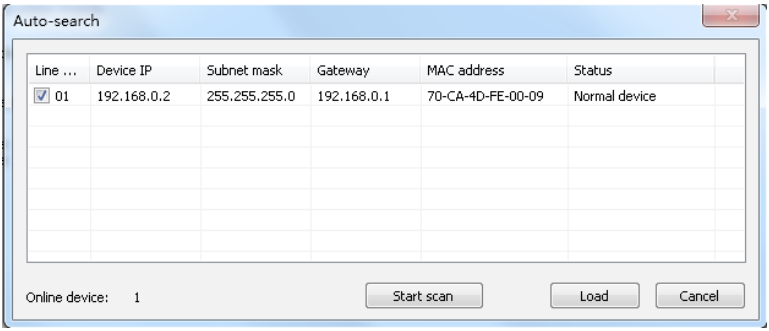
If you use **Load existing item**, note that the drive information recorded in the historical items is consistent with the current site situations.

- Connecting/Disconnecting communication

[Operation Description]

1. Connection

Click the **Auto-search** menu option, and the commissioning software automatically searches for connected device. Set the first three digits of **Device IP** to those of the IP address of **Gateway** and click **Load** to load the device.



2. Disconnect

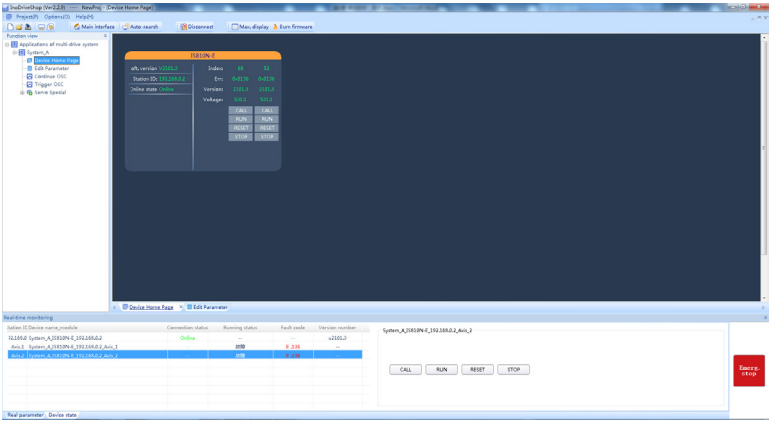
Click **Disconnected** on the toolbar to implement connection or disconnection.

- Main interface

Click **Main interface** on the toolbar.

Or

Choose **Function view** > **Device Home Page** and double-click.



Functional description:

1> Click **CALL**.

Click this button, and the LED of the drive unit flashes so that you can confirm the drive position.

2> Click **RESET**.

Faults are reset.

3> Click **RUN**.

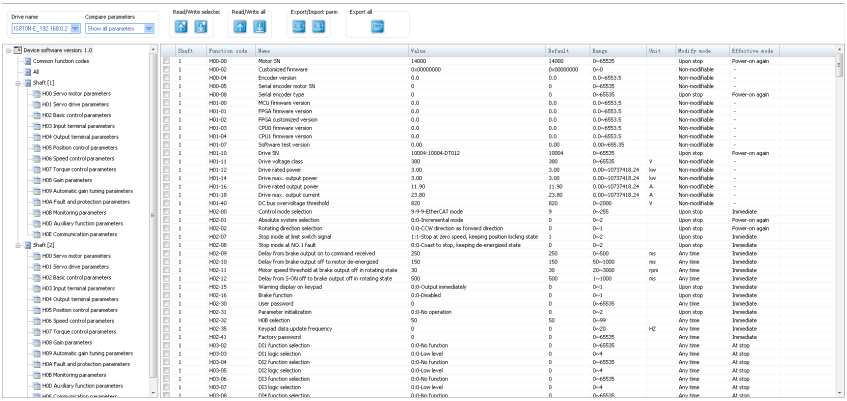
The drive unit runs.

4> Click **STOP**.

The drive unit is stopped.

- Edit Parameter

  Choose **Function view** > **Edit Parameter** and double-click.



Functional Description:

1> The function code information about the current devices are listed in detail, including the following contents:

Function code, **Name**, **Range**, **Value**, **Default**, **Unit**, **Modify mode**, and **Effective mode**.

To prevent misoperation, modified parameter values are not directly written to the drive. You must click to write them to the drive.

2> Left: Show the tree structure of parameter groups at all levels

3> Right: Show the list of parameters corresponding to a node selected from the operation tree on the left.

4> Common function codes: You can add any common parameters in the list to facilitate operation.

5> All: Summarize all function codes of the drive unit.

6> Click to read parameter values of the selected function codes of the device.

7> Click to write parameter values of the selected function codes to the device.

8> Click to read all parameter values of the selected drive.

9> Click to write all parameter values to the drive.

10> Click to save parameters of the selected drive to a file (xls/csv format).

11> Click to import a saved parameter file.

12> Click to save parameters of all connected drives to a file. Each drive corresponds to one parameter list.

13> Click the **Drive name** drop-down box to select a drive corresponding to parameters displayed in the interface.

14> Click the **Compare parameters** drop-down box. It:

Shows all parameters of a selected drive;

Shows only the parameters different from defaults;

Shows only the parameters that have been modified during commissioning;

Shows only the parameters that have been modified but not written to the drive;

Shows only the parameters different from the values in the current imported parameter record file.

15> Short-cut menus. They are used to:

Read selected parameters; write selected parameters; add to the monitoring list; add as self-defined parameters; delete from self-defined parameters; show system changeover (between the decimal and hexadecimal systems if the conditions are satisfied).

16> Prompt color : The current value is different from the default.

: The parameter value has been modified but not written to the drive.

- Continuous OSC

  Choose **Function view** > **Continue OSC** and double-click.

Functional Description:

Toolbar buttons

1> : Open a historical data file (.csv).

2> : Save the current sampling data to a .csv file.

3> : Save the current sampling waveform to a .bmp file.

4> : Zoom in in a specified waveform area. When you right-click the waveform area, the zoom-in is canceled. This function is exclusive with the **Move** function.

5> : Enable the horizontal movement. This function is exclusive with the Circle function.

6> : Display the coordinates of a sampling point. When the pointer is moved to the waveform area, coordinates are displayed. When the pointer is move out of the waveform area, coordinates are not displayed.

7> : Display curve names (channel names) in the waveform area or on the leftmost of waveforms.

8> : Open the vernier window. There is one group of verniers (A, B) in the horizontal and vertical direction each. The distance between verniers can be locked. The vernier window displays information about sampling points of each channel corresponding to verniers A and B.

9> : Highlight waveform curve sampling points (dots).

Drawing area

1> Scale area: Show the Y-scale on the left and X-axis (time axis) at the bottom.

2> Waveform display area: Draw curves composed of sampling points.

Channel information

1>ID: Show channel numbers.

2> Channel variable: Switch between channel variables.

3> Show: Show or hide waveform curves.

4> Color: Set the colors of curves and scales.

5> Scale: Show or hide Y-axis scale information.

6> Longitudinal scale:

a. Click **Auto** to automatically calculate the Y range value of the current curve.

b. Grid size: Change the Y-axis range by select a value corresponding to a grid. The middle position is an average of the current range values, that is, (YMax – Ymin)/2.

c. Up arrow: The waveform moves up one cell at a time.

d. Down arrow: The waveform moves down one cell at a time.

Sampling parameter settings

1> Sampling interval: Set a sampling interval coefficient in a valid range of 1 to 100. Sampling interval = Sampling coefficient * 2 ms.

2> Time axis: Set a time length that the X-axis indicates in ms.

Control buttons

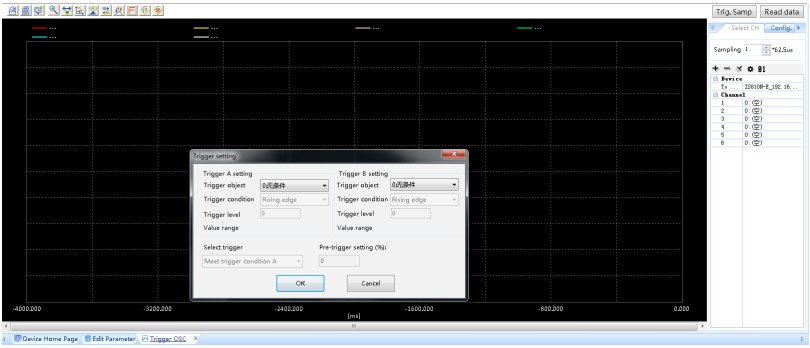
1> Continuous sampling: Start or stop continuous sampling.

- Trigger OSC

  Choose **Function view** > **Trigger OSC** and double-click.

  Functional Description:

  The basic operations are the same as those for the continuous oscilloscope. After the trigger parameters are set, a valid data segment can be read and displayed.



Control buttonsv

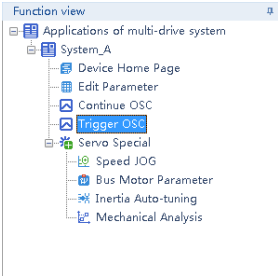
1> Single-time sampling: Start or stop single-time sampling.

2> Trigger setting: Display a dialog box that is used to set triggering parameters.

3> Bit channel configuration: Support configuring 8-bit channel display.

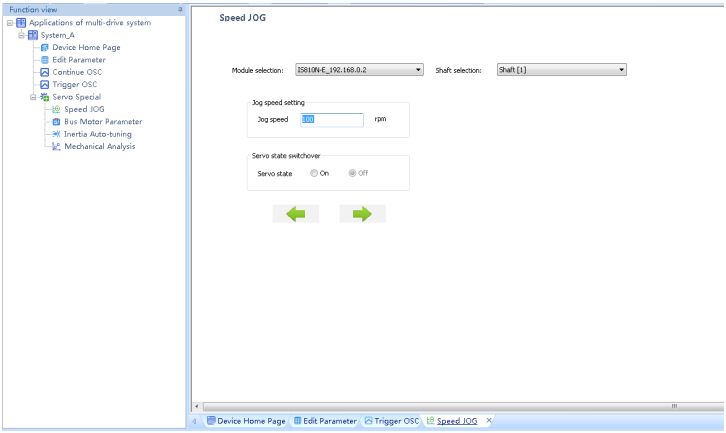
- Servo Special

  Choose **Function view** > **Servo Special**, double-click, and you can use the following special functions for the servo:



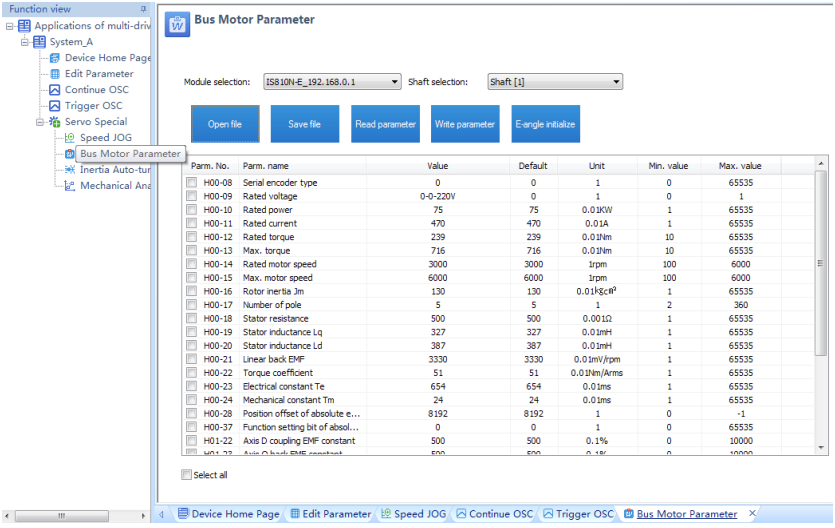
1. Speed JOG

   Note: The **Speed JOG** function can be used only in non-EtherCAT mode (H0200CA).



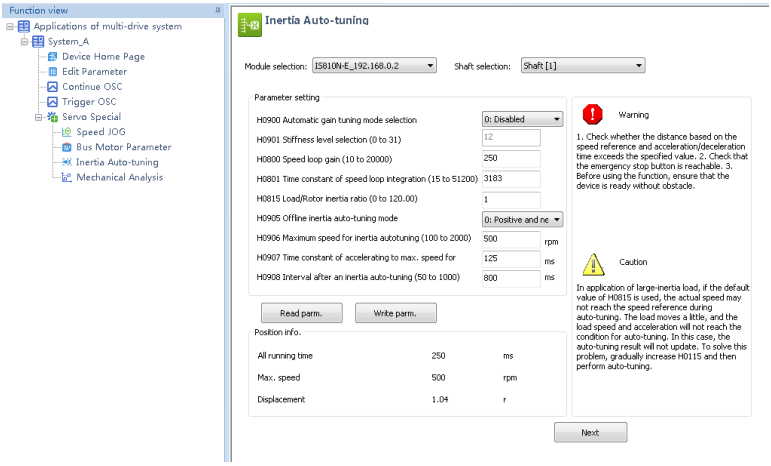
Function Description: The **Speed JOG** function is mainly used to perform trial run in the motor speed mode. Select a corresponding axis number in the **Shaft selection** drop-down box. Set a trial run speed in **Jog speed setting**. Set **Servo state** to **On**, and the motor enters the enabled state. At this point, hold down the left arrow button, and the motor performs trial run in the forward direction at a set jog speed. When you release the button, the motor stops running. Similarly, you can hold the right arrow button to make the motor perform trial run in the reverse direction. Set **Servo state** to **Off**, and the motor enters the disabled state.

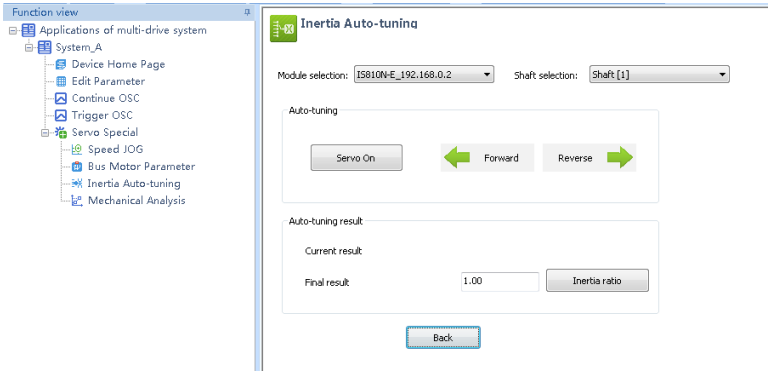
2. Serial Encoder Motor Parameter



Function Description: The **Bus Motor Parameter** function is mainly used to read and write motor-related parameters stored in the serial encoder and supports the initial electrical angle auto-tuning function. Before using this function, you must select a corresponding axis number in the **Shaft selection** drop-down box. Check the parameters to be read and click **Read parameter** to obtain serial encoder motor parameters. Check the parameters to be written, enter their values in **Value**, and click **Write parameter** to write serial encoder motor parameters. When the servo is in rdy state, click **E-angle initialize** and follow the prompts to finish initial electrical angle auto-tuning.

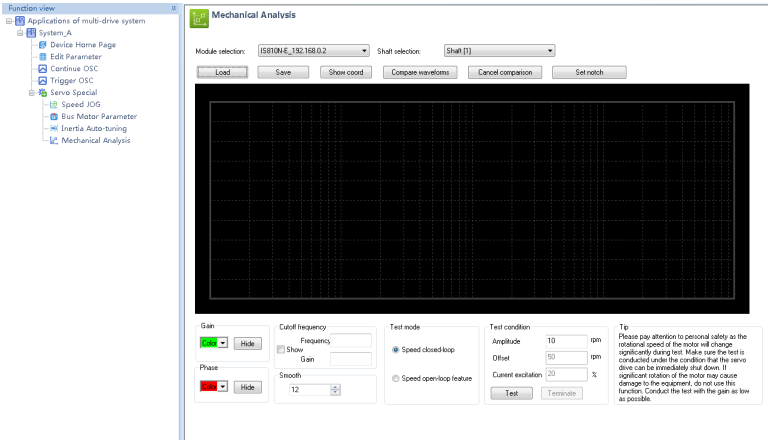
3. Inertia Auto-tuning





Function Description: The **Inertia Auto-tuning** function can auto-tune the load inertia of a corresponding axis and support writing load inertia auto-tuning results to the servo drive. Select a corresponding axis number in the **Shaft selection** drop-down box. Enter related parameters according to the prompts on the page. Click **Next** to enter the next page. Click **Servo On** and hold down **Forward** or **Reverse**. The motor continuously runs according to the given instructions. In addition, the auto-tuning result is displayed. Click **Inertia ratio** to write the inertia auto-tuning result to the servo drive.

4. Mechanical Analysis



Function Description: The **Mechanical Analysis** function is mainly used to analyze speed open-loop frequency and closed-loop frequency features of each axis. Select a corresponding axis number in the **Shaft selection** drop-down box. If you select **Speed closed-loop**, enter a speed excitation amplitude (10 RPM by default). When this axis is in rdy state, click **Test** to start an analysis of the speed closed-loop frequency feature. Wait until the data transmission progress bar is complete. The speed closed-loop frequency features of this axis is displayed in the drawing area. If you select **Speed open-loop feature**, enter a current excitation amplitude (20% by default). When this axis is in rdy state, click **Test** to start an analysis of the speed open-loop frequency feature. Wait until the data transmission progress bar is complete. Thespeed open-loop frequency feature of this axis is displayed in the drawing area.

6.3 Commissioning Cases

6.3.1 Basic Settings of the AM600 Controller for OMET

The following part introduces the communication settings with IS810N by using Inovance AM600 controller as the master.

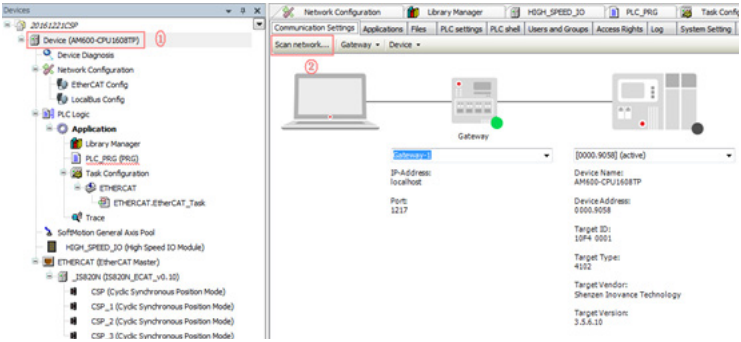
Note: To better fit for IS810N, it is recommended to use Version 1.10 or a later version of the AM600 backend.

1) Creating a project

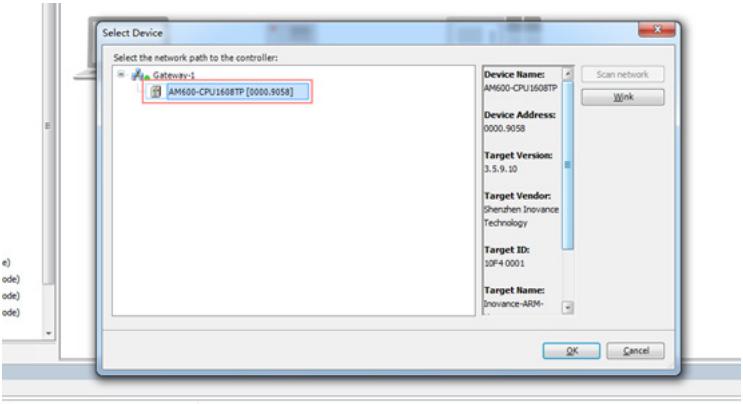
Create an AM600 project. Select **AM600-CPU1608TP**. The interface is shown in the following figure.

2) Communication setting

Correctly connect the communication cables. To have a normal communication connection, assign the PC an IP address belonging to the same network segment (192.168.1.xxx) as AM600.



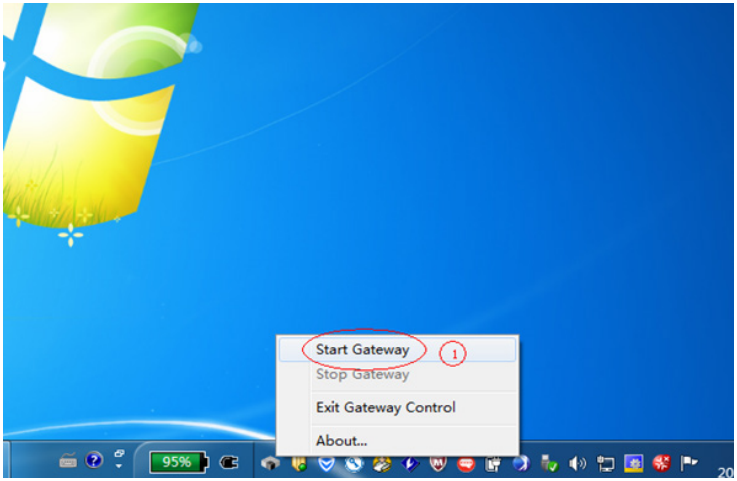
Click **Scan Network**.



Select the found AM600 device. Now the communication connection between PLC and PC is completed. Then, perform device configurations.

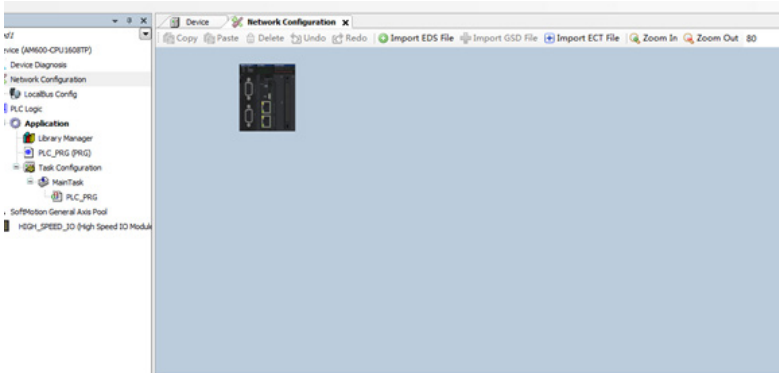
Note: If the AM600 device cannot be found in InoPro, check and turn on the CoDeSys gateway, and then rescan.

Check whether the CoDeSys gateway in the task in the lower- right corner of the PC is turned on (shown in color). If it is in STOP state, click **Start Gateway**.

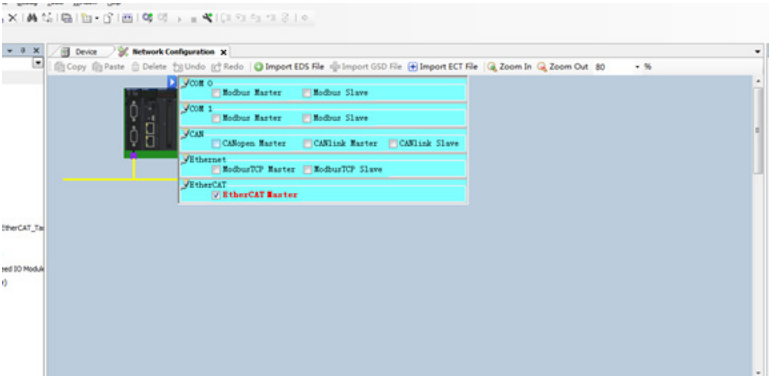


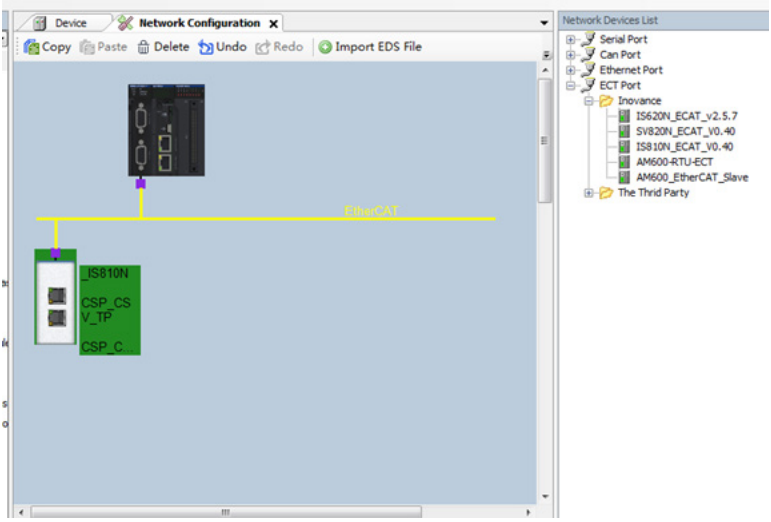
3) Adding devices to perform configurations

a) Adding the **XML** file of IS810N: Click **Import ECT File** in **Network Configuration** to add **XML** files (download **XML** files from Inovance's official website).

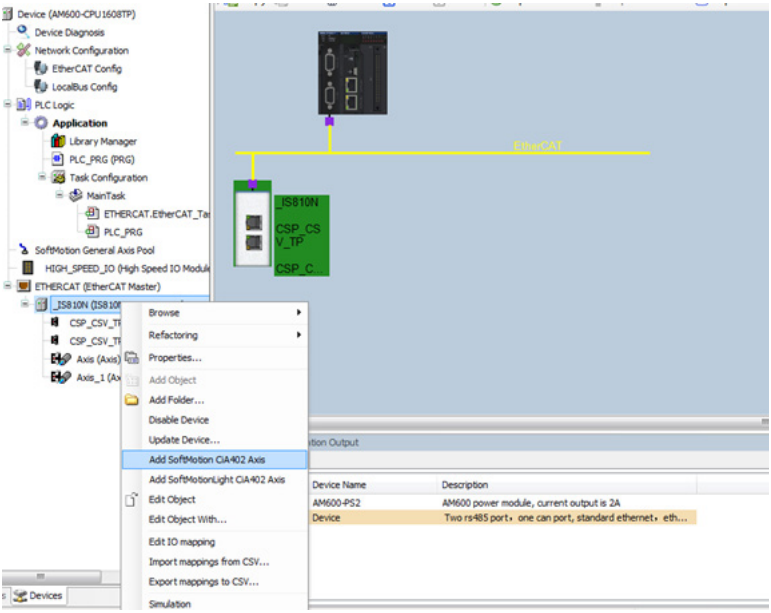


b) Performing device configurations for the system: Add the EtherCAT Master and add the IS810N device. (Drag **Ino_MultiAxesDrive_ECAT_V0.30.xml** into the configuration interface.)

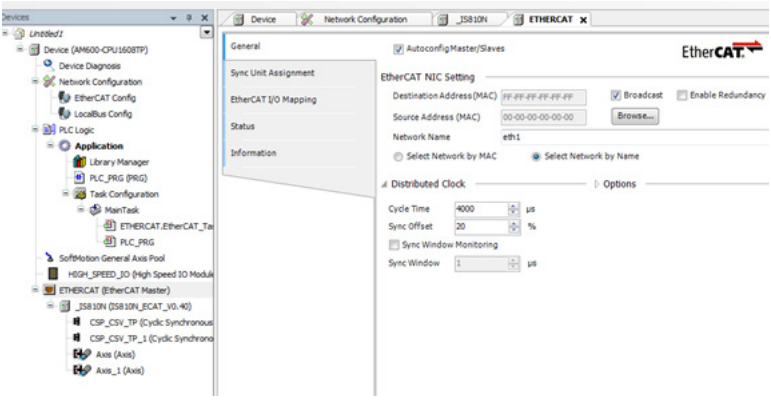




c) If the AM600 backend version is earlier than V1.10, please manually add two rotary motor axes by right-clicking the IS810N device option.

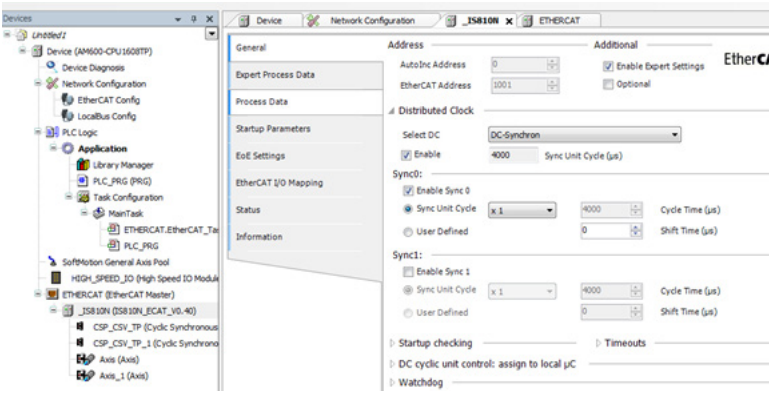


d) Retain the default EtherCAT master communication parameters. Select eth1 for the network. Select a synchronizing cycle.

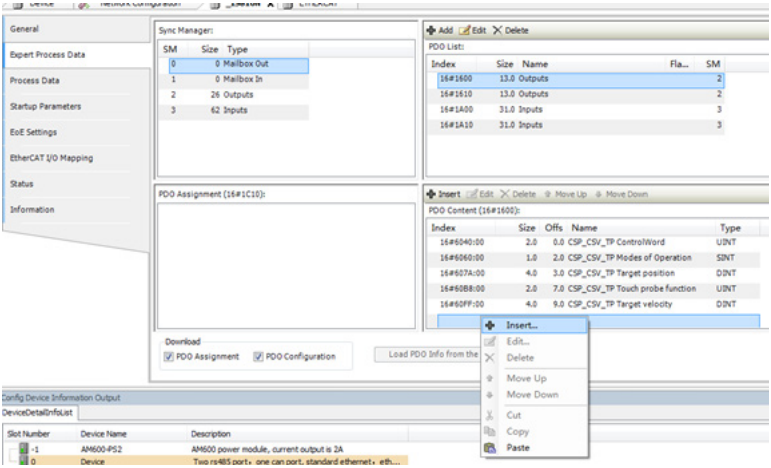


4) Configuring the PDO mapping for the slave

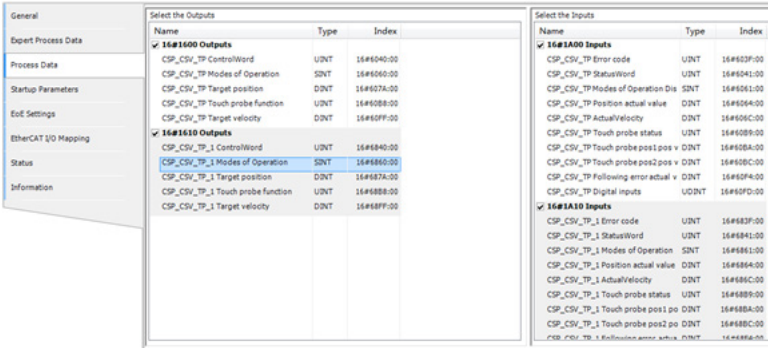
a) Enable expert settings.



b) Check the corresponding PDO list. In the PDO configuration interface, you may run a corresponding mode according to two axes and add a corresponding PDO object in PDO. Perform configurations according to process data required in the CSP (position) + CSV (velocity) +TP (probe) mode. Click the IS810N(IS810N_ECAT_v0.40) list.

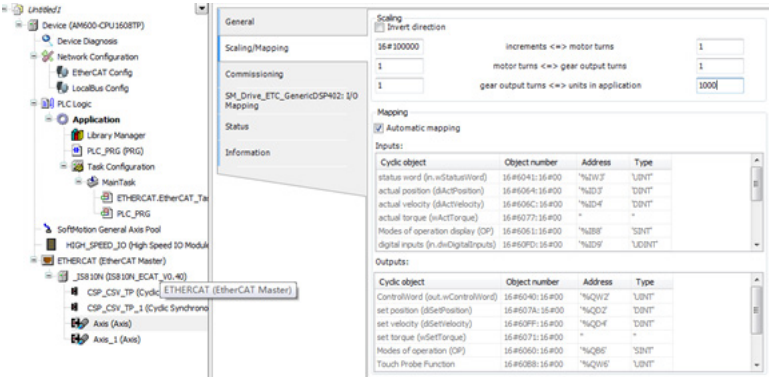


The PDO list configured according to the CSP (position) + CSV (velocity) + TP (probe) mode is as follows.



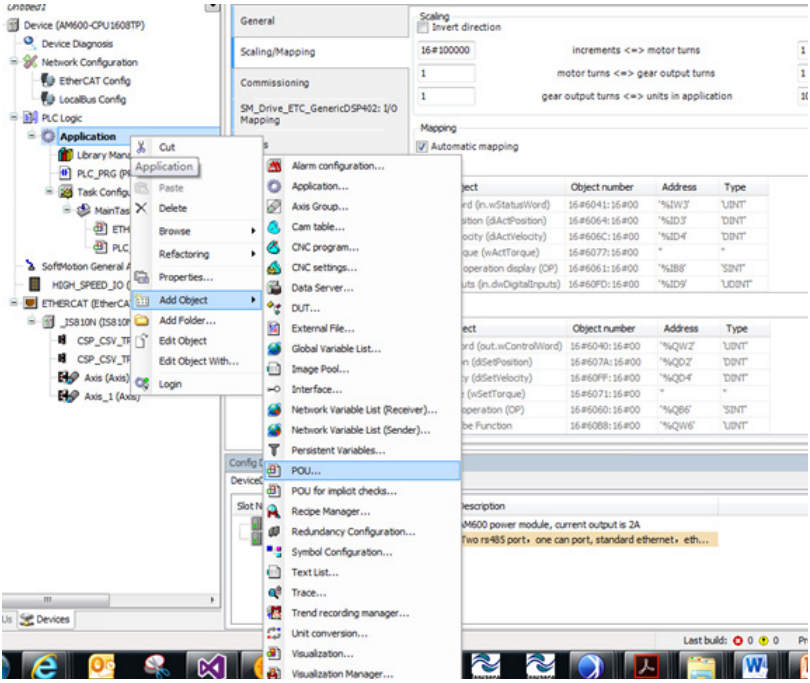
5) Axis scaling settings

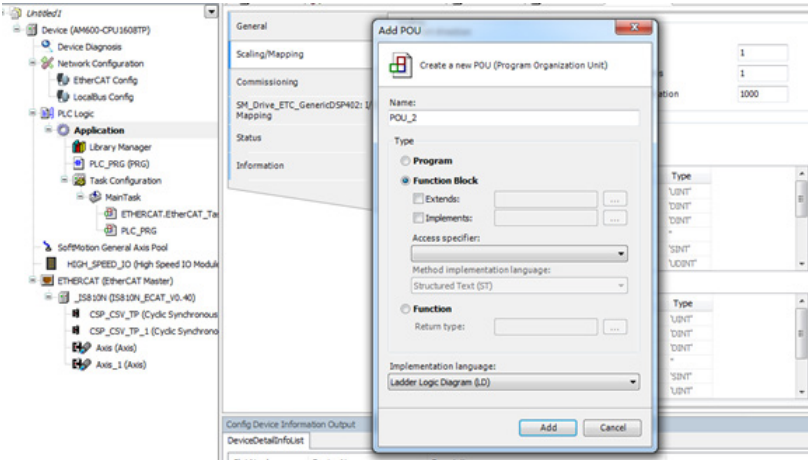
The axis uses a 20-bit incremental encoder and is configured according to the revolution of 1000 reference units.



6) PLC program

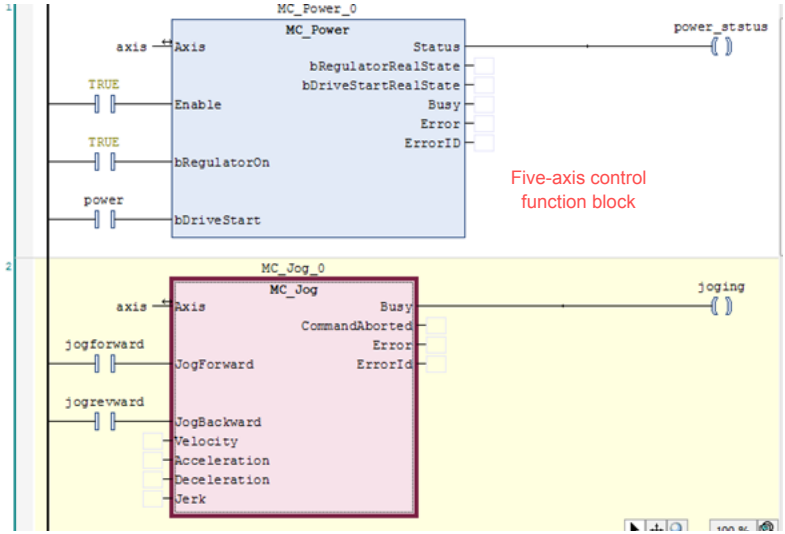
a) Add an FB file that edits the function block in **Application**.



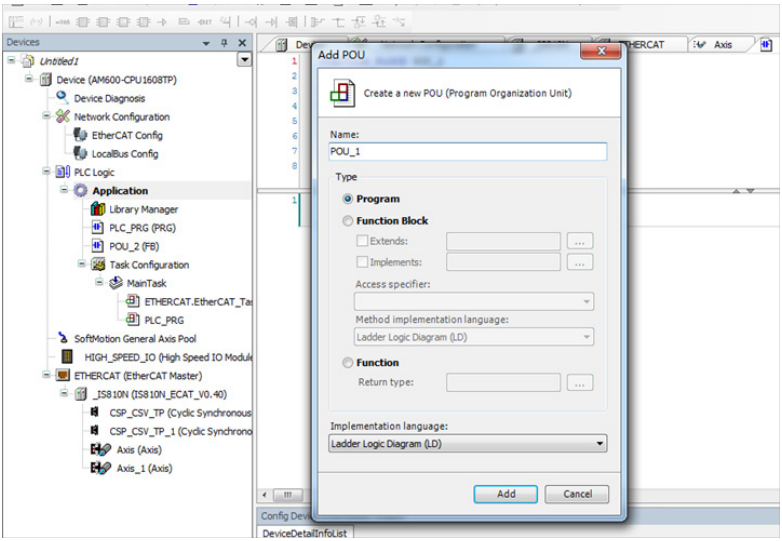


b) Definition part of FB

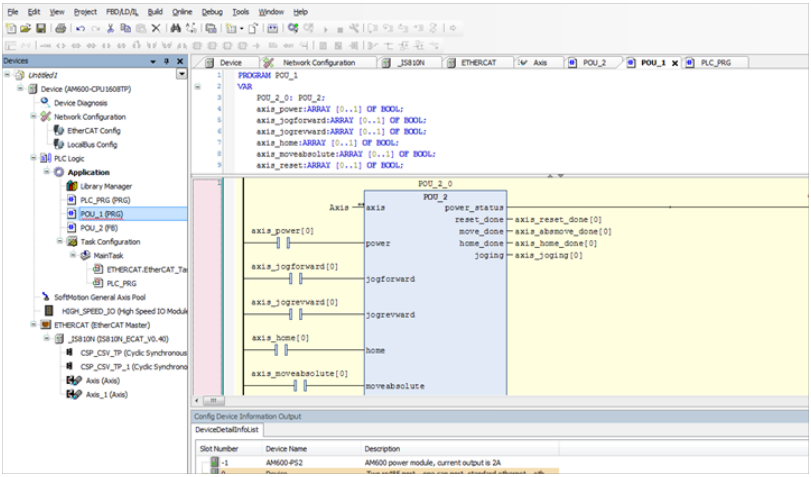
c) Five function blocks in FB



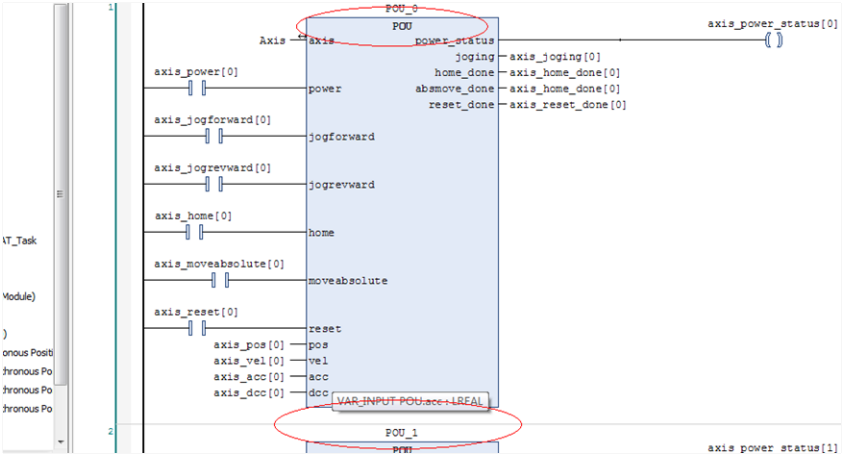
d) Add a main program POU, as shown in a).



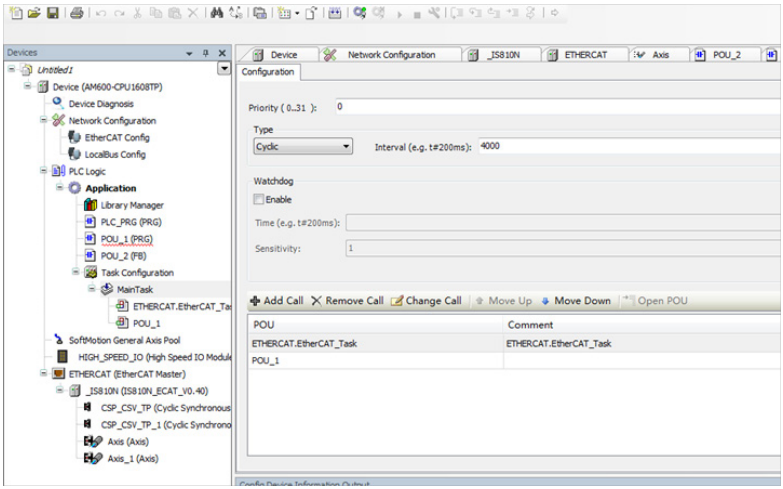
e) Add the FB function block to the newly created POU.



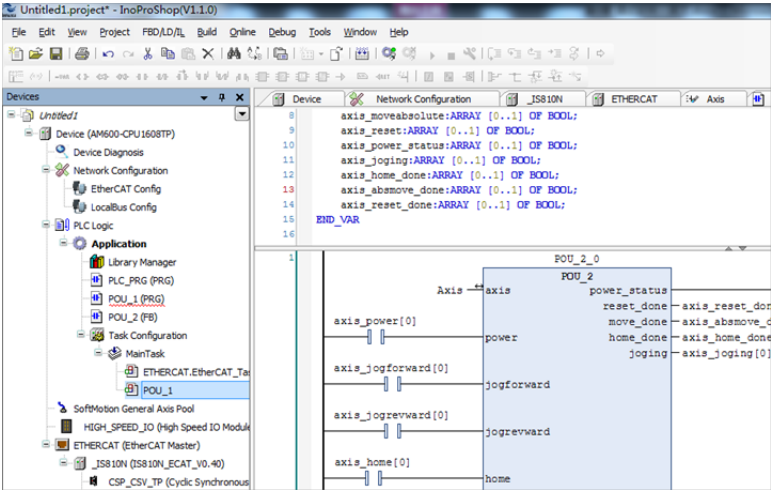
f) Instantiate this FB into four function blocks, and bind them to four axes respectively.



g) After calling this program in the EtherCAT task, simple enabling, jog, homing, and absolute position operation can be performed.



h) Log in to the PLC to operate the bus manually.

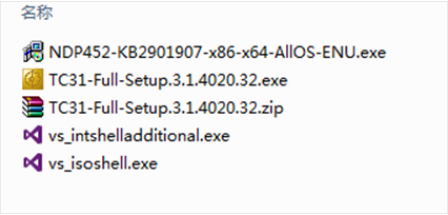


6.3.2 Basic Settings of the Beckhoff Controller for OMET

The following part describes how to configure the IS810N servo drive with Beckhoff TwinCAT3 master in CSP mode.

1) Install the TwinCAT software.

TwinCAT3 (supports the Windows 7 32-bit system or Windows 7 64-bit system) is available on Beckhoff's official website. (The 32-bit system is used as an example.)

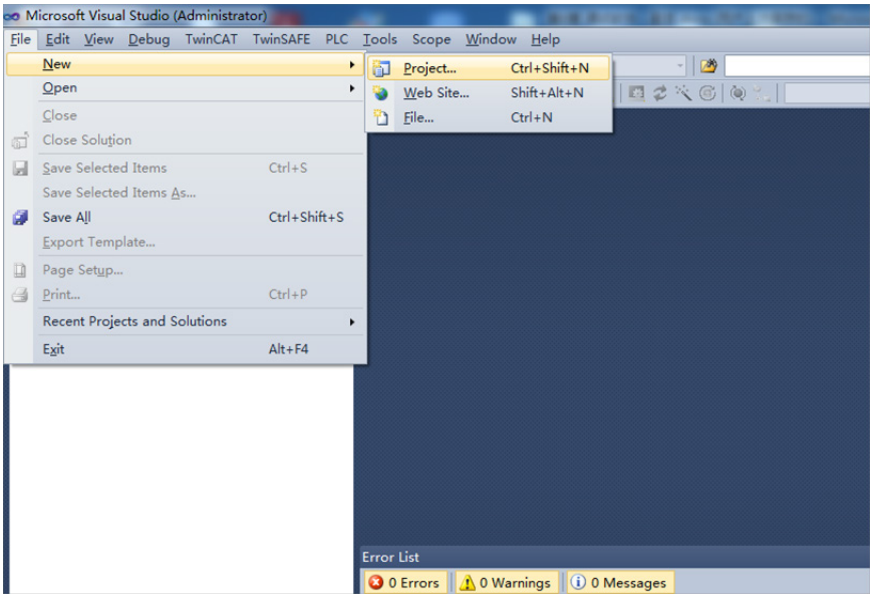


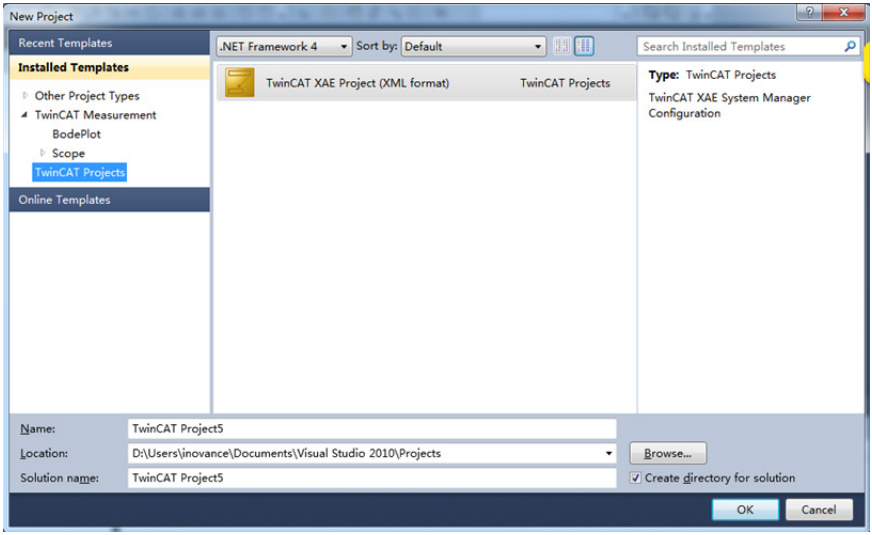
Note:

If you use a PC to drive directly, the 100M-Ethernet network adapter with an Intel chip must be used. Other network adapters may not support EtherCAT.

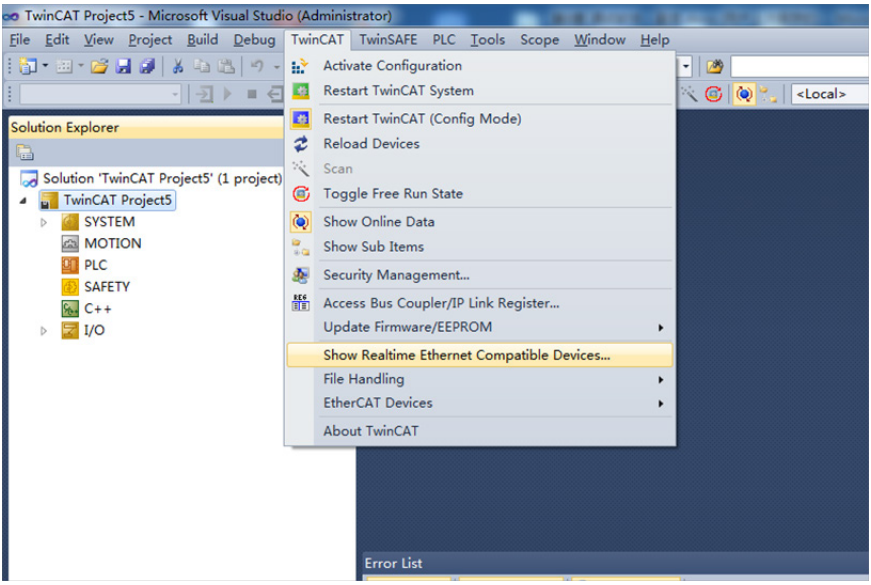
2) Copy the IS810N EtherCAT configuration file (Ino_MultiAxesDrive_ECAT_V0.10.xml) of SV820N to the TwinCAT installation directory: TwinCAT\3.1\Config\Io\EtherCAT.

3) Open Visual studio, and create a Twincat3 Project.

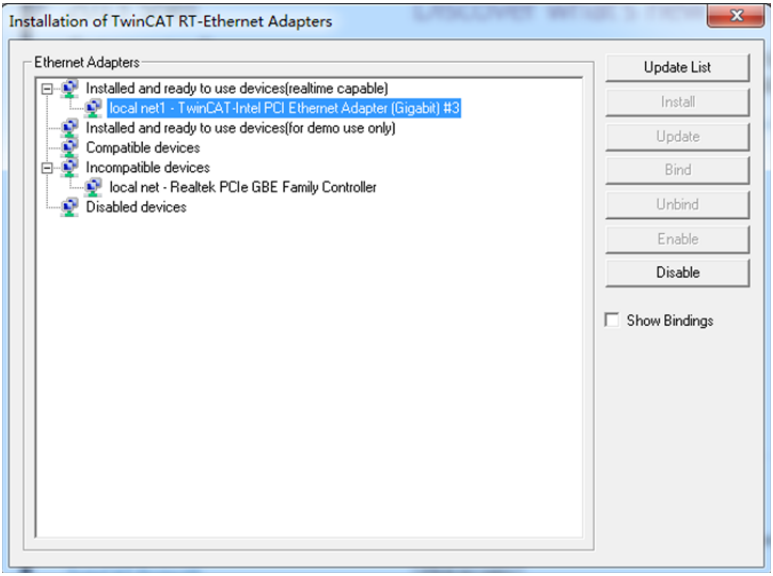




4) Install the TwinCAT network adapter driver.



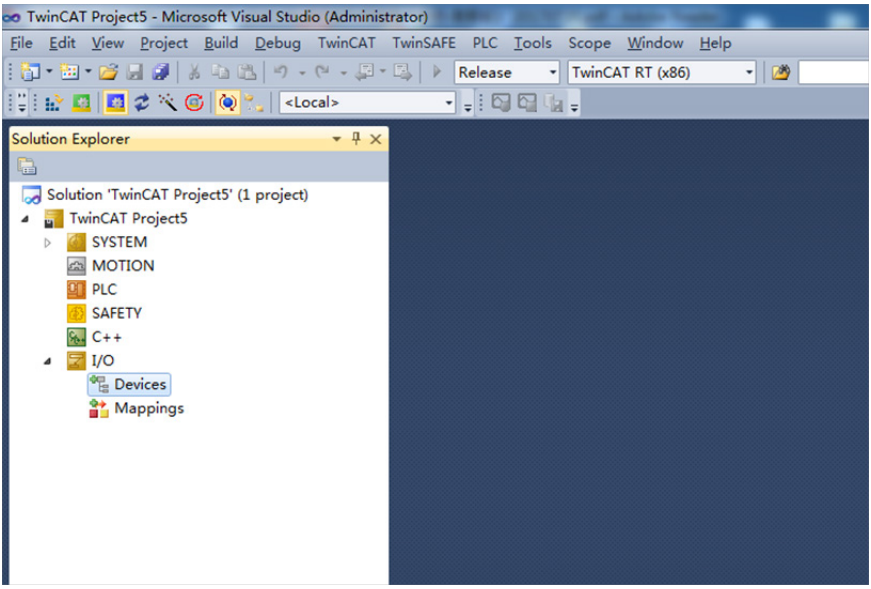
Open **Show Real Time Ethernet Compatible Devices** using the menu shown in the preceding figure. In the displayed dialog box, select the local network adapter from the incompatible devices, and click Install. After installation, the installed network adapter is displayed in **Installed and ready to use devices**.

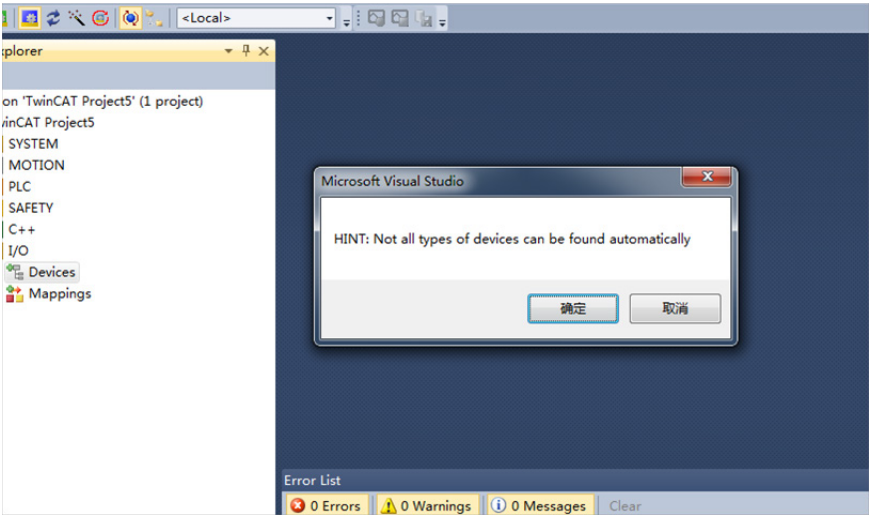


5) Search for devices.

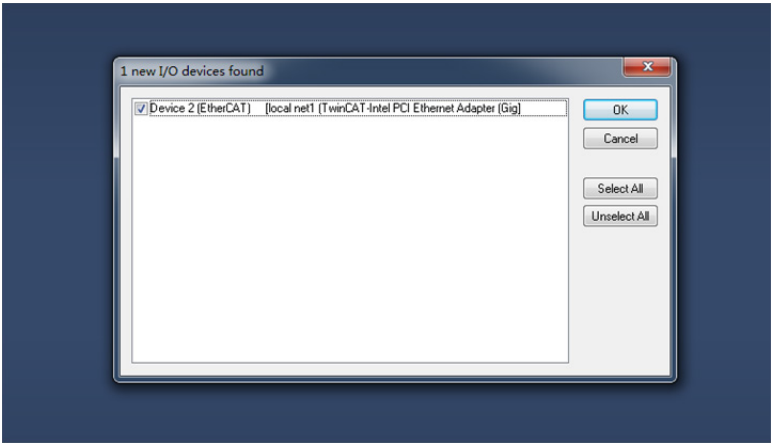
Create a project and search for devices. Select 

and click  , as shown in the following figure.

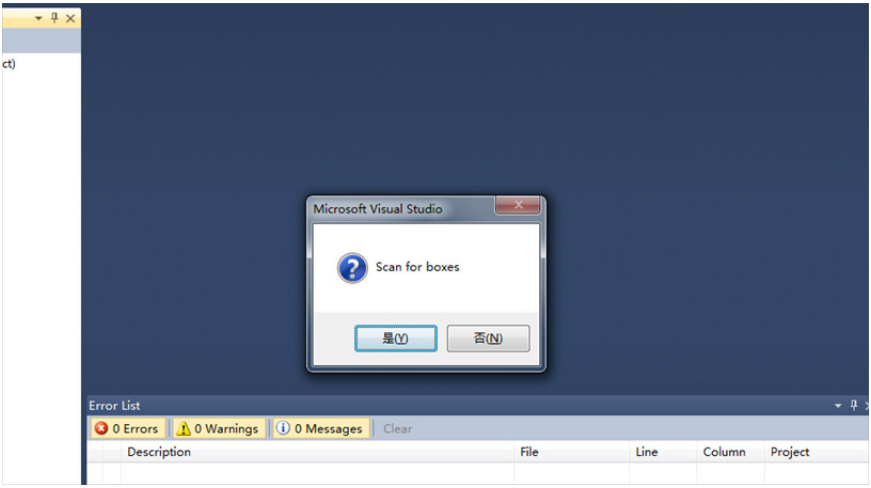




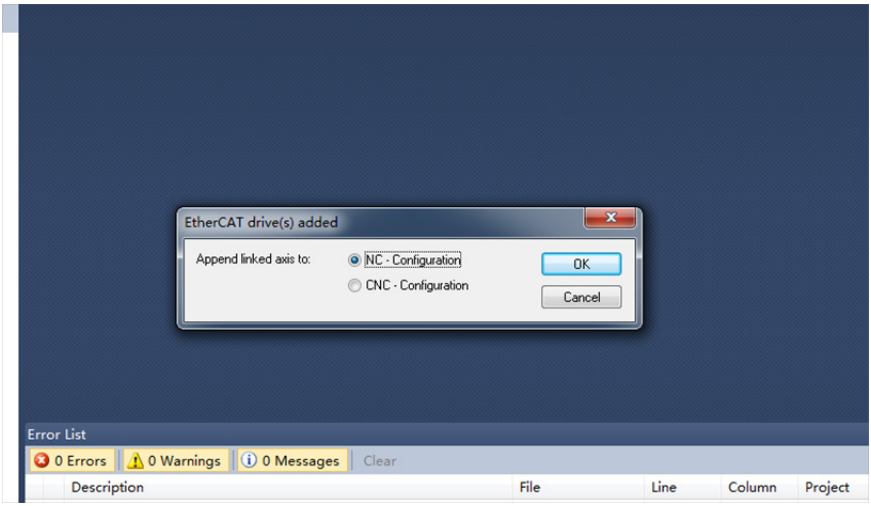
Click **OK**.



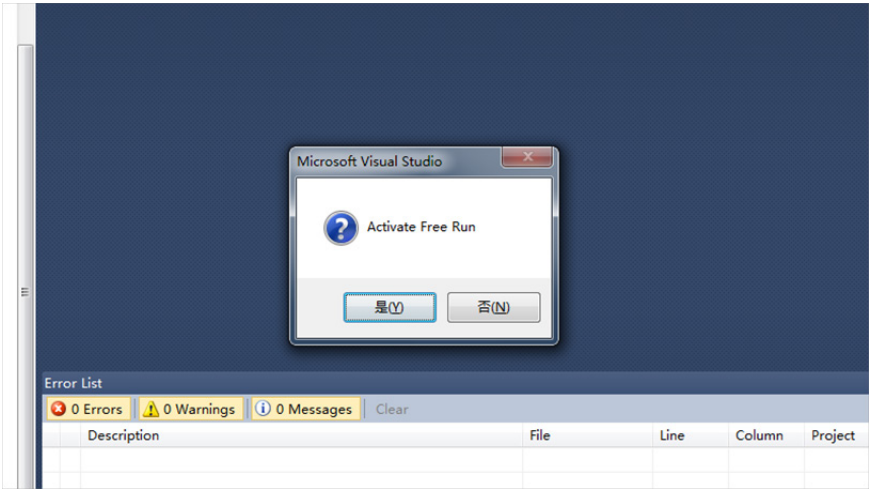
Click **OK**.



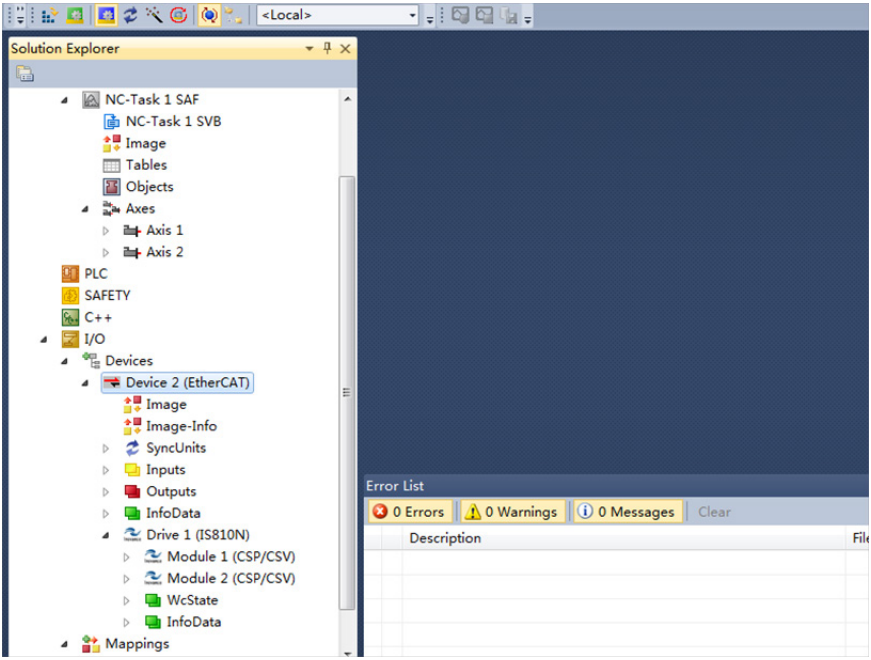
Click **Yes**.


EtherCAT drive(s) added
Append linked axis to:
NC - Configuration
CNC - Configuration
OK
Cancel
Error List
0 Errors
0 Warnings
0 Messages
Clear
Description
File
Line
Column
Project

Click **OK**.

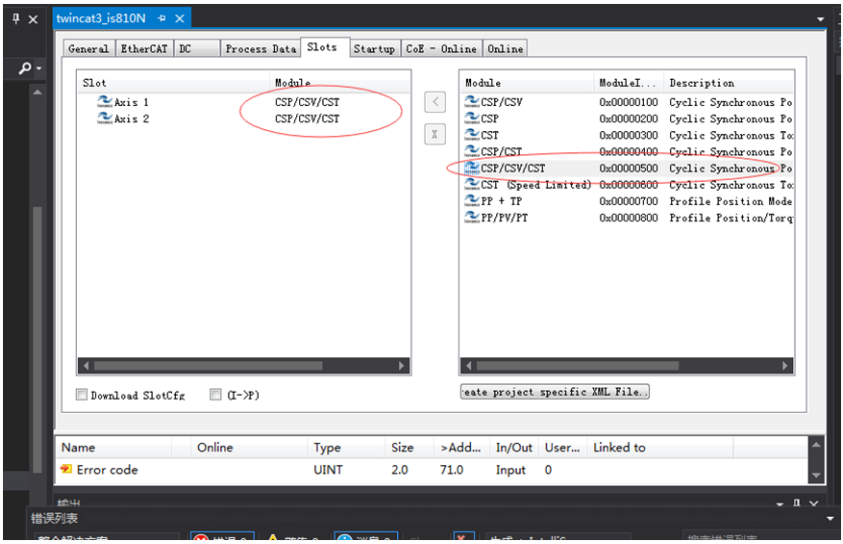

Microsoft Visual Studio
Activate Free Run
是(Y)
否(N)
Error List
0 Errors
0 Warnings
0 Messages
Clear
Description
File
Line
Column
Project

Click **No**. The equipment search is completed, as shown in the following:

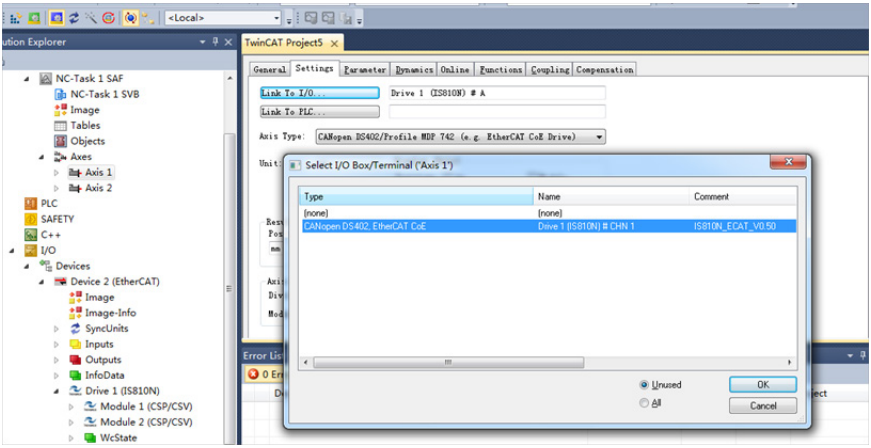


6) Configure PDO contents.

Take implementing CSP (position) + CSV (speed) + CST (torque) mode as an example. Quickly select a running mode in **Slots**.



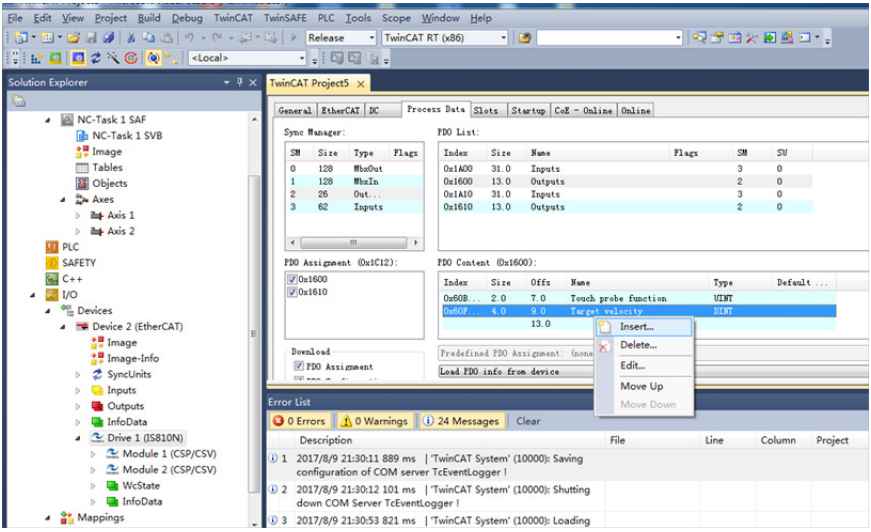
Attention: If anything is changed here, the axis must be reconnected to the device before the bus is started.



1. Configure RPDO: If you use two axes, check 0x1600 and 0x1610.

2. The RPDO configuration procedure is listed in detail as follows:

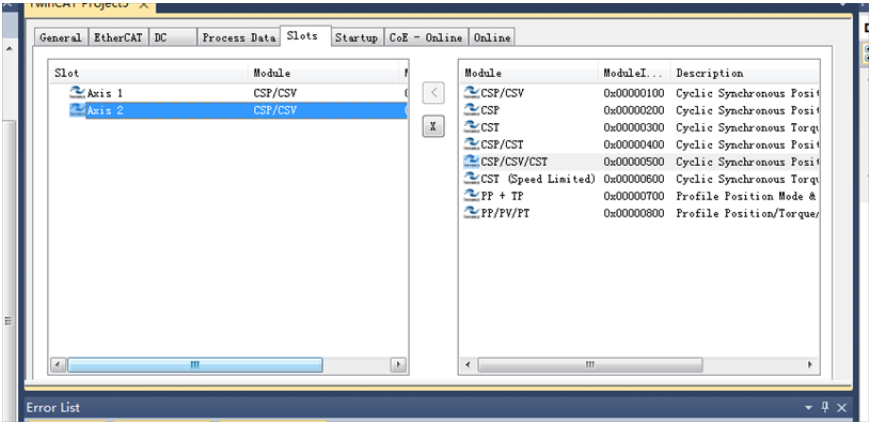
If the current PDO meets your requirements, you do not need to change it; otherwise you need to simply change the PDO list to suit your mode. To delete an unnecessary default PDO, right-click it in the **PDO Content** window and choose **Delete**. To add a PDO, right-click in the window and choose **Insert**.



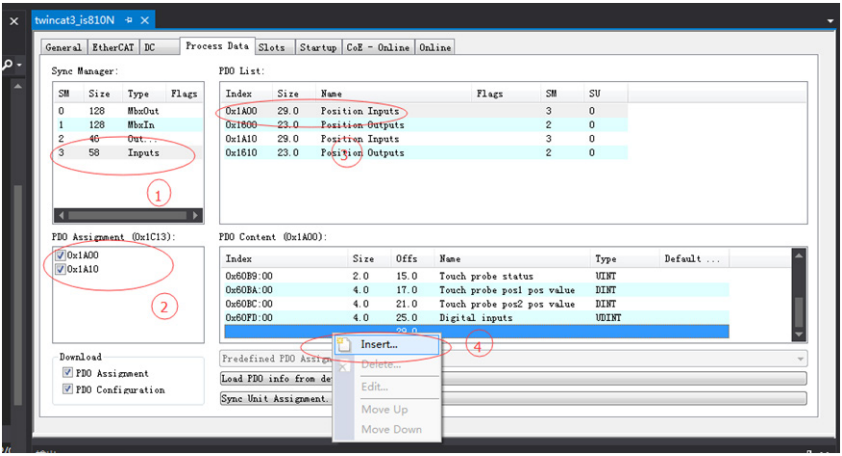
3. Take implementing CSP (position) + CSV (speed) + CST (torque) mode as an example.

Configure TPDO: If you use two axes, check 0x1A00 and 0x1A10.

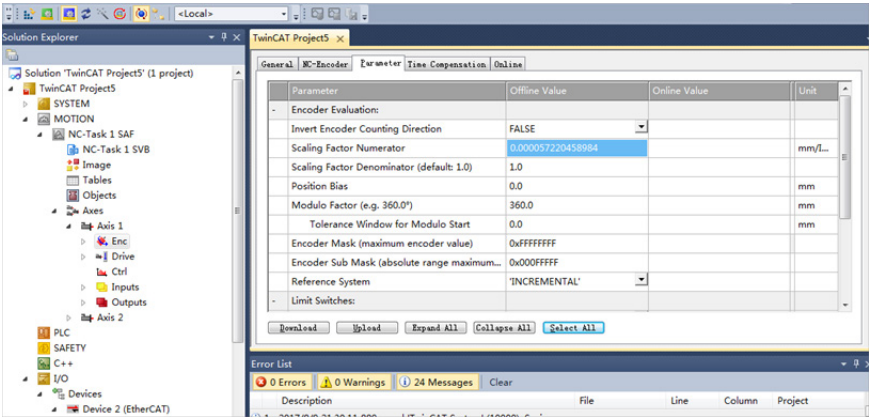
The RPDO configuration procedure is listed in detail as follows:



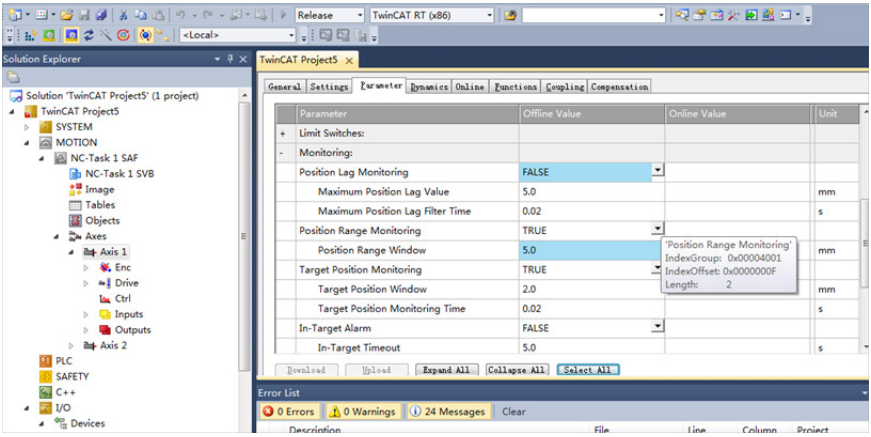
If the current PDO meets your requirements, you do not need to change it; otherwise you need to simply change the PDO list to suit your mode. To delete an unnecessary default PDO, right-click it in the **PDO Content** window and choose **Delete**. To add a PDO, right-click in the window and choose **Insert**.



Click **Axis 1** in **Axes**, select **Parameter** and set the scaling parameter of the device axis. In this example, set the required movement unit to 60 mm per revolution of the servo motor, and the value of **Scaling Factor Numerator** to 60/1048576 (same for the other axis).

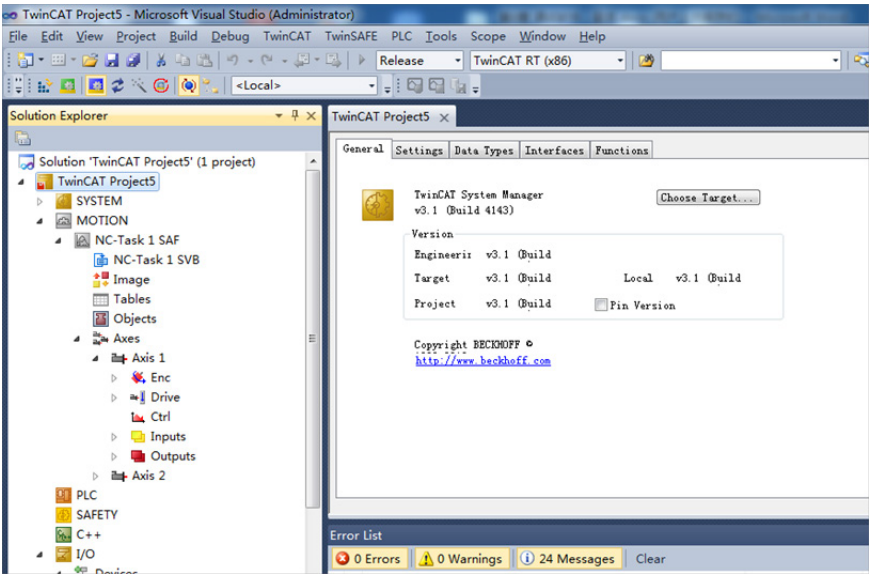


Click **Axis 1** in **Axes**, select **Parameter**, and temporarily shield the system deviation (same for the other axis).

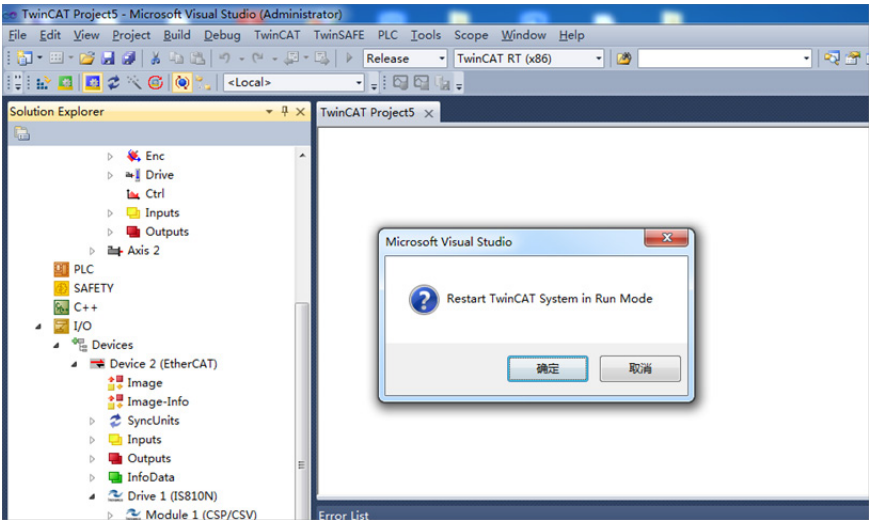


7) Activate the configuration and switch to the running mode.

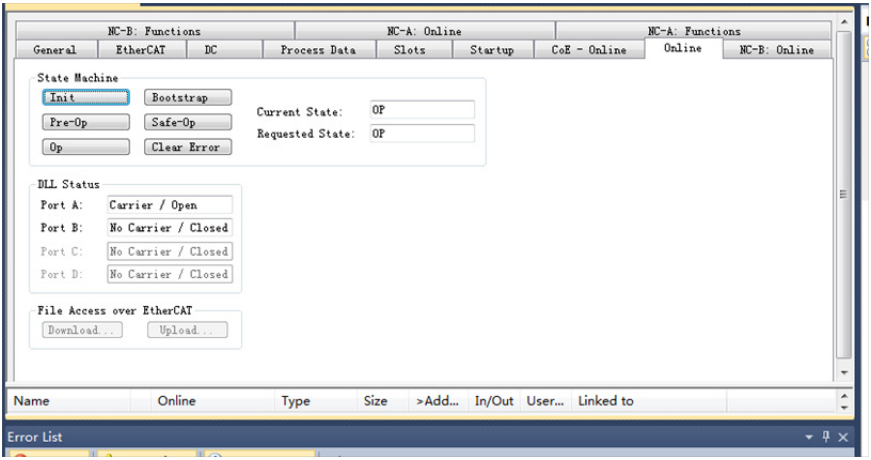
Click  .



Click **OK**.

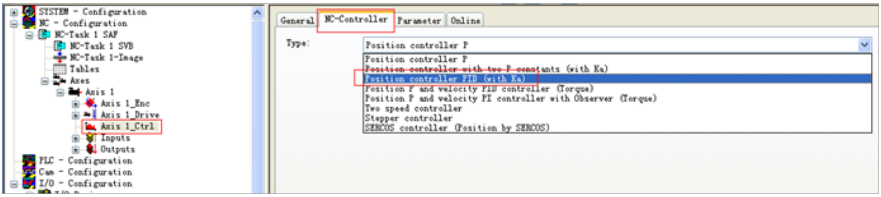


On the **Online** interface, you can view that the current state is OP, and the 2nd LED on the keypad of the servo drive displays "8".



8) Control the servo drive through the NC controller or PLC program.

- You can select the control type.

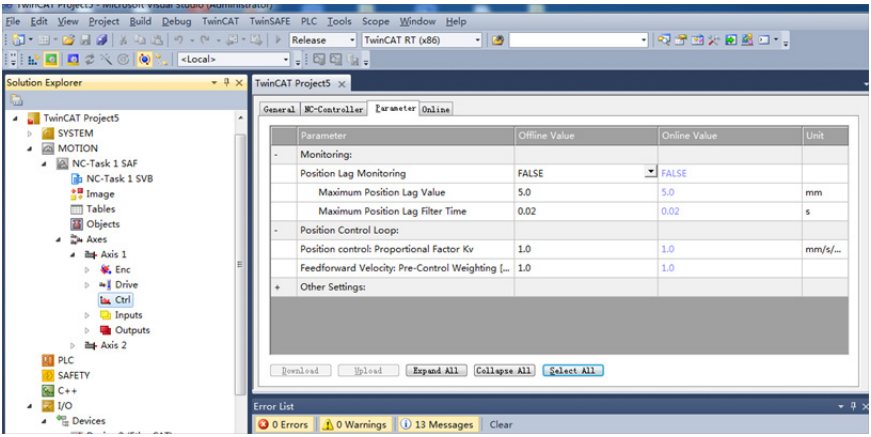


PID type of control loop:

Position loop: Drive Speed loop: Drive	Drive: Position mode	Position Controller P
Position loop: TWinCAT NC Speed loop: Drive	Drive: Velocity mode	Position Controller PID (With Ka)

Note: The TWinCAT NC controller can also implement the speed loop, and send the target torque to the drive in each cycle. This method, however, actually increases the CPU and network load, and is not recommended.

- Set the control parameters.



Adjust the proportion of the position loop based on the actual response:

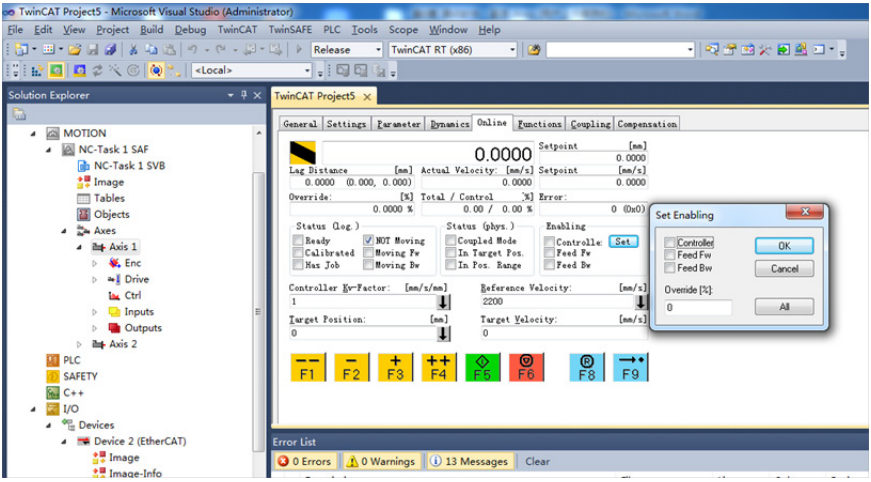
Position control: Proportional Factor Kv	1.0

Adjust the speed feedforward coefficient based on the actual response:

Feedforward Velocity: Pre-Control Weighting [0.0 ...	0.0

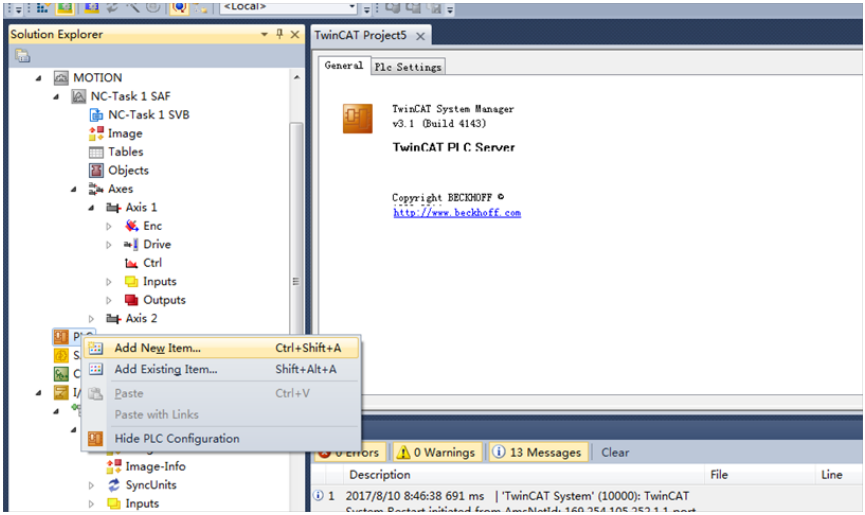
a) Perform trial jogging of the NC axis.

1. Click **Set** to display a dialog box and then click **All**. The servo drive is now enabled. Perform jogging through F1 to F4.

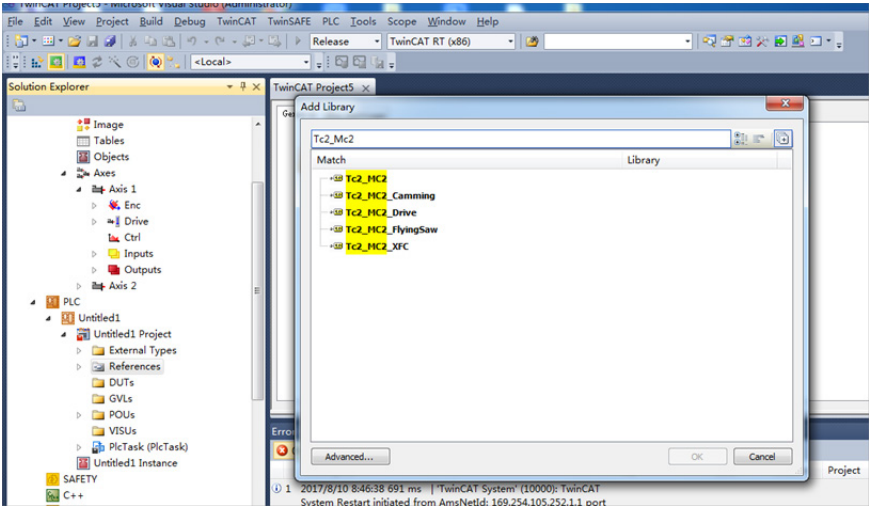


b) Right-click PLC.

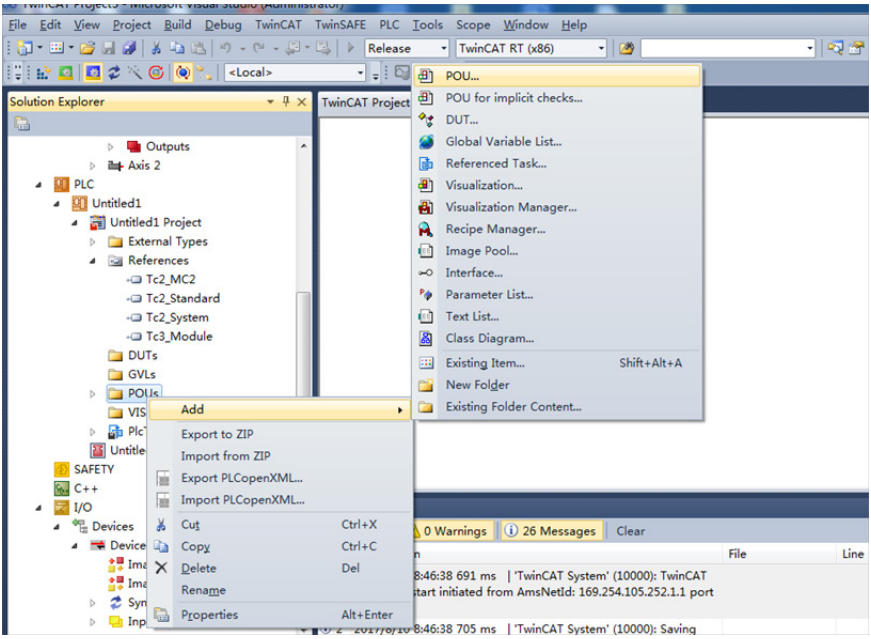
c) Create a PLC program.

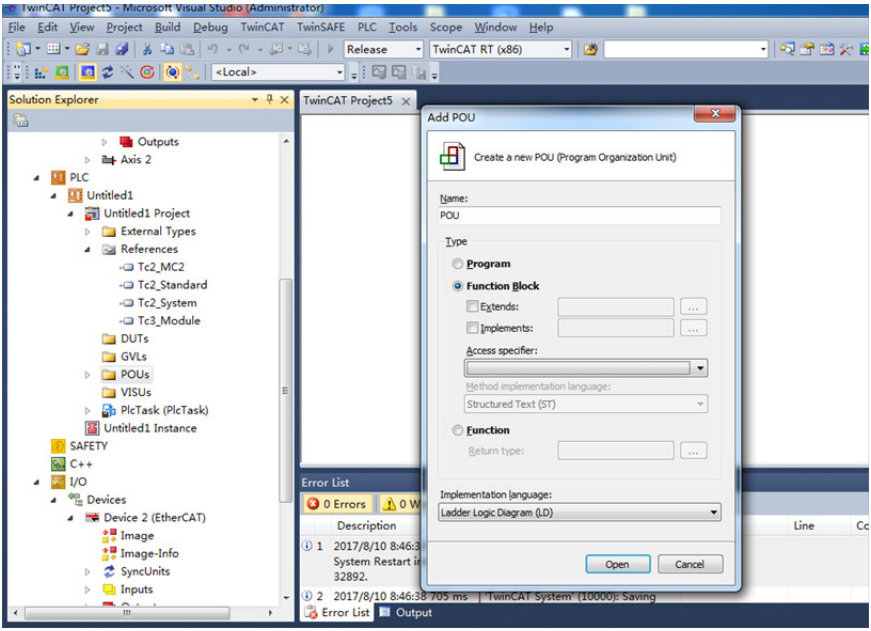


Add a motion control library to make it easy to call the motion control function block.

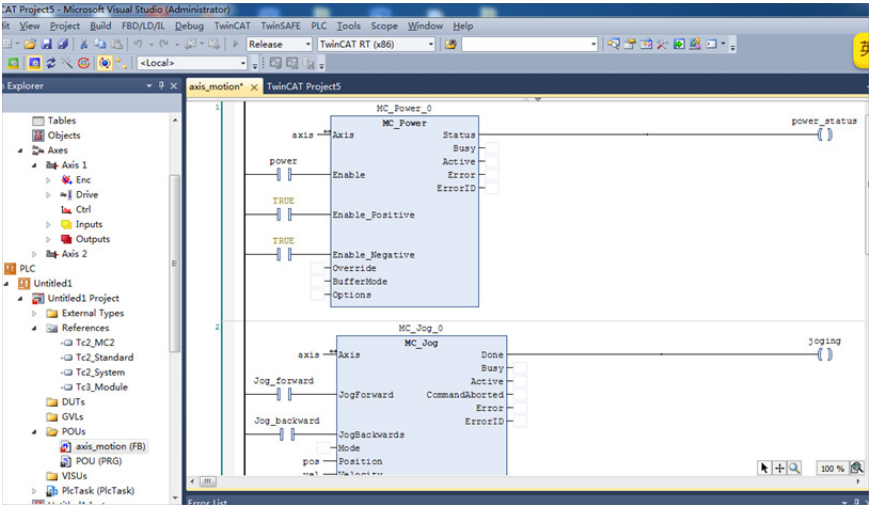


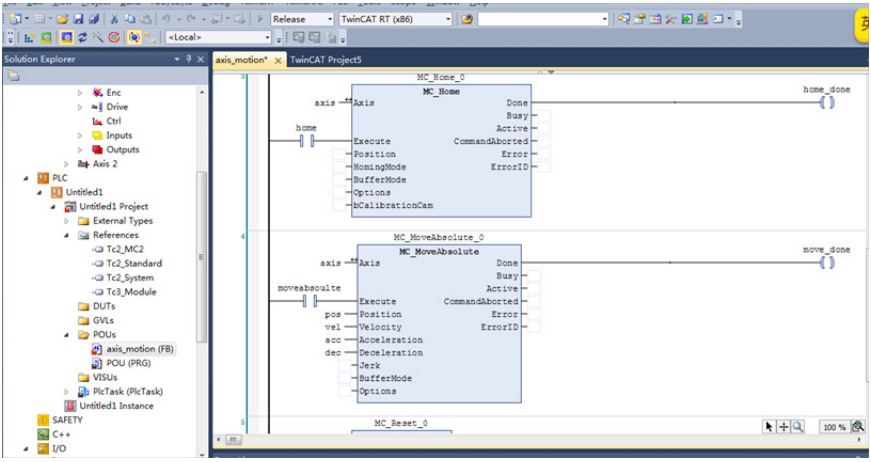
Create a new POU.


File Edit View Project Build Debug TwinCAT TwinSAFE PLC Tools Scope Window Help
Release
TwinCAT RT (x86)
<Local>
Solution Explorer
TwinCAT Project
Outputs
Axis 2
PLC
Untitled1
Untitled1 Project
External Types
References
Tc2_MC2
Tc2_Standard
Tc2_System
Tc3_Module
DUTs
GVLs
POUs
VISUs
Add
Export to ZIP
Import from ZIP
Export PLCopenXML...
Import PLCopenXML...
Cut Ctrl+X
Copy Ctrl+C
Delete Del
Rename
Properties Alt+Enter
POU...
POU for implicit checks...
DUT...
Global Variable List...
Referenced Task...
Visualization...
Visualization Manager...
Recipe Manager...
Image Pool...
Interface...
Parameter List...
Text List...
Class Diagram...
Existing Item... Shift+Alt+A
New Folder
Existing Folder Content...
SAFETY
C++
I/O
Devices
0 Warnings
26 Messages
Clear
File
Line
'TwinCAT System' (10000): TwinCAT
'TwinCAT System' (10000): Saving

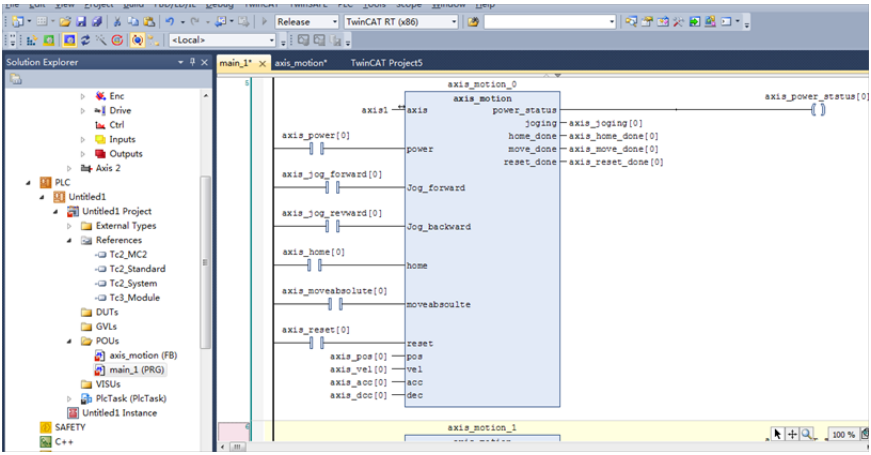

File Edit View Project Build Debug TwinCAT TwinSAFE PLC Tools Scope Window Help
Release
TwinCAT RT (x86)
<Local>
Solution Explorer
TwinCAT Project5
Add POU
Create a new POU (Program Organization Unit)
Name:
POU
Type
Program
Function Block
Extends:
Implements:
Access specifier:
Method implementation language:
Structured Text (ST)
Function
Return type:
Implementation language:
Ladder Logic Diagram (LD)
Open
Cancel
Outputs
Axis 2
PLC
Untitled1
Untitled1 Project
External Types
References
Tc2_MC2
Tc2_Standard
Tc2_System
Tc3_Module
DUTs
GVLs
POUs
VISUs
PlcTask (PlcTask)
Untitled1 Instance
SAFETY
C++
I/O
Devices
Device 2 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Error List
0 Errors
Description
Line
Error List
Output

i) Create a new FB and add MC_power, MC_jog, MC_home, MC_absolute and MC_reset to FB.

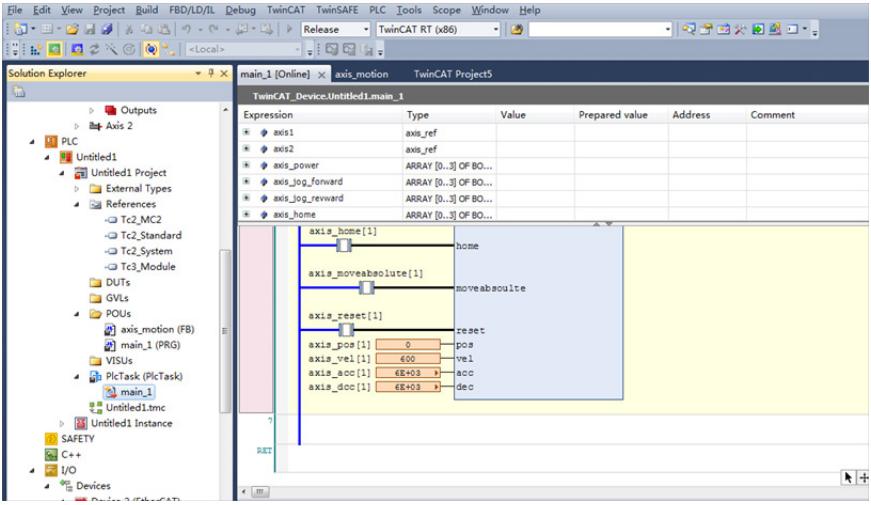




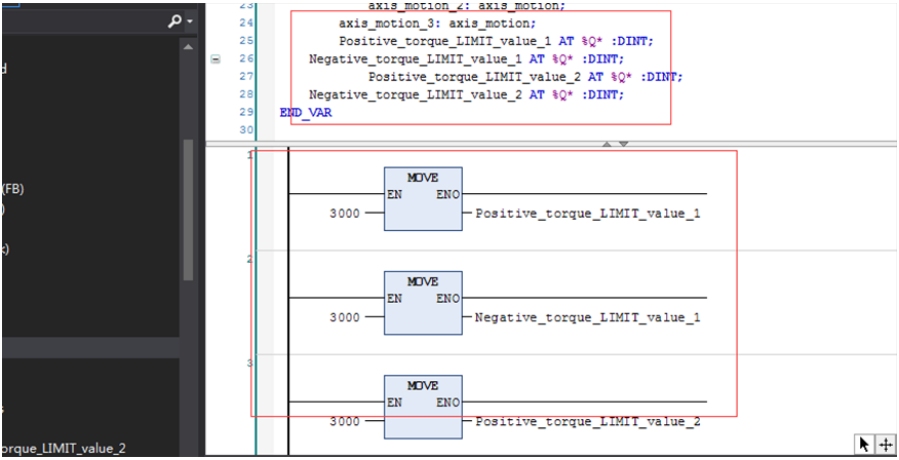
Call axis_motion in **main**.



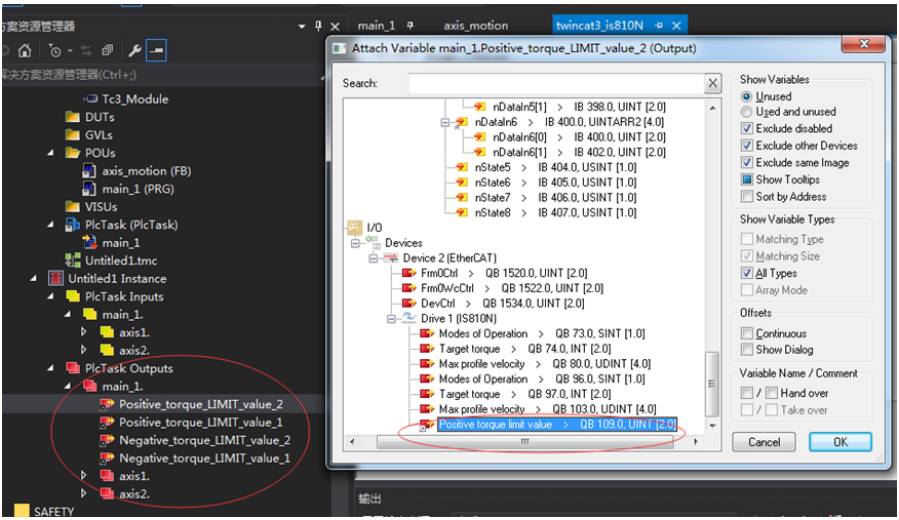
Call the program in **PLCTASK**.



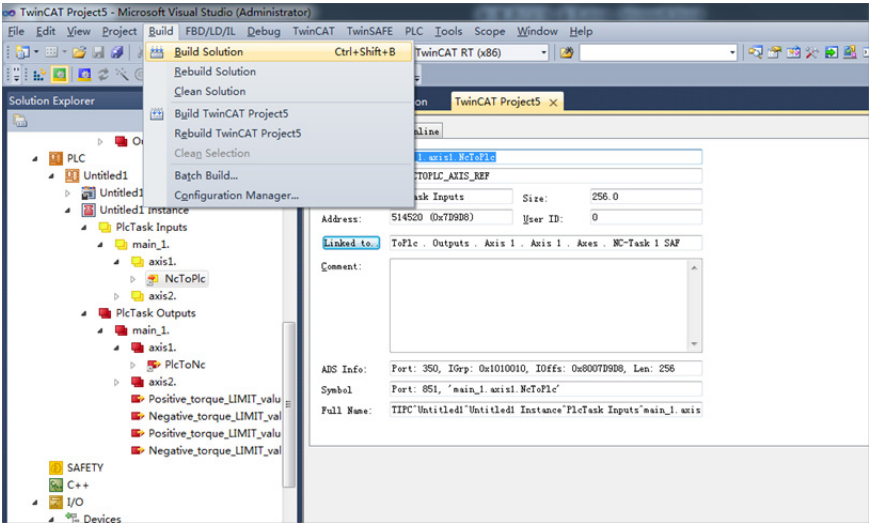
Because there are positive and negative maximum torque limits 60E1 and 60E0 in the CSP (position) +CSV (velocity) +CST (torque) mode, initial values must be assigned to them.

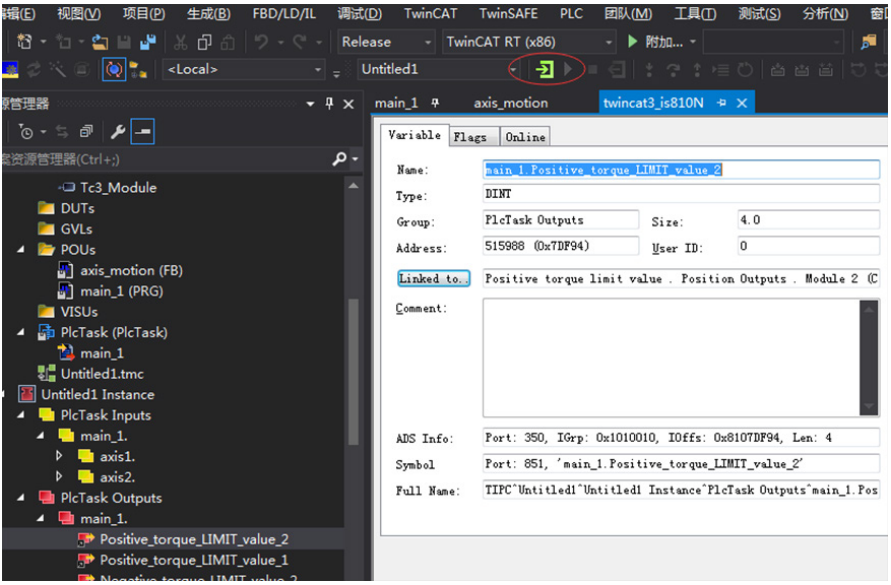


After compilation, perform variable link to 60E0 and 60E1.

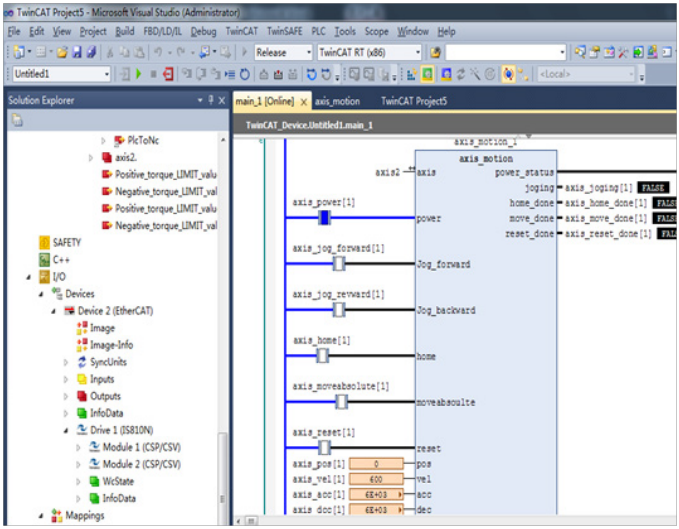


Compile the program. If there is no error, configuration can be activated, and then log in to the PLC.



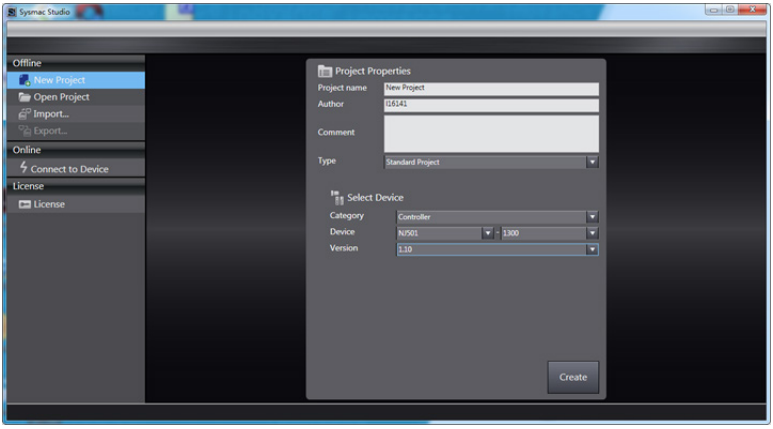


Click  so that the servo drive can be run through the bus.



6.3.3 Basic Settings of the Omron NJ Controller for OMET

1. Create a project and modify the project name as well as the model and version information of the controller. Note: The model and version information of the controller can be obtained from the nameplate of the controller.

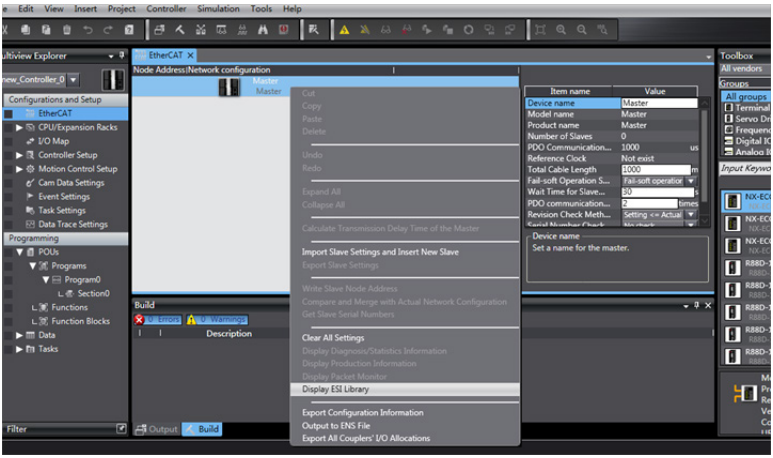


2.1 Network Configurations

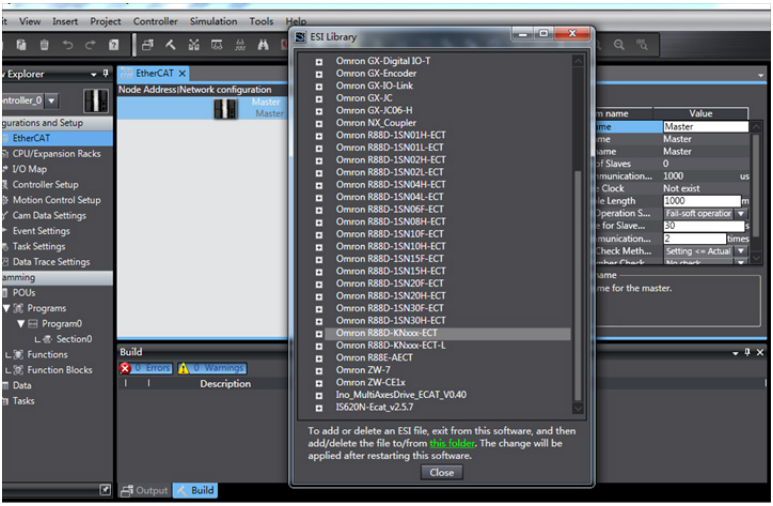
2.1.1. After creating a project, right-click the master icon on the EtherCAT device interface to open the short-cut menu, and click **Display ESI Library** to import the device description file.

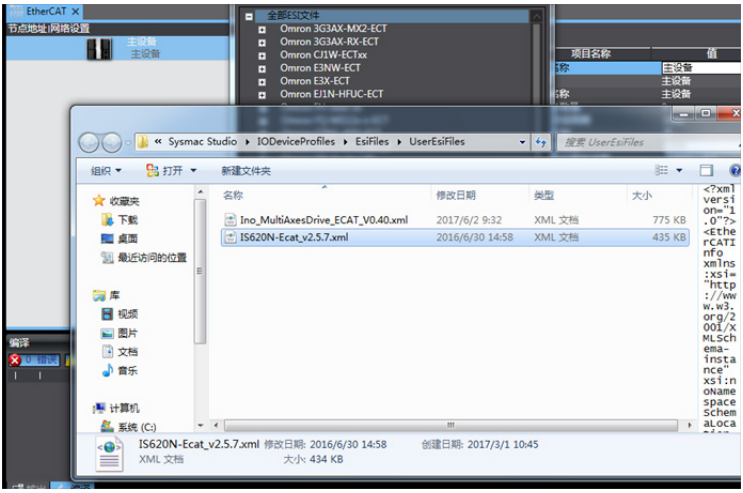
Ino_MultiAxesDrive_ECAT_V0.40.xml

Note: Please download the latest **XML** file for IS810N from Inovance's official website.

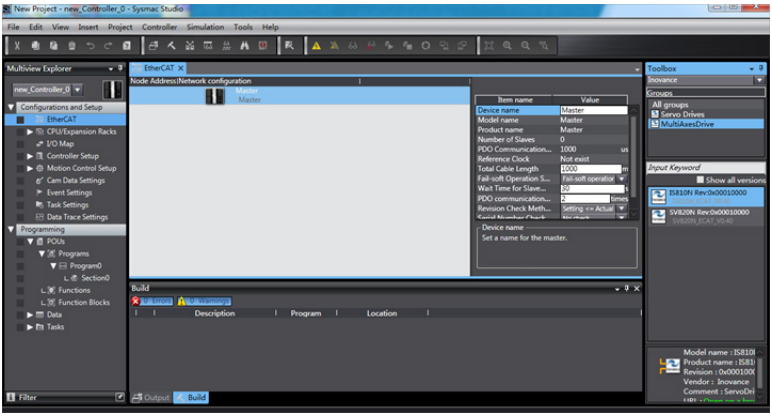


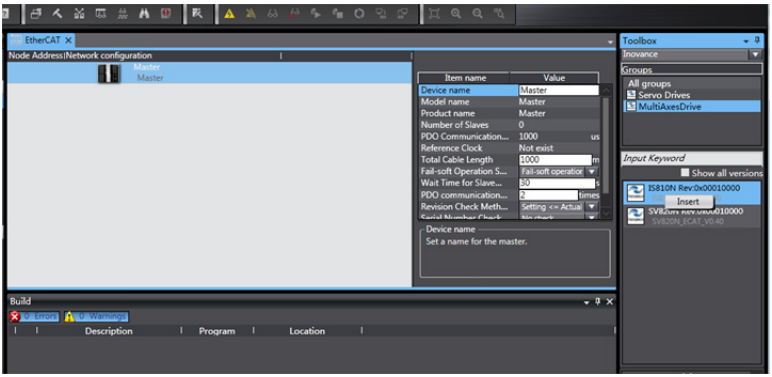
2.1.2. On the ESI library list, open the link "this folder" below. Put **Ino_MultiAxesDrive_ ECAT_V0.40.xml** corresponding to IS810N in this folder. Exit and restart the Sysmac Studio software to make it effective.





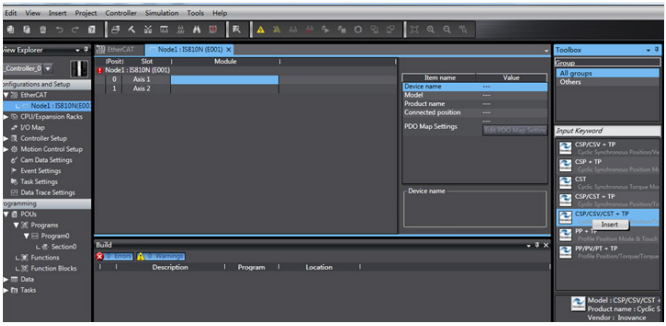
2.1.3. In the upper-right corner of the software, click all suppliers and select Inovance from the drop-down menu. Double-click IS810N in the device list to add the device to the configuration list. (If the network has been configured, skip this step and go to step 2.1.4 and upload configuration online.)



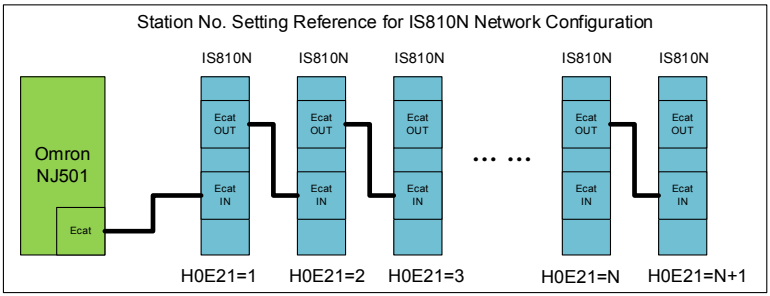


2.2.3.1 The IS810N is a 2-in-1 drive and plans the usability for the PDO list of each axis. Select the mode you want to run from "CSP/CSV+TP, CSP+TP, CST, CSP/CST+TP, CSP/CST/CSV+TP, PP+TP, PP\PV\PT+TP". In conjunction with the controller, the XML file will select the PDO list needed for the current mode.

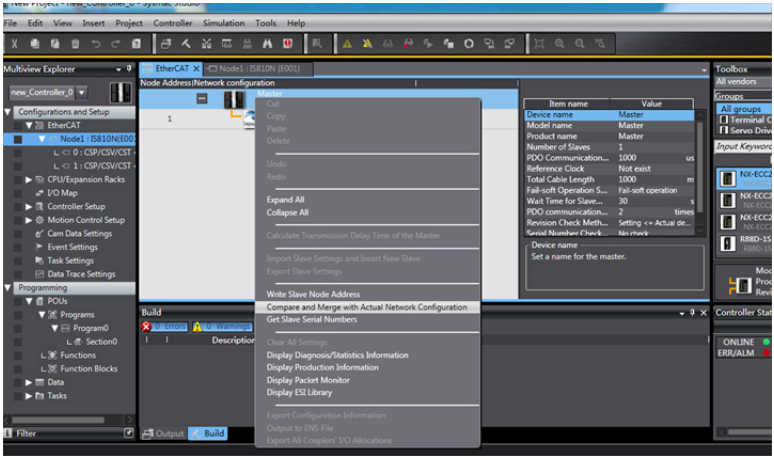
In this example, the CSP/CST/CSV+TP mode is selected for all axes.

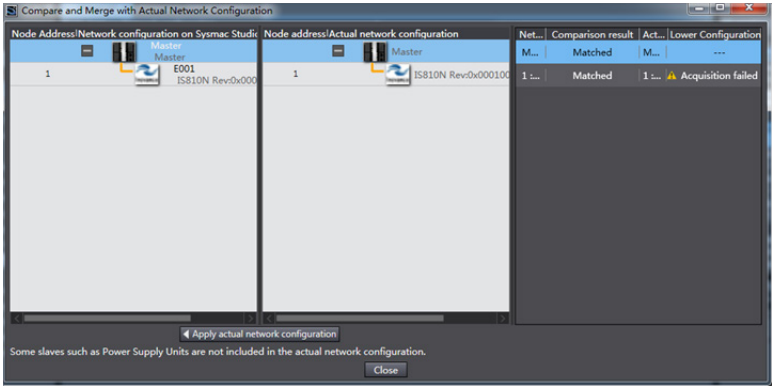


2.1.4. Set the EtherCAT communication site address through H0E-21 (currently available for NJ only). Perform power-on again after setting. For easier configuration management, it is recommended to set the address according to the actual physical connection order.



2.1.5. Set the master modification to online mode, and select Compare and Merge with the Actual Network Configuration in the menu bar. Set the actual physical network configuration to Sysmac software's network configuration.

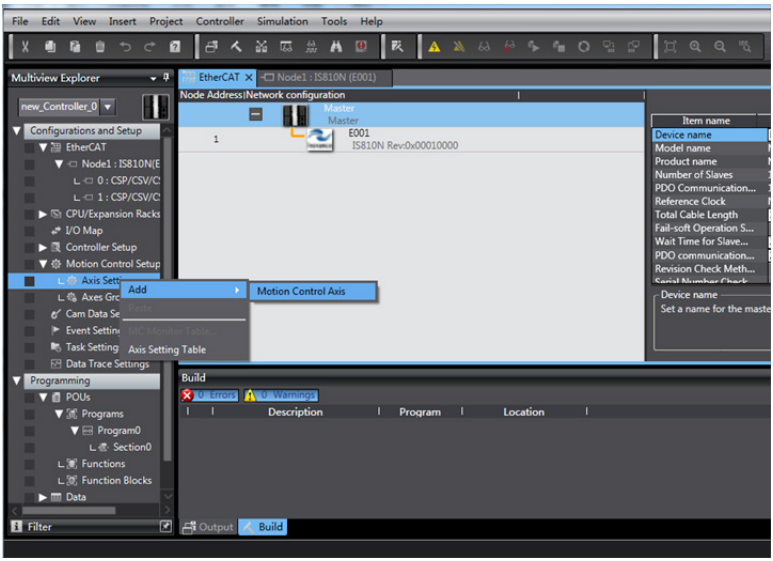


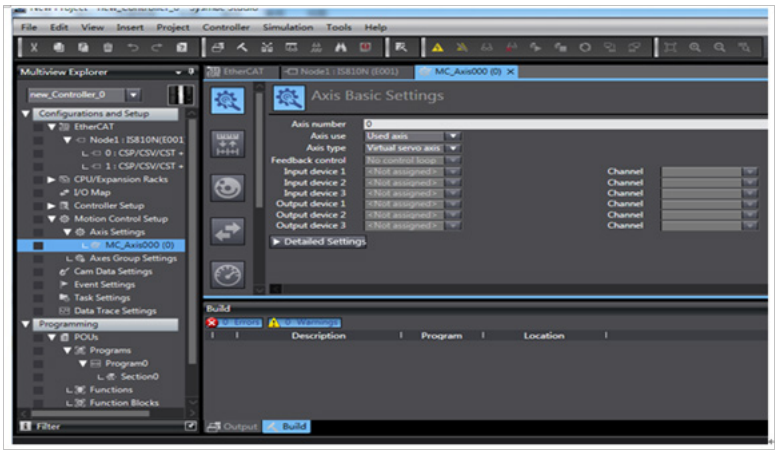


2.2. Communication Data Configuration

2.2.1. Motion Control Axis Settings

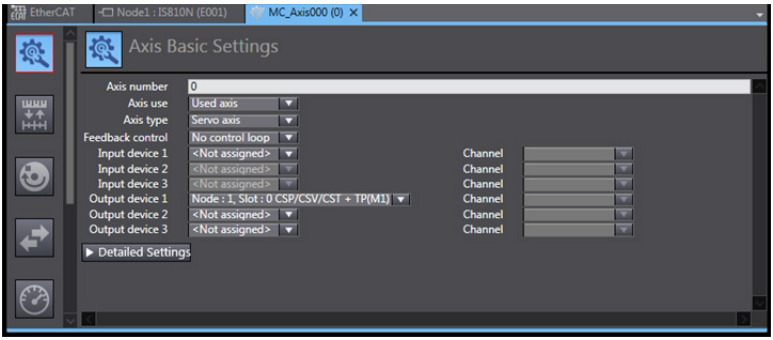
Exit the online mode. Add **Axis Settings** in **Motion Control Setup**. Double-click **MC_Axis000** and configure an IS810N device for the corresponding site on the corresponding Axis Basic Settings interface, as shown in the following figure. **MC_Axis000** can be renamed (even in Chinese).





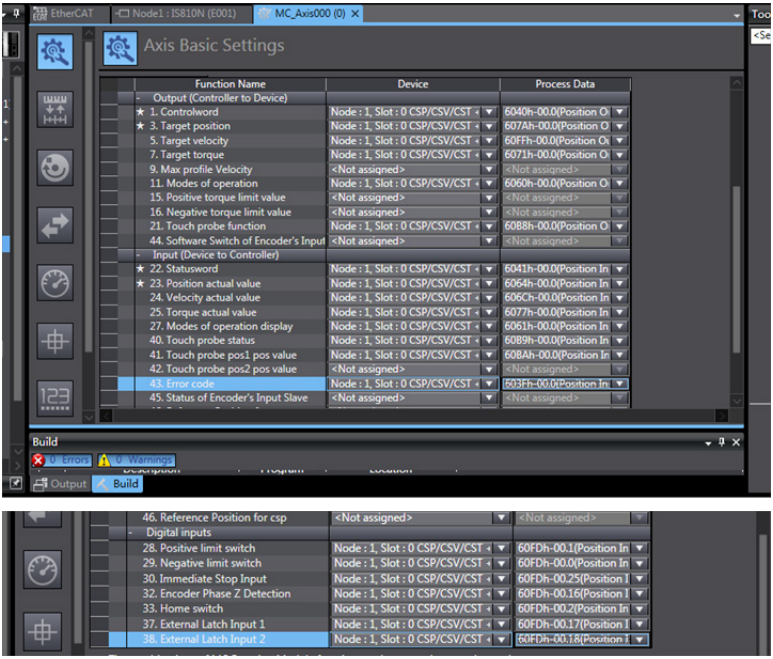
2.2.2. Motion Control Axis Settings

Perform detailed configurations for the axis parameters: All the four axes under each slave need to be configured using the same configuration process. If the number of axes is less than 2, set the value of 0200 of the IS810 servo drive to **255** to shield the axis; for any axis in normal use, perform normal configurations. The following example shows how to configure one of the axes.



2.2.3. Variable Configurations for Servo Axis Communication Mapping

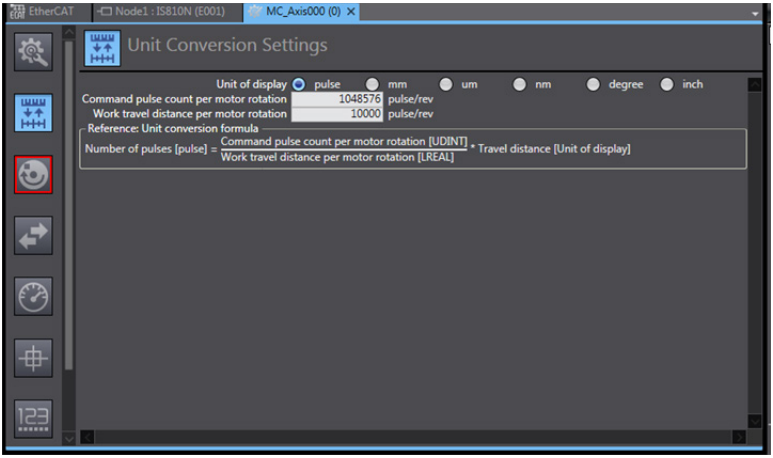
Click **Detailed Settings** to expand the configuration parameters. Perform object mapping configurations completely based on the following table and carefully check them. Currently, all IS810N axis configurations must be performed manually due to the limitation on Omron backend configurations.



2.2.4. Servo Axis Parameters Settings

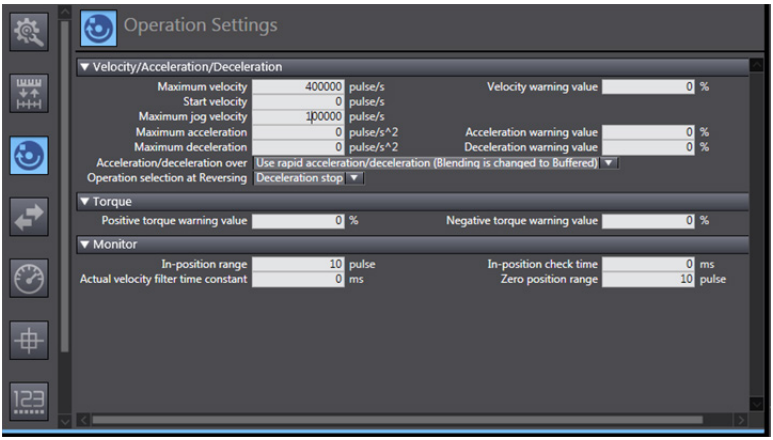
Unit conversion setting

Correctly set 1047586 pulses per revolution for the IS810N motor. The travel per motor revolution does not need to be changed from its default value. The effect is similar to that the host controller makes electronic gear ratio conversion, and the servo drive need not make the conversion again.



Operation setting

After setting the electronic gear ratio, an alarm will be given at the maximum speed and the parameter must be reset. Set the unit to the speed after unit conversion. 10000 pulses/s represents 1 R/S (60 RPM) of the actual servo motor. Set the maximum speed and jogging speed according to actual running. If there is no special requirement, other parameters may not be set.

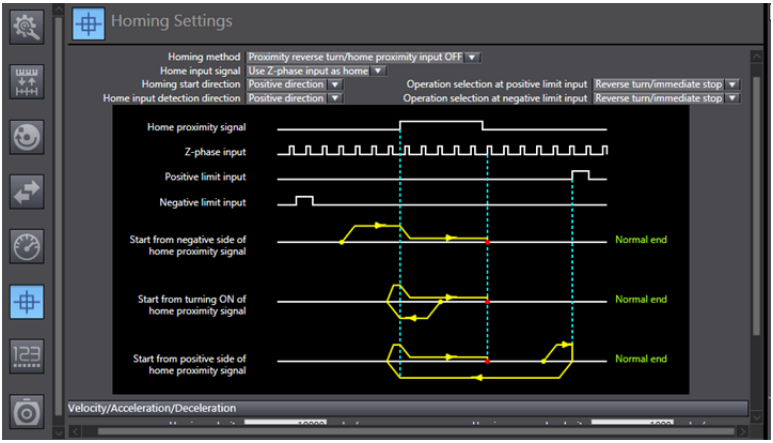


Homing setting

The homing mode affects interworking between the servo drive and the host controller. Set it according to the following table.

NJ Software Description	Servo Drive Function	Terminal Configuration
Home proximity signal	Home switch (FUN31)	DI9
External home input	Touch probe 1 (FUN38)	DI8
Z-phase input	Motor encoder Z-phase signal	N/A
Positive limit input	P-OT (FUN14)	DI1
Negative limit input	N-OT (FUN15)	DI2

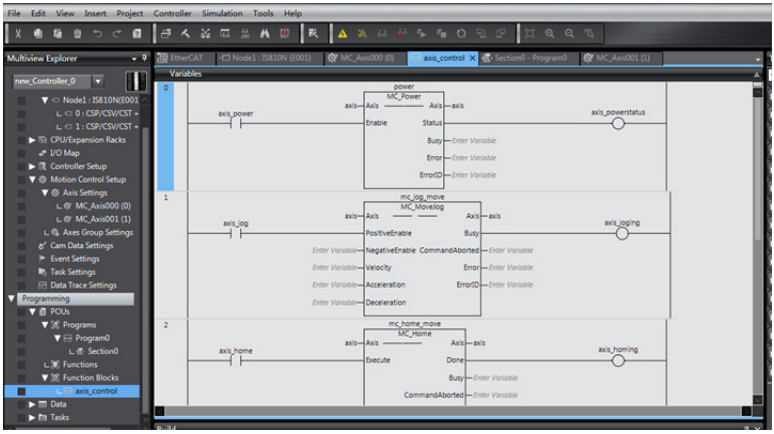
Note: Phase Z signal and external home switch signal shall not be used at the same time.

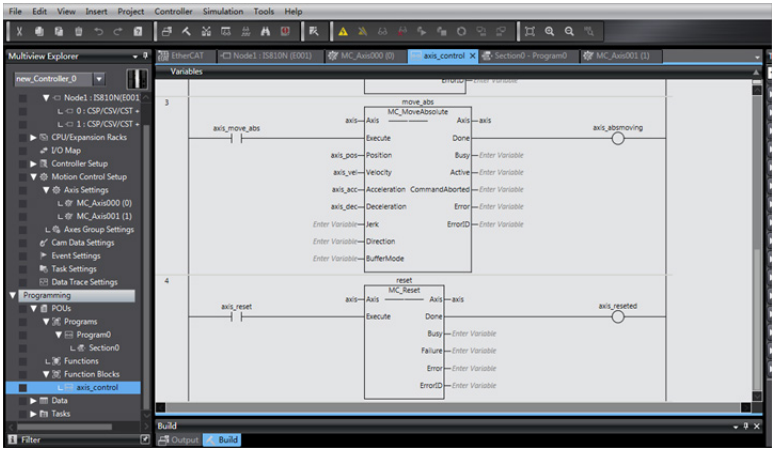


2.3 Program Control Running

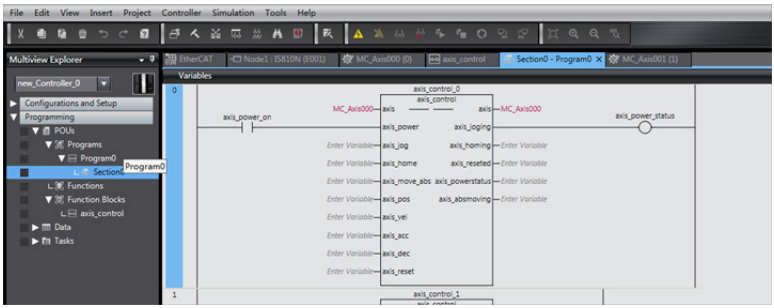
2.3.1 After the configuration is completed, run the servo drive via the PLC program.

For programming convenience, two axes are packaged into one function block to facilitate testing. The function block includes MC_power, MC_moveabsolute, MC_jog, MC_home, and MC_reset.

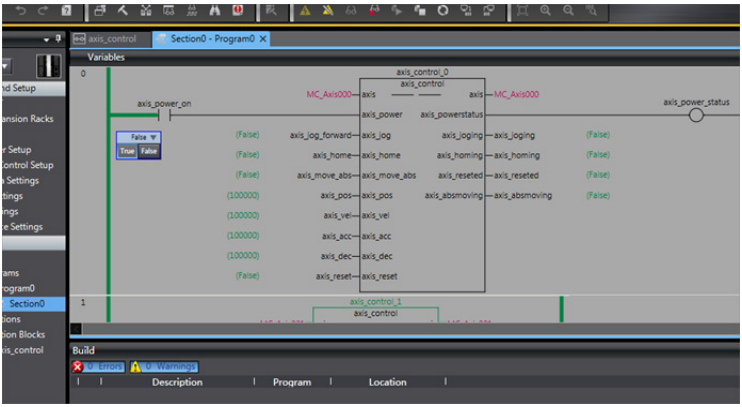




2.3.1.1 In section0, call the function block axis_control, and the axis can run via the bus.



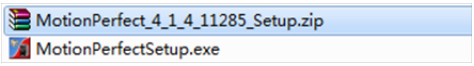
2.3.2 After logging in to the PLC, click axis_jog_forward[0], and the axis runs. For more information, contact Inovance.



6.3.4 Basic Settings of the Trio Controller for OMET

The following part describes some simple configuration methods of the Trio MC4N controller for IS810N.

1. Software installation

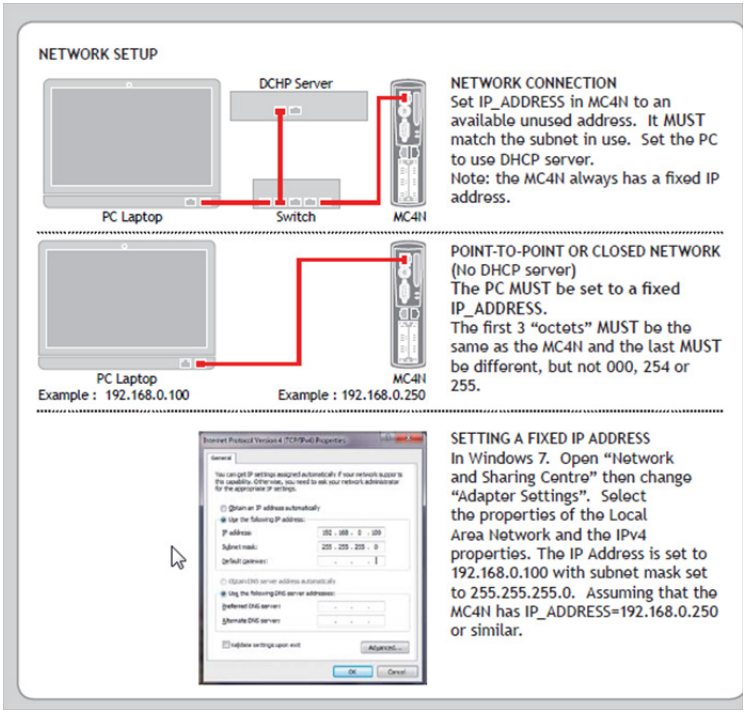


It is recommended to use a recent motion perfect4 version from Trio. The installation package can be downloaded from Trio's official website.

2. Hardware connection interface

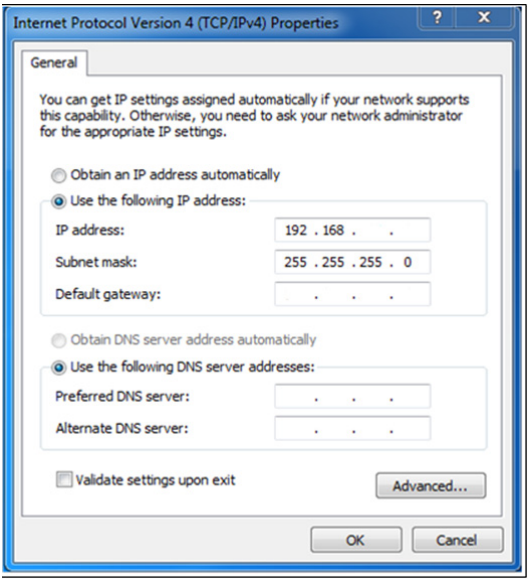
Trio recommends two connection methods. The mode of direct connection between the computer and the controller is generally selected. The following part mainly introduces how to use the direct connection mode.

Figure 1



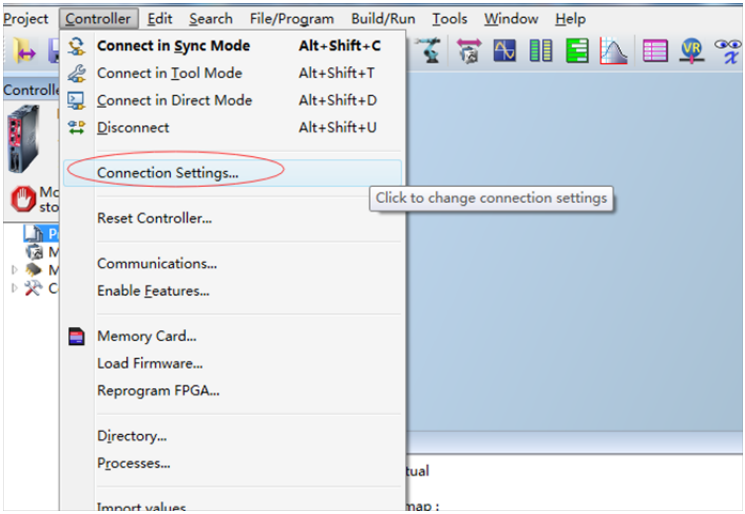
3. Change the IP address of the computer so that the computer and the controller are located in the same network segment.

Figure 2



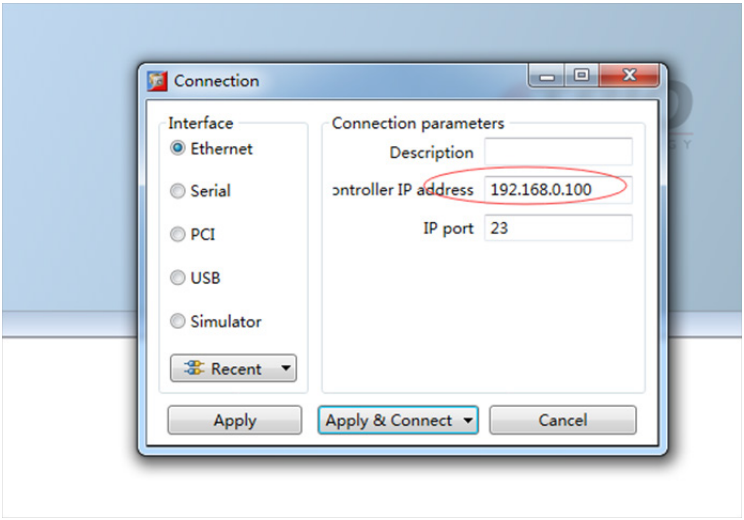
4. Open the controller operating software motion perfect4. Select Connection Settings in Controller on the toolbar.

Figure 3



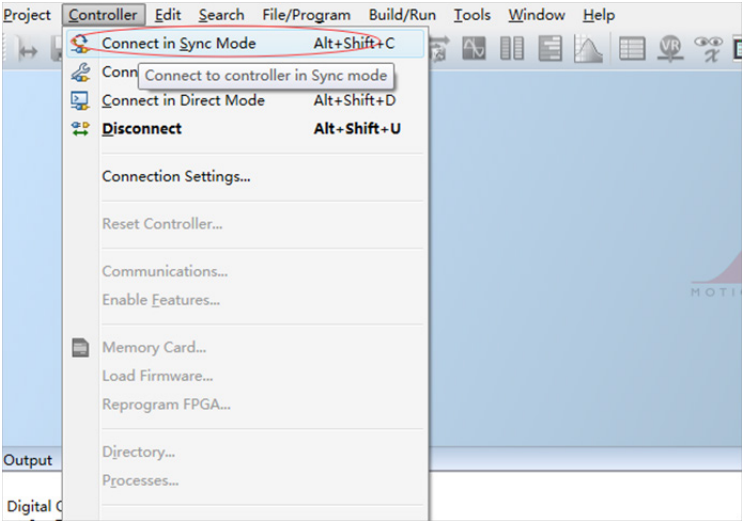
5. Change the IP address on motion perfect to that displayed on the LCD of the controller.

Figure 4



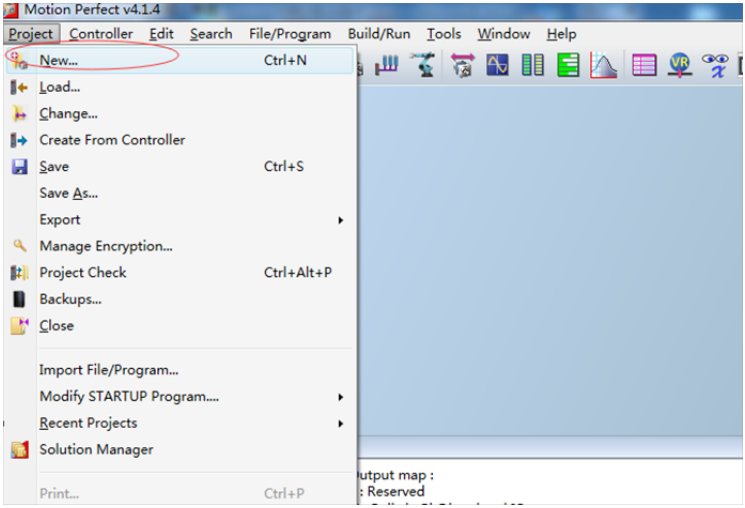
6. Click the **Connect in Sync Mode** button, as shown in the following figure.

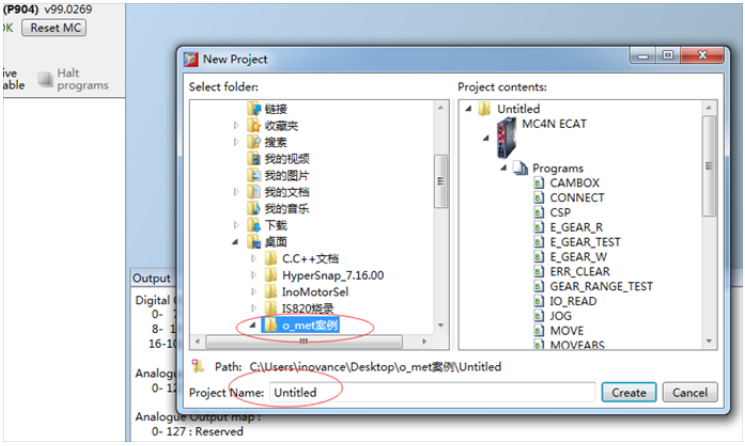
Figure 5



7. Create and name a project file in Project.

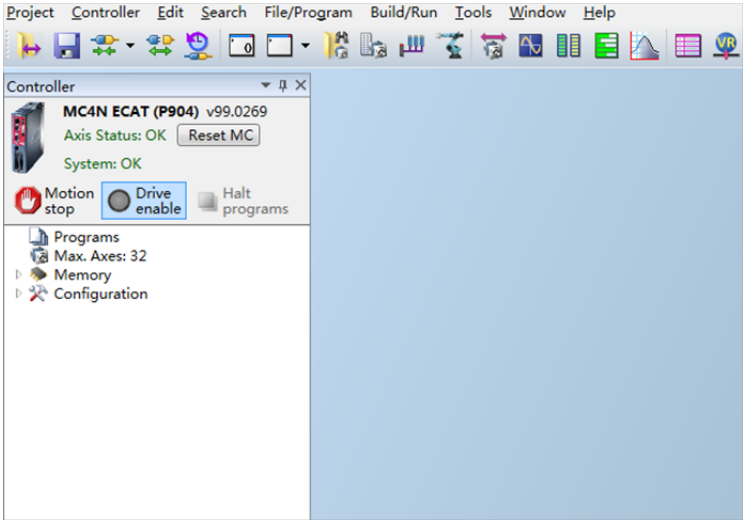
Figure 6





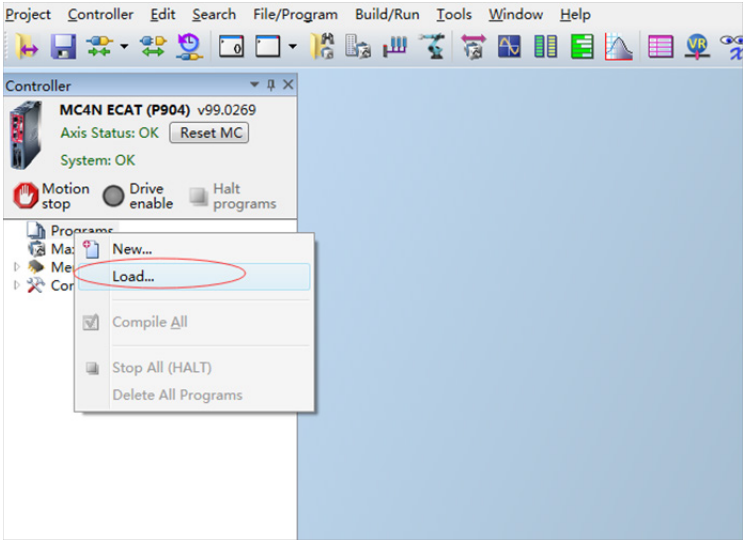
8. The new project is as follows:

Figure 7



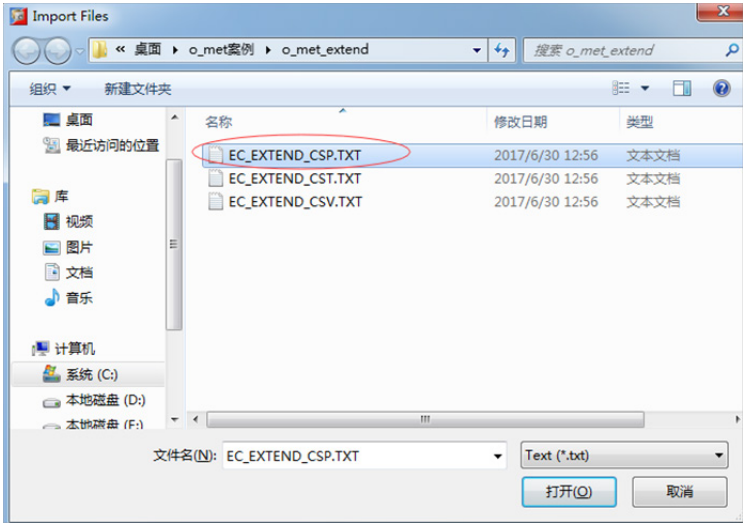
9. Import a configuration file in **Programs**, as shown in Figure 8. (Three files are provided for three modes, that is, CSP, CSV, and CST. Only the CSP mode is introduced.)

Figure 8



10. Find and import the **EC_EXTEND_CSP** file stored in the computer.

Figure 9



11. The name of Extend files in the TRIO project must be fixed to EC_EXTEND. Otherwise, the controller cannot identify it and the network cannot enter synchronization mode. Therefore, renaming is required.

Figure 10

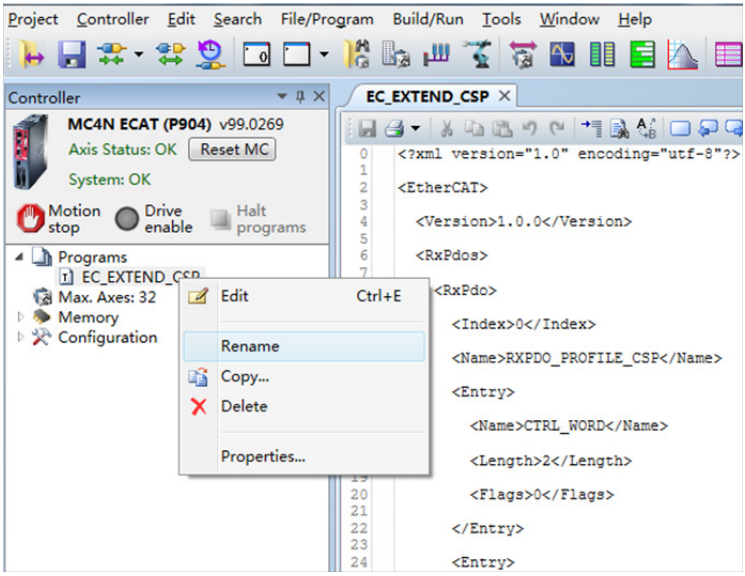
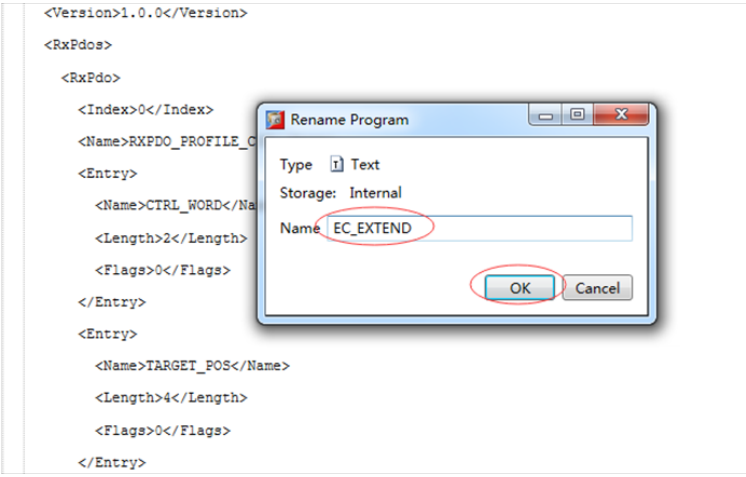
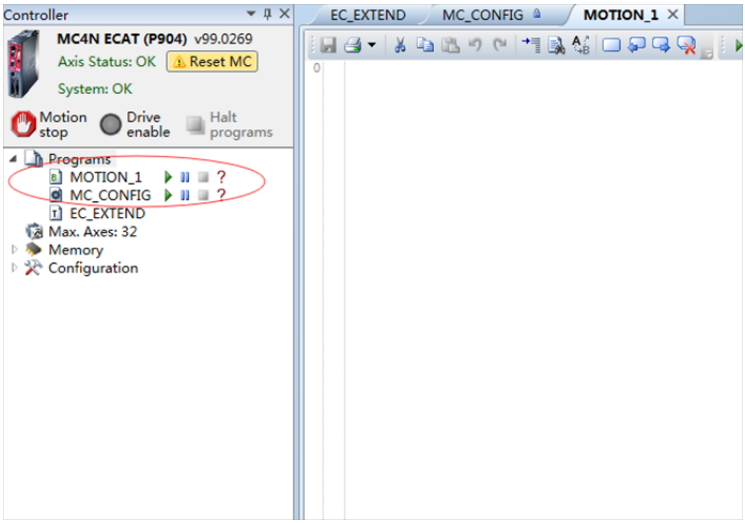


Figure 11



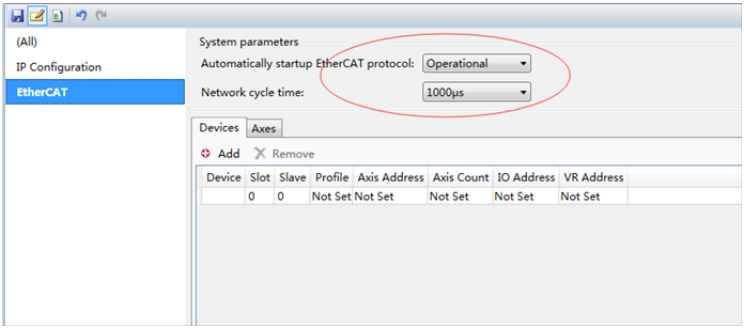
12. Create a MD_CONFIG configuration and a BASIC file in **Programs**.

Figure 12



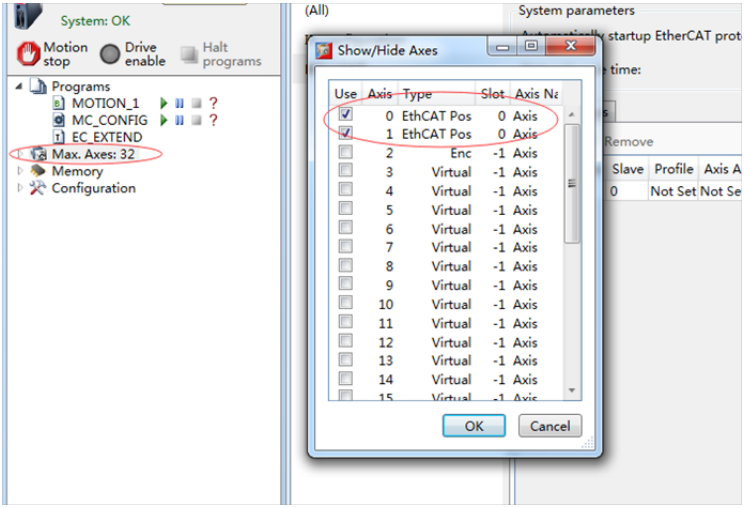
13. Set the current communication cycle to 1 ms.

Figure 13



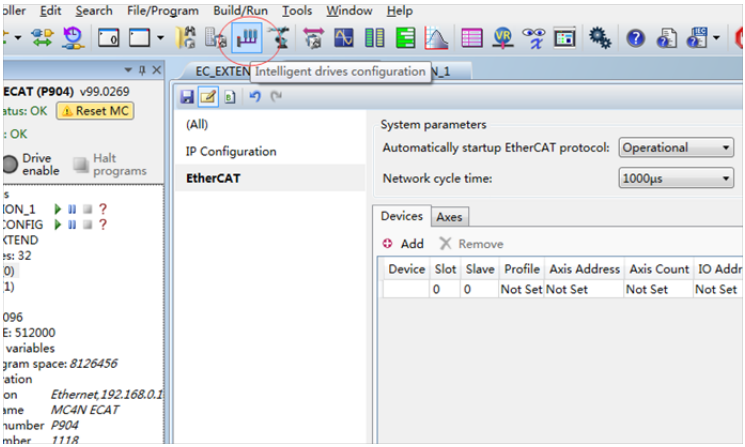
14. Double-click **MAX.AXES:32** and check the first two axes.

Figure 14



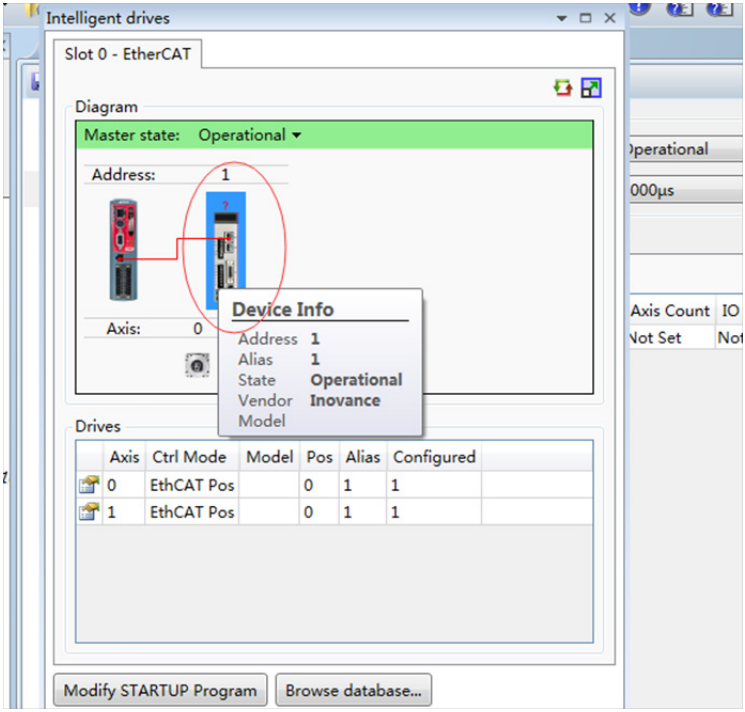
15. To add CoE objects corresponding to the servo, open the intelligent drives and access **Configure Categories**.

Figure 15



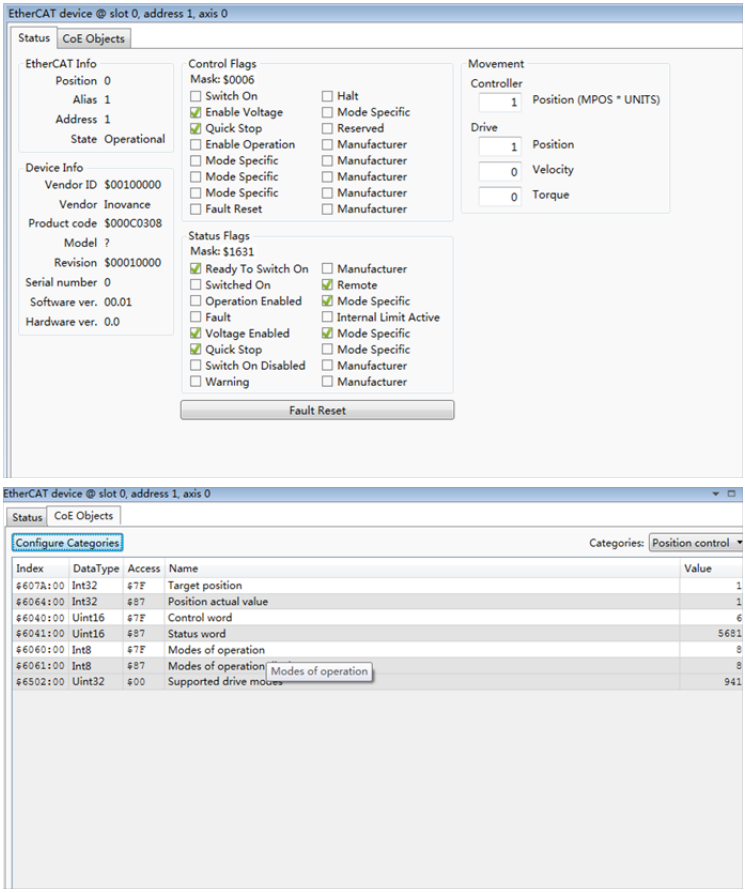
16. The motor servo enters the PDO configurations.

Figure 16



17. Add Inovance PDO data on this interface.

Figure 17



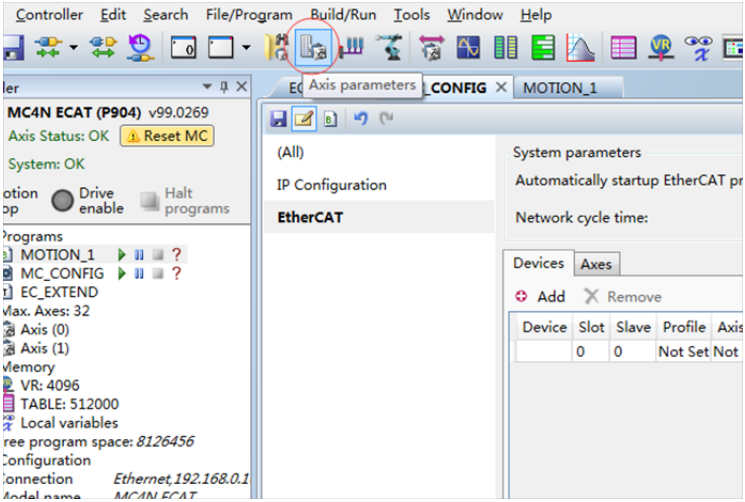
18. Perform data calculation before servo trial run.

If you want to set the Trio calibration unit to RPM, set UNITS = Encoder resolution / 60, e.g. 2^20 / 60 = 17476.

Set the acceleration ACCEL, deceleration DECEL, running speed SPEED, following error limit FE_LIMIT, and following error range FE_RANGE. (The recommended value is 0.6 * FE_LIMIT.) Similarly, set SPEED to 30 RPM and ACCEL to 30 RPM/s.

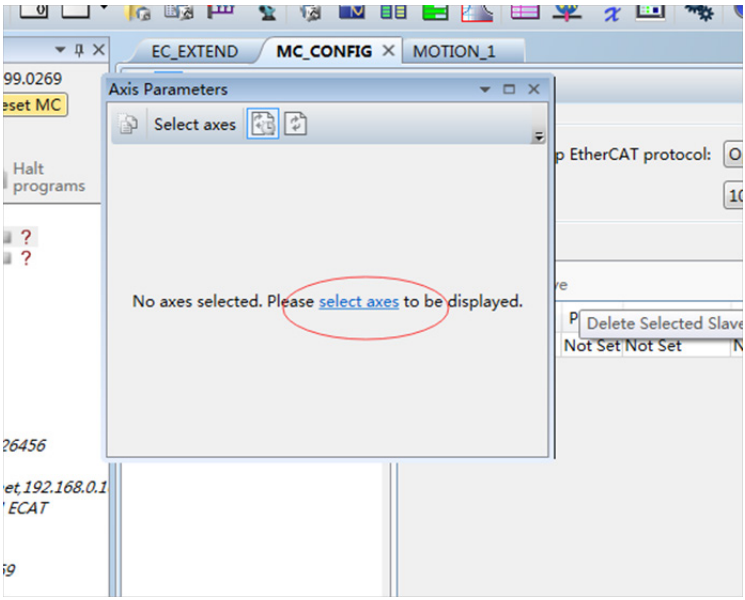
19. Set axis parameters.

Figure 18



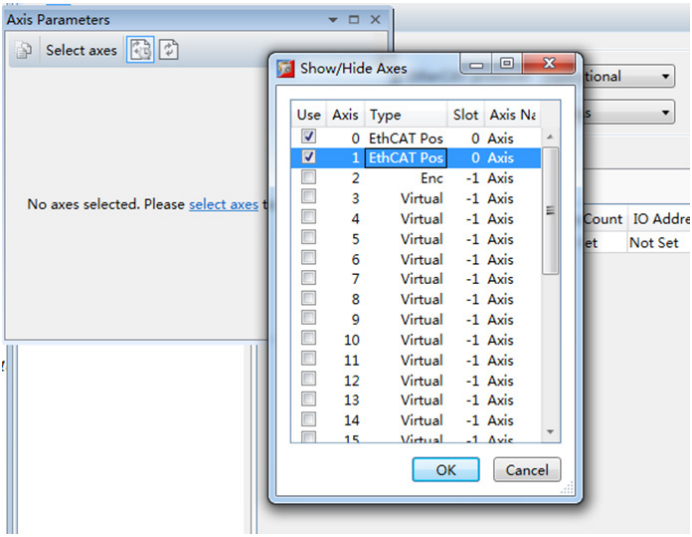
20. Select axis information.

Figure 19



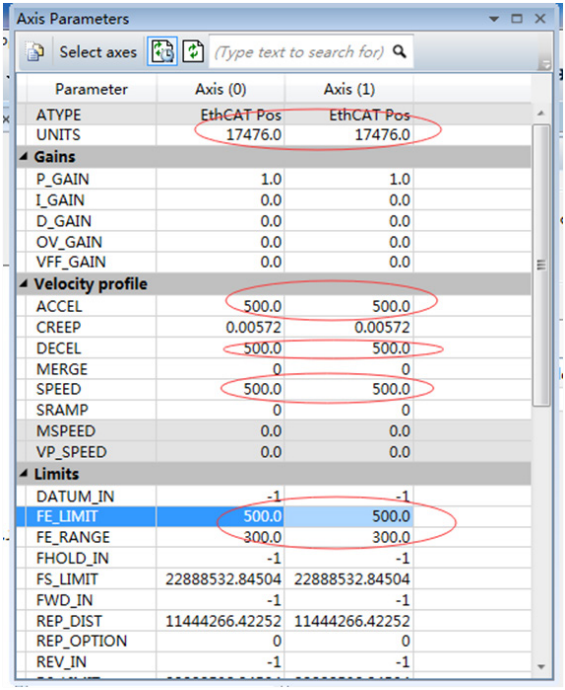
21. Check the first two axes.

Figure 20



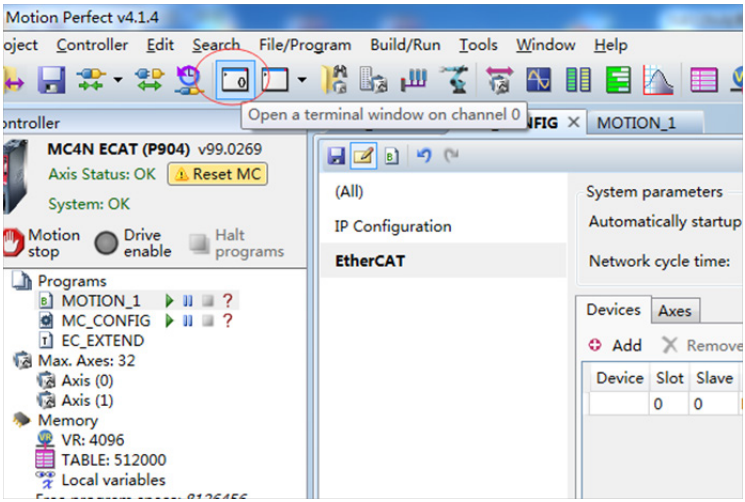
22. The parameter settings are as follows:

Figure 21



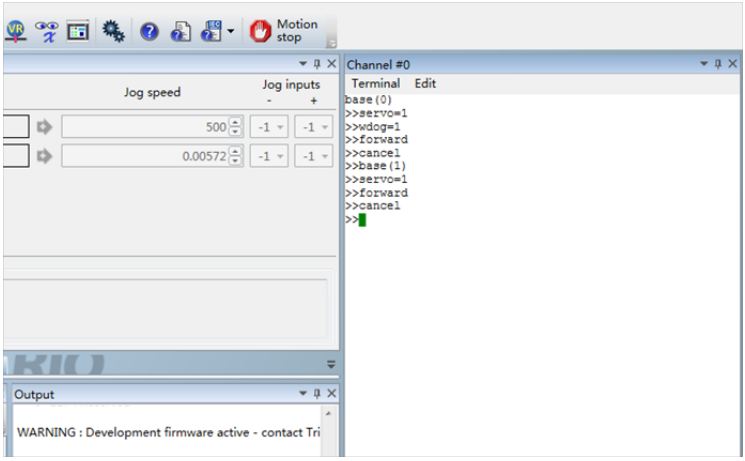
23. Use to commission the servo. Check whether the parameters are correct before using the servo.

Figure 22



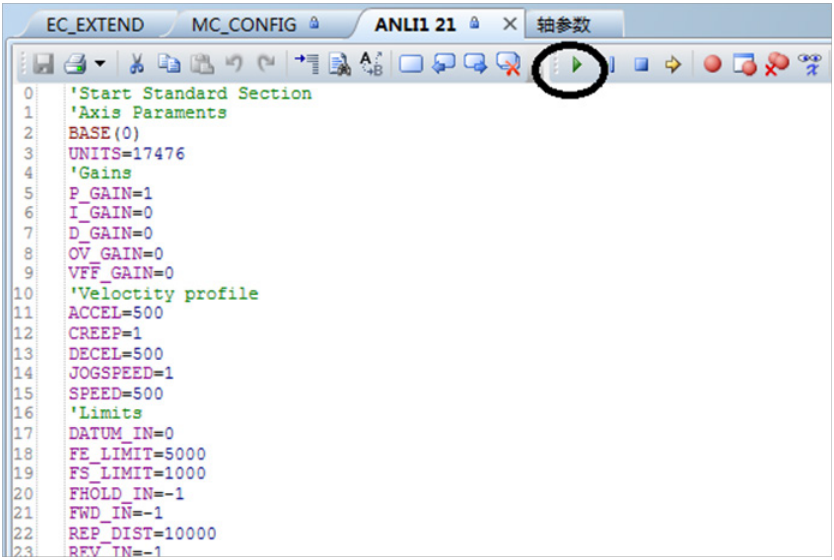
24. Enter the following in the terminal window: base (x) (select an axis address), servo=1 (closed-loop ETHERCAT bus), wdog = 1 (enable servo), forward (forward running), reverse (reverse running), cancel (stop running).

Figure 23



25. Perform programming and running. Enter the following codes in BASIC and click the run icon.

Figure 24



Codes are as follows:

```
'Start Standard Section
'Axis Paraments
BASE(0)
UNITS=17476
'Gains
P_GAIN=1
I_GAIN=0
D_GAIN=0
OV_GAIN=0
VFF_GAIN=0
'Veloctity profile
ACCEL=500
CREEP=1
DECEL=500
JOGSPEED=1
SPEED=500
'Limits
DATUM_IN=0
FE_LIMIT=5000
FS_LIMIT=1000
FHOLD_IN=-1
```

```
FWD_IN=-1
REP_DIST=10000
REV_IN=-1
RS_LIMIT=-10000

'Axis output
SERVO=1

BASE(1)
UNITS=17476
'Gains
P_GAIN=1
I_GAIN=0
D_GAIN=0
OV_GAIN=0
VFF_GAIN=0
'Veloctity profile
ACCEL=500
CREEP=1
DECEL=500
JOGSPEED=1
SPEED=500
'Limits
DATUM_IN=0
FE_LIMIT=5000
FS_LIMIT=1000
FHOLD_IN=-1
FWD_IN=-1
REP_DIST=10000
REV_IN=-1
RS_LIMIT=-10000

'Axis output
SERVO=1

'Stop standard Section
WDOG=1


WHILETRUE
TRIGGER
ACCEL=500
DECEL=500
```

```
MOVE(6000) AXIS(0)
MOVE(6000) AXIS(1)
WAITIDLE
WA(100)
MOVE(-6000) AXIS(0)
MOVE(-6000) AXIS(1)
WAITIDLE
WA(100)
WEND

'WHILE TRUE
' TRIGGER
' ACCEL=500
' DECEL=500
'MOVEABS(1)
' WAIT IDLE
' WA(100)
' MOVEABS(0)
' WAIT IDLE
' WA(100)
'WEND
```

Chapter 7 Troubleshooting

7.1 Power Supply Unit

For any faults of the power supply unit, refer to the User Guide MD810 Series AC Drive Multi-axis System.

7.2 Drive Unit

7.2.1 Fault and Warning Grading

Faults and alarms are graded into the following three levels based on degree of severity: NO.1 > NO.2 > NO.3.

NO.1 non-resettable fault

NO.1 resettable fault

NO.2 resettable fault

NO.3 resettable warning

"Resettable" means that the keypad stops displaying faults/warnings once the "reset signal" is input.

To reset a fault/warning, use either of the following methods:

Set 200D-02h = 1 (fault reset enabled).

Enable the rising edge of the control word 0x6040 bit7 on the host controller.

To reset a NO.1 fault or NO.2 fault, turn off the S-ON signal and then set the DI terminal allocated with function FunIN.2 (ALM-RST) to ON.

To reset NO.3 warning, set the DI terminal allocated with the function FunIN.2 (ALM-RST) to ON.

Relevant objects

Index	Name	Data Range	Description	Setting Mode	Effective Condition	Default
200Dh-02h	Fault reset	0: no operation 1: enabled	The keypad stops displaying the resettable faults and warnings. After reset, the value is restored to 0.	Any setting	Immediate	0

7.2.2 Communication Fault and Warning Code List

When communication or the servo drive is abnormal, the IS810 servo drive sends an emergency message to the network as a producer, or sends a response abort message when the SDO transmission is abnormal.

Fault code list (take the current operation axis 1 as an example):

Display	Fault Name	Type	Resettable	Fault Range
E1.101	Abnormal system parameter	NO.1	No	Equipment fault
E1.102	Abnormal communication initialization of coprocessor	NO.1	No	Equipment fault
E1.104	Abnormal communication or interrupt timeout of the coprocessor	NO.1	No	Equipment fault
E1.105	Abnormal internal program	NO.1	No	Equipment fault
E1.106	Abnormal main processor communication	NO.1	No	Equipment fault
E1.107	Main processor communication loss of the	NO.1	No	Equipment fault
E1.108	Parameter storage fault (read/write)	NO.1	No	Equipment fault
E1.111	Abnormal 2000h/2001h group parameter	NO.1	No	Equipment fault
E1.120	Product model matching fault (No corresponding motor No corresponding driver Absolute position parameter not matching 2nd-generation encoder parameter not matching)	NO.1	No	Shaft fault
E1.121	Invalid S-ON command	NO.2	Yes	Shaft fault
E1.122	Absolute position function and encoder matching fault (Motor model not matching 2nd-generation encoder parameter not matching)	NO.1	No	Shaft fault
E1.130	DI function setting error	NO.1	Yes	Shaft fault
E1.131	DO function setting error	NO.1	Yes	Shaft fault
E1.136	Data check error or no parameter stored in the motor ROM	NO.1	No	Shaft fault
E1.150	STO signal input protection	NO.1	Yes	Shaft fault
E1.201	Hardware overcurrent (Phase P overcurrent Phase N overcurrent Phase U overcurrent Phase V overcurrent)	NO.1	No	Shaft fault
E1.208	FPGA sampling operation timeout Encoder communication timeout Sigma_Dleta modulation fault	NO.1	No	Shaft or equipment fault
E1.210	Output short-circuit to ground	NO.1	No	Shaft fault
E1.220	UVW phase sequence error	NO.1	No	Shaft fault

Display	Fault Name	Type	Resettable	Fault Range
E1.234	Runaway	NO.1	No	Shaft fault
E1.400	Main circuit overvoltage	NO.1	Yes	Equipment fault
E1.410	Main circuit undervoltage	NO.1	Yes	Equipment fault
E1.500	Motor overspeed	NO.1	Yes	Shaft fault
E1.602	Angle auto-tuning failure	NO.1	Yes	Shaft fault
E1.610	Servo drive overload	NO.2	Yes	Shaft fault
E1.620	Motor overload	NO.2	Yes	Shaft fault
E1.630	Motor rotor locked	NO.2	Yes	Shaft fault
E1.650	Heatsink overheat	NO.2	Yes	Shaft fault
E1.661	NTC cable breaking	NO.2	Yes	Shaft fault
E1.731	Encoder battery failure	NO.2	Yes	Shaft fault
E1.733	Encoder multi-turn counting error	NO.2	Yes	Shaft fault
E1.735	Encoder multi-turn counting overflow	NO.2	Yes	Shaft fault
E1.740	Encoder interference	NO.1	No	Shaft fault
E1.A33	Abnormal encoder data reading/ writing	NO.1	No	Shaft fault
E1.B00	Position deviation excess	NO.2	Yes	Shaft fault
E1.B01	Abnormal position reference increment	NO.2	Yes	Shaft fault
E1.B03	Electronic gear ratio setting exceeding limit	NO.2	Yes	Shaft fault
E1.D09	Software position setting error	NO.2	Yes	Shaft fault
E1.D10	Home position setting error	NO.2	Yes	Shaft fault
E1.E08	Synchronization loss*	NO.2	Yes	Equipment fault
E1.E11	ESI configuration file not burnt*	NO.2	Yes	Equipment fault
E1.E13	Synchronization cycle setting error*	NO.2	Yes	Equipment fault
E1.E15	Synchronization cycle error is too large*	NO.2	Yes	Equipment fault

Warning code list (take the current operation axis 1 as an example)

Display	Fault Name	Type	Resettable	Fault Range
E1.110	Setting error of frequency-division pulse output	NO.3	Yes	Shaft fault
E1.601	Home attaining warning	NO.3	Yes	Shaft fault
E1.730	Encoder battery warning	NO.3	Yes	Shaft fault
E1.760	Encoder overheat	NO.3	Yes	Shaft fault
E1.909	Motor overload warning	NO.3	Yes	Shaft fault
E1.941	Parameter modification taking effect only after being re-powered on	NO.3	Yes	Equipment fault
E1.942	Parameter storage too frequent	NO.3	Yes	Equipment fault
E1.950	Positive limit switch warning	NO.3	Yes	Shaft fault
E1.952	Negative limit switch warning	NO.3	Yes	Shaft fault
E1.980	Abnormal encoder algorithm	NO.3	Yes	Shaft fault
E1.998	Homing object dictionary error	NO.3	Yes	Shaft fault
E1.E20	Ethernet hardware error	NO.3	Yes	Equipment fault
E1.E21	Drive MAC address not burnt	NO.3	Yes	Equipment fault

7.2.3 Troubleshooting

Take the current operation axis 1 as an example.

E1.101: abnormal system parameter

Cause:

The total number of parameters changes, which generally occurs after software updates.

The actual parameter values of group 2002h and its following groups exceed the limit, which generally occurs after software updates.

Probable Cause	Confirming Method	Corrective Action
1. The control power voltage drops instantaneously.	Check whether the power is cut off or whether an instantaneous power failure occurs.	Restore the default setting (2002-20h = 1), and rewrite the parameters.
	Measure whether the voltage on the power supply side is within the following specifications: 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V)	Increase the power capacity or replace the power supply with a large-capacitance power supply. Restore the default setting (2002-20h = 1), and rewrite the parameters.
2. Instantaneous power failure occurs during parameter storage.	Check whether instantaneous power failure occurs during parameter storage.	Power on the system again, restore the default setting (2002-20h = 1), and rewrite the parameters.
3. The number of times to write parameters within a certain period exceeds the limit.	Check whether the parameter update is performed frequently by the host controller.	Change the parameter writing method and rewrite parameters. If the servo drive is faulty, replace it.
4. The software is upgraded.	Check whether the software is upgraded.	Reset the servo drive model and the servo motor model, and restore the default setting (2002-20h = 1).
5. The servo drive is faulty.	If the servo drive is powered off and powered on several times and the default setting is restored, but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.

E1.102: Abnormal communication initialization of coprocessor

Cause:

Multi-core communication initialization fault or core software version not matching

Probable Cause	Confirming Method	Corrective Action
1. The FPGA software version and the software version of CPU cores do not match.	View the FPGA software version (2001-03h), the CUP0 software version (2001-04h), and the CUP1 software version (2001-05h) via the keypad or the Inovance servo commissioning software. Check whether the non-zero values of the most significant bits are the same in the two versions.	Contact Inovance for technical support. Update the software to make them match.
2. The FPGA is faulty.	The fault persists after the servo drive is powered off and on several times.	Replace the servo drive.

E1.104: Abnormal communication or interrupt timeout of coprocessor

Cause:

Coprocessor or FPGA interrupt timeout, cyclic access among coprocessors timeout

Probable Cause	Confirming Method	Corrective Action
1. The FPGA is faulty.	The fault persists after the servo drive is powered off and on several times.	Replace the servo drive.
2. The communication handshake between the FPGA and the HOST is abnormal.		
3. Access between HOST and coprocessor times out.		

E1.107: main processor communication loss

Cause:

Cyclic handshake communication between the main processor and coprocessor is lost.

Probable Cause	Confirming Method	Corrective Action
Internal communication failure	The fault persists after the servo drive is powered off and on several times.	Replace the servo drive.

E1.108: parameter storage fault

Cause:

Parameter values cannot be written to EEPROM.

Parameter values cannot be read from EEPROM.

Probable Cause	Confirming Method	Corrective Action
1. Parameter writing is abnormal.	Modify a parameter, power on the servo drive again and check whether the modification is saved.	If the modification is not saved and the fault persists after the servo drive is powered off and on several times, replace the servo drive.
2. Parameter reading is abnormal.		

E1.110: Setting error of frequency-division pulse output

Cause:

The number of frequency-division output pulses is excessively large.

Probable Cause	Confirming Method	Corrective Action
The number of frequency-division output pulses is excessive.	View the H05-17 value of a corresponding axis: The H05-17 value exceeds the encoder resolution.	Modify the H05-17 value.

E1.111: abnormal 2000h/2001h group parameter

Cause:

The total number of parameters changes, which generally occurs after software updates.

The actual parameter values of group 2000 or 2001 exceed the limit, which generally occurs after software updates.

Probable Cause	Confirming Method	Corrective Action
1. Instantaneous power failure occurs during parameter storage.	Check whether instantaneous power failure occurs during parameter storage.	Set drive model (2001-0Bh) incorrectly, and power on the system, then correctly set the drive model and power on the system again.
2. Instantaneous power failure occurs during serial encoder motor parameter writing.	Check whether instantaneous power failure occurs during serial encoder motor parameter writing.	Write the parameters of serial encoder motor using Inovance commissioning software.
3. The software is upgraded.	Check whether the software is upgraded.	Set drive model (2001-0Bh) incorrectly, and power on the system, then correctly set the drive model and power on the system again.
4. The servo drive is faulty.	If the fault persists after the servo drive is powered off and on again, and step 1 and 2 are repeated for several times, it indicates that the servo drive is faulty.	Replace the servo drive.

E1.120: product model matching fault

Cause:

The motor model and drive model do not match or the parameter setting is incorrect, or the drive unit recognition is incorrect.

Probable Cause	Confirming Method	Corrective Action
1. The product (encoder, motor or servo drive) SN does not exist.	Internal fault code 200B-2Eh = 1120: View the motor nameplate to check whether the motor is suitable. Check whether 2000-01h setting is correct.	Set 2000-01h (Motor SN) correctly according to the motor nameplate or use a matching motor.
	Internal fault code 200B-2Eh = 2120: View the drive model in 2001-0Bh and check whether this model is present by referring to the description of designation rules and nameplate in 2.1 Servo Drive.	If the drive SN does not exist, set it correctly according to the drive nameplate by referring to the description of designation rules and nameplate in 2.1 Servo Drive.
2. The power rating of the servo motor and does not match that of the servo drive.	Internal fault code 200B-2Eh = 3120: Check whether the drive model in 2001-0Bh matches the serial encoder model in 2000-06h by referring to the description of designation rules and nameplate in 2.1 Servo Drive and the specifications in 2.2 Servo Motor.	Use matching produces according to section 2.3 Servo System Configuration.
3. Settings of drive model do not match auto recognition results.	Check whether H01-10 of the faulty axis is the same as H01-62.	Set H01-10 to be the same as H01-62. Replace the drive unit.

E1.121: invalid S-ON command

Cause:

When some auxiliary functions are used, a redundant S-ON signal is given.

Probable Cause	Confirming Method	Corrective Action
When the servo drive is enabled internally, the S-ON signal is turned on via communication.	Check whether the S-ON signal is sent from the host controller when the auxiliary functions (200D-03h, 200D-04h, 200D-0Ch) are used.	Turn off the S-ON signal from the host controller.

E1.122: product matching fault in the absolute position mode

Cause:

The motor does not match in the absolute position mode or the motor SN is set incorrectly.

Probable Cause	Confirming Method	Corrective Action
The motor does not match in absolute position mode or the motor SN is set incorrectly.	View the motor nameplate to check whether the motor is a multi-turn absolute encoder motor. Check whether H0000 (Motor SN) is correct.	Set H0000 (Motor SN) correctly according to the motor nameplate or use a matching motor.

E1.130: DI function setting error

Cause:

The same function is allocated to different DIs.

The set values are not supported.

Probable Cause	Confirming Method	Corrective Action
1. The same function is allocated to different DIs.	View 2003-03h, 2003-05h, and 2003-07h to 2003-11h to check whether they are allocated with the same non-zero DI function No.	Allocate parameters that have been allocated with the same non-zero DI function No. with different DI functions. Then turn on the control power again to allow the modifications to take effect. You can also turn the S-ON signal off and give the reset signal to make the modification take effect.
2. DI function set values are incorrect.	Check whether the set values in 2003-03h, 2003-05h, and 2003-07h to 2003-11h do not meet the requirements. Requirements for set values: Axis No. + Supported DI function No.	Set values according to the requirements for set values. Then turn on the control power again to allow the modifications to take effect. You can also turn the S-ON signal off and give the reset signal to make the modification take effect.

E1.131: DO function setting error

Cause:

The set values are not supported.

Probable Cause	Confirming Method	Corrective Action
DO function set values are incorrect.	Check whether the set values in 2004-01h and 2004-03h do not meet the requirements. Requirements for set values: Axis No. + Supported DO function No.	Set values according to the requirements for set values. Then turn on the control power again to allow the modifications to take effect. You can also turn the S-ON signal off and give the reset signal to make the modification take effect.

E1.136: Data check error or no parameter stored in the motor ROM

Cause:

When reading parameters from the encoder ROM memory, the servo drive detects that no parameter is saved there or parameter values are inconsistent with the agreed values.

Probable Cause	Confirming Method	Corrective Action
1. The servo drive model and the motor model do not match.	View the servo drive and servo motor nameplates to check that the equipment used is an Inovance IS810 series servo drive and a matching servo motor.	Replace the matching servo drive and servo motor.
2. A parameter check error occurs or no parameter is stored in the serial increment encoder ROM memory.	Check whether the encoder cable is used according to the standard configuration. For cable specification, refer to 2.4 Matching Cables. The cable must be connected reliably and must not be damaged, broken, or under poor contact. Measure signals PS+, PS-, +5 V and GND at both ends of the encoder cable and observe whether signals at both ends are consistent. For the definition of signals, refer to Hardware wiring.	Use the recommended encoder cable. Ensure that the cable is connected to the motor securely and tighten the screws on the drive side. If necessary, use a new encoder cable. Never bundle encoder cable and power cables (RST, UVW) together.
3. The encoder wiring is incorrect or disconnected.	Check the encoder wiring. Check whether on-site vibration is excessively intense, which loosens the encoder cable or even damages the encoder.	Connect the encoder cable correctly. Re-connect the encoder cable securely.
4. The servo drive is faulty.	The fault persists after the servo drive is powered on again.	Replace the servo drive.

E1.150: STO input protection

Cause:

STO input protection

E1.201: Overcurrent

Cause:

Hardware overcurrent is detected.

Probable Cause	Confirming Method	Corrective Action
1. References are input simultaneously at the servo drive startup or the reference input is too early.	Check whether a reference is input before the keypad displays "ry".	The time sequence is: After the keypad displays "ry", turn on the S-ON signal and then input a reference. If allowed, add reference filter time constant or increase acceleration/ deceleration time.
3. The motor cables are in poor contact.	Check whether the servo drive power cables and motor UVW cables are loose.	Tighten the cables that are loose or are disconnected.

Probable Cause	Confirming Method	Corrective Action
4. The motor cables are grounded.	After ensuring the servo drive power cables and motor cables are connected securely, measure whether the insulation resistance between the servo drive UVW cables and ground cable (PE) is MΩ-level.	Replace the motor if the insulation is poor.
5. The motor UVW cables are short-circuited.	Disconnect the motor cables and check whether they are short-circuited and whether burrs exist.	Connect the motor cables correctly.
6. The motor is damaged.	Disconnect the motor cables and measure whether the resistance between motor cables UVW is balanced.	Replace the motor if the resistance is unbalanced.
7. The gain setting is improper and the motor oscillates.	Check whether the motor oscillates or generates a shrill noise during motor startup and running. You can view current feedback by using the drive Inovance servo commissioning software.	Carry out gain adjustment.
8. The encoder cable is incorrectly wired, corrosive, or connected loosely.	Check whether the encoder cable is used according to the standard configuration. Check whether the cable is aging, corrosive or loose. Turn off the S-ON signal, rotate the motor shaft manually, and check whether 200B-12h (electrical angle) changes as the motor rotates.	Re-weld, fasten or replace the encoder cable.
9. The servo drive is faulty.	The fault persists after the motor cables are disconnected and the servo drive is powered on again.	Replace the servo drive.
10. Bleeder resistor overcurrent	Check whether external bleeder resistor resistance value is small or the bleeder resistor is short-circuited (P and C ends at main circuit input terminal).	Select a new resistance value and model of the bleeder resistor. Perform the wiring again.

E1.208: FPGA sampling operation timeout

Cause:

Find the cause based on the internal fault code (200B-2Eh).

Probable Cause	Confirming Method	Corrective Action
1. Communication with the encoder times out.	Internal fault code 200B-2Eh = 2208: Encoder wiring is incorrect. Connection of the encoder cable becomes loose. The encoder cable is too long. Communication interference exists. The encoder is faulty.	Use the recommended encoder cable. If a non-standard cable is used, check that it complies with the specifications and is a shielded twisted pair cable. Check whether the connectors at both ends of the encoder are in good contact. Contact the manufacturer. Do not bundle motor cables and encoder cables together. Ensure the servo motor and servo drive are well grounded. Replace the servo motor.

Probable Cause	Confirming Method	Corrective Action
2. Current sampling times out.	Internal fault code 200B-2Eh = 3208: Check whether there is large equipment generating interference on-site and whether there are interference sources such as various variable-frequency devices inside the cabinet. The internal current sampling chip is damaged.	Separate the heavy current from the light current. Replace the servo drive.
3. FPGA operation times out.	Internal fault code 200B-2Eh = 0208: Determine causes 1/2/3.	Remove the preceding causes 1/2/3.

E1.210: Output to-ground short-circuit

Cause:

The servo drive detects abnormal motor phase current or bus voltage during self-check at power-on.

Probable Cause	Confirming Method	Corrective Action
1. The servo drive power cables (UVW) are short-circuited to ground.	Disconnect the motor cables, and measure whether the servo drive power cables (UVW) are short-circuited to ground (PE).	Re-connect these cables or replace them.
2. The motor is short-circuited to ground.	After ensuring that the servo drive power cables and motor cables are connected securely, measure whether the insulation resistance between the servo drive UVW cables and ground cable (PE) is at the MΩ level.	Replace the motor.
3. The servo drive is faulty.	Remove the power cables from the servo drive. The fault persists after the drive is powered off and on several times.	Replace the servo drive.

E1.220: UVW phase sequence incorrect

Cause:

Incorrect UVW phase sequence is detected during angle auto-tuning.

Probable Cause	Confirming Method	Corrective Action
Power cable sequences are incorrect.	Check whether power cable sequence are correct.	Change any two phase sequences for angle auto-tuning again.

E1.234: Runaway

Cause:

The torque reference direction is reversed to the speed feedback direction in the torque control mode.

The speed feedback direction is reversed to the speed reference direction in the position or speed control mode.

Probable Cause	Confirming Method	Corrective Action
1. The main circuit input voltage is too high.	Check whether the voltage on the power supply side is within the following specifications: 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V)	Replace or adjust the power supply according to the specifications.
2. The power supply is instable or affected by lightning.	Check whether the power supply is unstable or affected by lightning, or whether it satisfies the preceding specifications.	Connect a surge suppressor and then the power supply. If the fault persists, replace the servo drive.
5. The motor is in abrupt acceleration/ deceleration status. The maximum braking energy exceeds the energy absorption value.	Confirm the acceleration/deceleration time during running and measure the DC bus voltage between P and C to check whether the voltage exceeds the fault threshold during deceleration.	Ensure that the input voltage of main circuit is within the specifications. Then increase the acceleration/deceleration time within the allowed range.
6. The bus voltage sampling value has a large deviation from the actually measured value.	Check whether 200B-1Bh (Bus voltage) is within the following specifications: 220V drive: 200B-1Bh > 420 V Measure the DC bus voltage between and and check whether the DC bus voltage is normal and smaller than 200B-1Bh.	Contact Inovance for technical support.
7. The servo drive is faulty.	The fault persists after the main circuit is powered off and on several times.	Replace the servo drive.

E1.410: Main circuit undervoltage

Cause:

The DC bus voltage is lower than the overvoltage threshold.

380 V drive: normal value: 540 V, overvoltage threshold: 350 V

Probable Cause	Confirming Method	Corrective Action
1. The control power supply is unstable or power failure occurs.	Check whether the voltage on the power supply side is within the following specifications: 220 V drive: 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V). Measurement is required for three phases.	Improve the power capacity.
2. Instantaneous power failure occurs.		
3. The power voltage drops during running.	Check the input voltage on the power supply side and check whether main power is applied to other devices, resulting in insufficient power capacity and a voltage dip.	

Probable Cause	Confirming Method	Corrective Action
5. The servo drive is faulty.	Check whether 200B-1Bh (Bus voltage) is within the following specifications: 380 V drive: 200B-1Bh < 350 V The fault persists after the power supply on the power supply side is powered off and on several times.	Replace the servo drive.

E1.500: Motor overspeed

Cause:

The actual speed of the servo motor exceeds the overspeed threshold.

Probable Cause	Confirming Method	Corrective Action
1. The UVW phase sequence of the motor cables is incorrect.	Check whether the servo drive power cables are in the same phase sequence as the servo drive UVW cables and the motor UVW cables.	Connect the UVW cables according to the correct sequence.
2. The setting of 200A-09h is incorrect.	Check whether the overspeed threshold is smaller than the actual maximum motor speed. Overspeed threshold = 1.2 times maximum motor speed (200A-09h = 0). Overspeed threshold = 200A-09h (200A-09h ≠ 0, and 200A-09h < 1.2 times maximum motor speed).	Re-set the overspeed threshold according to the actual mechanical requirement.
3. The input reference is higher than the overspeed threshold.	Check whether the motor speed corresponding to the input reference exceeds the overspeed threshold. Position control mode: In CSP mode, view the gear ratio 6091-01h/6091-02h to check the position reference increment for a single synchronous cycle and convert it to speed. In PP mode, view the gear ratio 6091-01h/6091-02h and check the value of 6081h (profile velocity). In HM mode, view the gear ratio 6091-01h/6091-02h, and determine 6099-01h and 6099-02h. In speed control mode, view the gear ratio 6091-01h, and the values of 60FFh (Target velocity) and 607Fh (Max profile velocity). Torque control mode: View the speed limit 607Fh in torque control.	Position control mode: CSP: Decrease the position reference increment for a single synchronous cycle, and the host controller needs to increase the position ramp additionally when generating references. PP: Decrease the value of 6081h, or increase the acceleration/deceleration ramp (6083h, 6084h). HM: Decrease 6099-01h and 6099-02h, or increase the acceleration/deceleration ramp (609Ah). Decrease the gear ratio according to the actual conditions. Speed mode: Decrease the target velocity, speed limit value, gear ratio. In PV mode, increase the speed ramp 6083h and 6084h; in CSV mode, the host controller needs to increase speed ramp additionally. Torque control mode: Set a speed limit value smaller than the overspeed threshold.
4. The motor speed overshoots.	Check whether the actual speed exceeds the overspeed threshold through the drive Inovance servo commissioning software.	Adjust the gain or mechanical conditions.
5. The servo drive is faulty.	The fault persists after the servo drive is powered on again.	Replace the servo drive.

E1.602: Angle auto-tuning failure

Cause:

Abnormal jitter is reported by the encoder during the angle auto-tuning.

Probable Cause	Confirming Method	Corrective Action
Abnormal encoder feedback data	Check if the encoder communication is interrupted.	Check the encoder hardware wiring

E1.610: Servo drive overload

Cause:

Heat accumulation of the servo drive reaches the fault level.

E1.620: Motor overload

Cause:

Heat accumulation of the motor reaches the fault level.

Probable Cause	Confirming Method	Corrective Action
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check wirings between the servo drive, servo motor and encoder according to the correct wiring diagram.	Connect the wirings according to the correct wiring diagram. Preferably use the cables recommended by Inovance. When self-made cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is too heavy. The motor keeps outputting effective torque higher than the rated torque for a long time.	Confirm the overload characteristics of the servo drive or servo motor. Check whether the average load ratio (200B-0DH) remains greater than 100.0% for long time.	Use a servo drive of larger capacity and matching servo motor. Reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/ deceleration is too frequent or the load inertia is too large.	Calculate the mechanical inertia ratio or perform the inertia auto-tuning. Then view 2008-10h (load inertia ratio). Check the single running cycle when the servo motor runs circularly.	Increase acceleration/ deceleration time during a single run.
4. The gain is improper, or the stiffness is too high.	Check whether the motor vibrates and produces abnormal noise during running.	Re-adjust the gain.
5. The servo drive or motor model is set incorrectly.	View the bus motor model in 2000-06h and servo drive model in 2001-0Bh.	View the servo drive nameplate and set the servo drive model in 2001-0Bh correctly and use a matching servo motor according to Section 2.3.

Probable Cause	Confirming Method	Corrective Action
6. Locked-rotor occurs due to mechanical factors, resulting in very heavy load during running.	Check the running reference and motor speed (200B-01h) through Inovance servo commissioning software or the keypad: Running reference in position control: 200B-0Eh (Input position reference counter) Running reference in speed mode: 200B-02h (Speed reference) Running reference in torque mode: 200B-03h (Internal torque reference) Check that the running reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
7. The servo drive is faulty.	The fault persists after the servo drive is powered on again.	Replace the servo drive.

E1.630: Overheat protection for locked-rotors

Cause:

The actual motor speed is lower than 10 rpm but the torque reference reaches the limit. The duration reaches the value set in 200A-21h.

Probable Cause	Confirming Method	Corrective Action
1. Power output (UVW) phase loss or incorrect phase sequence occurs in the servo drive.	Perform motor trial run when there is no load and check the motor wirings.	Correct the wiring or replace the cables.
2. The servo drive UVW cable or the encoder cable is broken.	Check wirings.	Correct the wiring or replace the cables.
3. Locked-rotor occurs due to mechanical factors.	Check the running reference and motor speed (200B-01h) through Inovance servo commissioning software or the keypad: Running reference in position control: 200B-0Eh (Input position reference counter) Running reference in speed mode: 200B-02h (Speed reference) Running reference in torque mode: 200B-03h (Internal torque reference) Check that the running reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.

E1.650: Heatsink overheat

Cause:

The temperature of the servo drive power module is higher than the over-temperature protection threshold.

Probable Cause	Confirming Method	Corrective Action
1. The ambient temperature is too high.	Measure the ambient temperature	Improve the cooling conditions for the servo drive to reduce the ambient temperature.
2. The servo drive is powered off and powered on several times to reset the overload fault.	View the fault records (set 200B-22h and view 200B-23h) and check whether an overload fault/ warning (E1.610, E1.620, E1.630, E1.650) occurs.	Change the fault reset method. After overload occurs, wait 30s and then perform the reset operation. Increase the capacity of the servo drive and servo motor, increase acceleration/ deceleration time, and reduce the load.
3. The fan is damaged.	Observe whether the fan works during running.	Replace the servo drive.
4. The installation direction and clearance away from other servo drives are improper.	Check whether installation of the servo drive is proper.	Install the servo drive according to the requirements.
5. The servo drive is faulty.	The fault persists after restart and 10 minutes after powering off.	Replace the servo drive.

E1.661: NTC cable breaking

Cause:

The drive temperature detection circuit is abnormal.

Probable Cause	Confirming Method	Corrective Action
The drive temperature detection circuit is abnormal.	Check whether H0B-27 (Drive temperature) of a corresponding axis remains at 12°C.	Replace the servo drive.

E1.731: Encoder battery failed

Cause:

The battery voltage of the absolute encoder is lower than 3.0 V.

Probable Cause	Confirming Method	Corrective Action
The battery is not connected during power-off.	Check whether the battery is connected during power-off.	Set 200D-15h = 1 to remove the fault.
The battery voltage of the encoder is too low.	Measure the battery voltage.	Use a new battery of matching voltage.

E1.733: Encoder multi-turn counting error

Cause:

Encoder multi-turn counting error

Probable Cause	Confirming Method	Corrective Action
The encoder is faulty.	Set 200D-15h = 2 to remove the fault. E1.733 persists after power-on again.	Replace the motor.

E1.735: Encoder multi-turn counting overflow

Probable Cause	Confirming Method	Corrective Action
The absolute encoder rotates over 32767 revolutions in a single direction in linear mode.	View H0B70 and check whether the encoder continues to run in this direction after the value reaches 32767.	View the operating instructions of the absolute encoder. 1) This fault can be shielded in the case that no multi-turn absolute position but the running absolute position needs to be recorded; 2) The rotation mode must be used in the case that the single-turn absolute position needs to be recorded.

E1.740: Encoder interference

Cause:

The encoder communication has been interrupted, resulting in an error in the communication process.

Probable Cause	Confirming Method	Corrective Action
1. The encoder wiring is incorrect.	Check the encoder wiring.	Reconnect cables according to the correct wiring diagram.
2. Connection of the encoder cable becomes loose.	Check whether on-site vibration is excessively intense, which loosens the encoder cable or even damages the encoder.	Re-connect the encoder cable securely.
3. Interference on Z signal of the encoder exists.	Check on-site wirings: Check whether large equipment is generating interference on site and whether there are interference sources such as various variable-frequency devices inside Make servo drive in "rdy" status and rotate the motor shaft counterclockwise (CCW) manually, and observe whether 200B-12h (Electrical angle) increases/ decreases smoothly, and whether one turn corresponds to five 0 to 360°. (This is for Z series motors. For X series motors, the number should be 4.) If 200B-12h changes abnormally during rotation, it indicates that a fault occurs on the encoder. If there is no alarm during rotation but the system alarms during servo running, interference may exist.	Preferably use the cables recommended by Inovance. If a non-standard cable is used, check whether the cable meets the requirements and is an STP cable. Do not bundle motor cables and encoder cables together. Ensure the servo motor and servo drive are well grounded. Check that the connectors at both ends of the encoder are in good contact.

Probable Cause	Confirming Method	Corrective Action
4. The encoder is faulty.	Use a new encoder cable. If the fault no longer occurs after replacement, it indicates that the original encoder cable is damaged. Place motor at the same position, power on the system several times and observe changes of 200B-12h. The electrical angle must be within ±30°.	Use a new encoder cable. Replace the servo motor if the encoder is faulty.

E1.A33: Encoder reads and writes data abnormally

Cause:

Internal parameters of the encoder are abnormal.

Probable Cause	Confirming Method	Corrective Action
1. The serial incremental encoder cable is broken or loose.	Check wirings.	Check the connection of the encoder cable to see whether there is an incorrect connection, a broken cable, or poor contact. If motor cables and encoder cables are bundled together, separate them.
2. Reading and writing of the series incremental encoder parameters are abnormal.	If the servo drive is powered off and on several times but the fault persists, it indicates that the encoder is faulty.	Replace the servo motor.

E1.B00: Position deviation excess

Cause:

The position deviation is larger than the setting of 6065h in position control mode.

Probable Cause	Confirming Method	Corrective Action
1. Power output (UVW) phase loss or incorrect phase sequence occurs in the servo drive.	Perform motor trial run when there is no load and check the motor wirings.	Correct the wiring or replace the cables.
2. The servo drive UVW cable or the encoder cable breaks.	Check wirings.	Reconnect the UVW cables. The servo motor UVW cables must be connected to the corresponding servo drive UVW cables. If necessary, replace all cables and ensure a reliable connection.

Probable Cause	Confirming Method	Corrective Action
3. Locked-rotor occurs due to mechanical factors.	Check the running reference and motor speed (200B-01h) through Inovance servo commissioning software or the keypad: Running reference in position control: 200B-0Eh (Input position reference counter) Running reference in speed mode: 200B-02h (Speed reference) Running reference in torque mode: 200B-03h (Internal torque reference) Check that the running reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
4. The servo drive gain is too low.	Check the position loop gain and speed loop gain of the servo drive. 1st gain: 2008-01h to 2008-03h 2nd gain: 2008-04h to 2008-06h	Adjust the gain manually or perform gain auto-tuning.
5. The position reference increment is too large.	Position control mode: In CSP mode, view the gear ratio 6091-01h/6091-02h to check the speed reference increment for a single synchronous cycle and convert it to speed. In PP mode, view the gear ratio 6091-01h/6091-02h and check the value of 6081h (profile velocity). In HM mode, view the gear ratio 6091-01h/6091-02h, and determine 6099-01h and 6099-02h.	CSP: Decrease the position reference increment for a single synchronous cycle, and the host controller needs to increase the position ramp additionally when generating references. PP: Decrease the value of 6081h, or decrease the acceleration/deceleration ramp (6083h, 6084h). HM: Decrease 6099-01h and 6099-02h, or decrease the acceleration/deceleration ramp (609Ah). Decrease the gear ratio according to the actual conditions.
6. Relative to the running condition, 6065h (following error window) is too small.	Check whether the setting of 6065h is too small.	Increase the value of 6065h.
7. The servo drive or motor is faulty.	Monitor the running curve through the oscilloscope function in Inovance servo commissioning software: Position reference, position feedback, speed reference, torque reference	If the position reference is not 0, but the position feedback is always 0, replace the servo drive or motor.

E1.B01: abnormal position reference increment

Cause:

The target position increment in CSP mode is too large.

Probable Cause	Confirming Method	Corrective Action
1. The position reference increment is too large.	Check the target position increment of the adjacent synchronization cycles.	Decrease the position reference speed, or set a certain acceleration/deceleration curve when the host controller plans the target position.
2. Before switching modes, the target position is not aligned with the current position.	Check whether mode switching happened in the controller software.	Before mode switching, assign the value of the current position to the target position.
3. When the servo is enabled, the target position is not aligned with the current position.	Check whether the operation of enabling the servo happened in the controller software.	When the servo is enabled, assign the value of the current position to the target position.
4: The target position value is abnormal.	After the soft limit function is used, the target position overflows near 231-1 or -231. After any hardware limit signal is valid, the target position overflows near 231-1 or -231.	When the soft limit function or hardware limit signal is valid, the target position must be limited between [-231, 231-1].
5. The gear ratio setting is unreasonable.	Check whether the 6091-01h and 6091-02h are set incorrectly. Check whether scaling factors of the host controller associated with machine and motor encoder are set incorrectly.	Modify gear ratio and host controller related scaling factors according to practical applications.
6. Motor selection is unreasonable.	Check whether the maximum motor speed is less than the maximum operating speed that satisfies on-site demand.	Re-select the motor or reduce the maximum operating speed on site.

E1.B03: Electronic gear ratio setting exceeds limit

Cause:

Electronic gear ratio exceeds limit: (0.001 x encoder resolution/10,000, 4,000 x encoder resolution/10,000).

Probable Cause	Confirming Method	Corrective Action
1. The electronic gear ratio setting exceeds the preceding range.	Check whether the ratio value of 6091-01h/6091-02h exceeds the preceding range.	Set the gear ratio within the required range.

E1.D09: incorrect software position setting

Cause:

The lower limit of the software position is greater than the upper limit.

Probable Cause	Confirming Method	Corrective Action
The lower limit of the software position is greater than the upper limit.	The lower limit (607D-01) of the parameter soft limit is greater than the upper limit (607D-02).	Reset the parameters.

E1.D10: incorrect origin position setting

Cause:

The origin offset exceeds the soft limit.

Probable Cause	Confirming Method	Corrective Action
The origin offset exceeds the soft limit.	The value of the parameter 607Ch exceeds the soft limit 607D-01 and the soft limit upper limit 607D-02.	Reset the parameters.

7.2.4 Troubleshooting of Warnings

E1.601: Home attaining warning

Cause:

When using the homing function, home is not found within the time set in 2005-24h.

Probable Cause	Confirming Method	Corrective Action
1. The home switch fails.	There is only high-speed searching and no low-speed searching during the homing operation. After high-speed searching of homing, the drive keeps reverse low-speed searching.	If a hardware DI is used, check whether the DI function has been allocated to a DI in group 2003h and then check the wiring of the DI. Manually change the DI logic and observe whether the servo drive receives DI level change in 200B-04h. If the home signal is Z but it cannot be found at all times, check the Z signal status.
2. The search time is too short.	Check whether the time for homing set in 2005-24h is too short.	Increase 2005-24h.
3. The speed for searching for the home switch signal at high speed is too small.	Check the distance from the initial position of homing to the home switch. Then check whether 6099-01h is too small, resulting in a very long time of finding home switch.	Increase 6099-01h.
4. The setting of the home switch is improper.	Check whether the limit signals at two sides are active simultaneously. Check whether a limit signal is active simultaneously with the home signal.	Set the position of the hardware switch properly.

E1.730: Encoder battery alarm

Cause:

The battery voltage of the absolute encoder is lower than 3.0 V.

Probable Cause	Confirming Method	Corrective Action
The battery voltage of the absolute encoder is lower than 3.0 V.	Measure the battery voltage.	Use a new battery with the matching voltage.

E1.909: Motor overload warning

Cause:

Accumulative heat of 60Z series 200 W and 400 W motors reaches the warning threshold.

Probable Cause	Confirming Method	Corrective Action
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check the wiring between the servo drive, servo motor and the encoder according to the correct wiring diagram.	Connect the wirings according to the correct wiring diagram. Preferably use the cables recommended by Inovance. When self-made cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is too heavy. The motor keeps output of effective torque higher than the rated torque for a continuous operation.	Confirm the overload characteristics of the servo drive or servo motor. Check whether the average load ratio (200B-0Dh) exceeds 100.0% for a long time.	Use a servo drive of larger capacity and matching servo motor. Reduce the load and increase the acceleration/deceleration time.
3. Acceleration/ deceleration is too frequent or the load inertia is too large.	Check the mechanical inertia ratio or perform the inertia auto-tuning. Then view 2008-10h (load inertia ratio). Check the single running cycle when the servo motor runs circularly.	Increase the acceleration/ deceleration time.
4. The gain is improper, or the stiffness is too high.	Check whether the motor vibrates and produces abnormal noise during running.	Re-adjust the gain.
5. The servo drive or motor model is set incorrectly.	View the bus motor model in 2000-06h and servo drive model in 2001-0Bh.	View the servo drive nameplate and set the servo drive model in 2001-0Bh correctly and use a matching servo motor according to Section 2.3.

Probable Cause	Confirming Method	Corrective Action
6. Locked-rotor occurs due to mechanical factors, resulting in very heavy load during running.	Check the running reference and motor speed (200B-01h) through Inovance servo commissioning software or keypad: Running reference in position control: 200B-0Eh (Input position reference counter) Running reference in speed mode: 200B-02h (Speed reference) Running reference in torque mode: 200B-03h (Internal torque reference) Check that the running reference is not 0 or very large but the motor speed is 0 in corresponding mode.	Eliminate mechanical factors.
7. The servo drive is faulty.	Power off and on the servo drive.	Replace the servo drive if the fault persists after the servo drive is powered on again.

E1.941: Parameter modification taking effect only after the servo drive is powered on again

Cause:

After parameters with the effective condition "power-on again" are modified, the servo drive prompts the user to power on again.

Probable Cause	Confirming Method	Corrective Action
Parameters with the effective condition "power-on again" are modified.	Check whether such parameters are modified.	Power on the servo drive again.

E1.942: Parameter storage too frequent

Cause:

The number of function codes that are modified at the same time exceeds 200.

Probable Cause	Confirming Method	Corrective Action
A great number of function code parameters are modified and stored frequently to EEPROM (200E-02h = 1)	Check whether the host controller performs frequent and fast function code parameter modification on the servo drive.	Check the running mode. For parameters that need not be stored in EEPROM, set 200E-02h to 0 before the wiring operation of the host computer.

E1.950: Positive limit switch warning

Cause:

The logic of the DI allocated with FunIN.14: P-OT (positive limit switch) is valid.

Probable Cause	Confirming Method	Corrective Action
The logic of the DI allocated with FunIN.14: P-OT (forward limit switch inhibited) is valid.	Check whether a DI is allocated with FunIN.14 (P-OT) in group 2003h. Check whether the DI logic is valid in 200B-04h (monitored DI states).	Check the running mode. Ensure safety, and then send a reverse reference or rotate the motor to make the logic of DI with the positive limit switch function become invalid.

E1.952: Negative limit switch warning

Cause:

The logic of the DI allocated with FunIN.15: N-OT (negative limit switch) is valid.

Probable Cause	Confirming Method	Corrective Action
The logic of the DI allocated with FunIN.15: N-OT (negative limit switch inhibited) is valid.	Check whether a DI is allocated with FunIN.15 (N-OT) in group 2003h. Check whether the DI logic is valid in 200B-04h (monitored DI states).	Check the running mode. Ensure safety, and then send a reverse reference or rotate the motor to make the logic of DI with the negative limit switch function become invalid.

E1.980: Encoder internal fault

Cause:

An encoder algorithm error occurs.

Probable Cause	Confirming Method	Corrective Action
An encoder internal fault occurs.	If the servo drive is powered off and on several times but the warning is still reported, it indicates that the encoder is faulty.	Replace the servo motor.

E1.998: Incorrect homing object dictionary

Cause:

Homing mode (6098h) sets an unsupported value.

Probable Cause	Confirming Method	Corrective Action
The value of object 6098h is not supported.	Check the setting value of object 6098h.	Set parameters according to the specifications.

E1.E20: Ethernet hardware error

Cause:

Ethernet hardware fault

Probable Cause	Confirming Method	Corrective Action
Ethernet hardware error	If the servo drive is powered off and on several times but the warning is still reported, it indicates that the Ethernet is faulty.	Replace the servo drive.

E1.E21: MAC address not burned

Cause:

The MAC address of the driver is not burnt.

Probable Cause	Confirming Method	Corrective Action
The MAC address is not burned.	The drive does not burn the MAC address if the fault persists after the servo drive is powered off and on several times.	Please consult the manufacturer's technical service personnel.

7.2.5 Troubleshooting Communication Faults

This part describes how to rectify communication faults.

E1.E08: Synchronization lost

Cause:

The masters synchronization signal is abnormal during communication.

Probable Cause	Confirming Method	Corrective Action
1. The slave station's receipt signal is abnormal during synchronous communication.	Check whether a shielded twisted pair cable is used as the communication cable. Check whether the servo drive is well grounded. Check whether drive's Ethernet port is damaged.	Use a shielded twisted pair cable. Connect the cable according to the wiring instructions. Check the network connection status via the first LED on the left.
2. The master's sending signal is abnormal during synchronous communication.	The synchronization clock of the host controller is not valid. The synchronization clock error of the host controller is too large.	Measure the synchronization cycle by background oscilloscope or actual oscilloscope: If the synchronization cycle is 0, it indicates that the synchronization clock of the host controller is not valid. First, check whether the network cable connects all slaves s in accordance with entering from the IN port and going out from the OUT port; then restart the network. But if the network cable connection sequence is correct, restart the network directly. If it is not 0 and within the permissible fluctuation range (2us) of the servo drive, increase the permissible interruption loss times (200E-21h) of the slave station.
3. When the servo is enabled, the network switches from OP to non-OP.	Check whether the network state has switched from OP to non-Op.	Check the host computer network status switch program.

E1.E11: ESI configuration file not burned

Cause:

The ESI configuration file is not burned.

Probable Cause	Confirming Method	Corrective Action
1. The equipment configuration file is not burnt.	When the host computer scans the slave station, the ID of the salve is empty.	Burn the equipment configuration file.
2. The servo drive is faulty.	Servo drive failure	Replace the servo drive.

E1.E13: Synchronization cycle setting error

Cause:

After the system switches over to the running mode, the synchronization cycle is not an integer multiple of reference scheduling cycles.

Probable Cause	Confirming Method	Corrective Action
1. The synchronization cycle is not an integer multiple of reference scheduling cycles.	Check the setting of the synchronization cycle.	Change the setting of the synchronization cycle to the integer multiples of the reference scheduling cycle. Remark: The reference scheduling cycle can be calculated by factory parameters (H0160 and H0161).

E1.E15: Synchronization cycle error is too large

Cause:

The synchronization cycle error exceeds the threshold.

Probable Cause	Confirming Method	Corrective Action
The controller has a large synchronization cycle error.	Measure the synchronization cycle of the controller. Measure the synchronization cycle through a digital oscilloscope or the oscilloscope function in the Inovance servo commissioning software.	Increase the factory parameter (200E-21h).

Appendix 1 List of Object Groups

Parameter Address Structure

Parameter access address: Index+subindex, both are hexadecimal data.

The CiA402 protocol has the following constraints on the address of the parameter:

Index (Hex)	Description
0000-0FFF	Data type description
1000-1FFF	CoE communication object
2000-5FFF	Manufacturer specific object
6000-9FFF	Sub-protocol object
A000-FFFF	Reserved

The IS810N servo drive has 2 drive modules on one axis, and each module supports the same parameter. Except that 1000h-1FFFh CoE communication object's 2 modules have a common parameter, unless otherwise stated, the parameter address of each module is independent of each other. However, the following relation exists among them:

Parameter address (HEX) of Module N = Parameter address (HEX) of Module 1 + 0x800 x (N - 1)

Example:

-	Module 1	Module 2
Manufacturer specific object: Speed loop gain address	2008-01h	2808-01h
Sub-protocol object: Control word address	6040-00h	6840-00h

This document describes all the parameters based on the parameter address of Module 1, unless otherwise specified.

Object Group 1000h

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default
1000	00	Device type	RO	NO	UINT32	-	-	0x00020192
1008	00	Manufacturer device name	RO	NO	-	-	-	IS810N-ECAT
1009	00	Manufacturer hardware version	RO	NO	-	-	-	Determined by the software version
100A	00	Manufacturer software version	RO	NO	-	-	-	Determined by the hardware version
1018	ID Object							
	00	Highest sub-index supported	RO	NO	UINT8	-	-	0x04
	01	Vendor	RO	NO	UINT32	-	-	0x00100000
	02	Product code	RO	NO	UINT32	-	-	0x000C0308
	03	Revision number	RO	NO	UINT32	-	-	0x00010000

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default
1C00	Factory Software Version							
	00	Number of Sync Manager channels	RO	NO	UINT8	-	-	0x04
	01	Communication type SM0	RO	NO	UINT8	-	-	0x01
	02	Communication type SM1	RO	NO	UINT8	-	-	0x02
	03	Communication type SM2	RO	NO	UINT8	-	-	0x03
	04	Communication type SM3	RO	NO	UINT8	-	-	0x04
1600	RPDO1 Mapping Object							
	00	Number of mapped application objects in RPDO1	RW	NO	UINT8	-	0 to 0x0A	0x05
	01	1st mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60400010
	02	2nd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60600008
	03	3rd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x607A0020
	04	4th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60B80010
	05	5th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60FF0020
	06	6th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	07	7th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	08	8th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	09	9th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	0A	10th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default
1610	RPDO11 Mapping Object							
	00	Number of mapped objects in RPDO11	RW	NO	UINT8	-	0 to 0x0A	0x05
	01	1st mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68400010
	02	2nd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68600008
	03	3rd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x687A0020
	04	4th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68B80010
	05	5th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68FF0020
	06	6th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	07	7th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	08	8th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	09	9th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
	0A	10th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	-
1A00	TPDO1 Mapping Object							
	00	Number of mapped application objects in TPDO1	RW	NO	UINT8	-	0 to 0x0A	0x0A
	01	1st mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x603F0010
	02	2nd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60410010
	03	3rd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60610008
	04	4th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60640020
	05	5th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x606C0020
	06	6th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60B90010
	07	7th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60BA0020
	08	8th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60BC0020
	09	9th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60F40010
	0A	10th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x60FD0010

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default
1A10	TPDO11 Mapping Object							
	00	Number of mapped objects in TPDO11	RW	NO	UINT8	-	0 to 0x0A	0x0A
	01	1st mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x683F0010
	02	2nd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68410010
	03	3rd mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68610008
	04	4th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68640020
	05	5th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x686C0020
	06	6th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68B90010
	07	7th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68BA0020
	08	8th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68BC0020
	09	9th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68F40010
	0A	10th mapping object	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0x68FD0010
1C12	Sync Manager 2_Assigned RPDO							
	00	Number of assigned RPDOs	RW	NO	UINT8	-	0 to 0x02	0x02
	01	1st PDO mapping object index of assigned RPDO	RW	YES	UINT16	-	0 to 0xFFFF	0x1600
	02	Index for Object 2 of assigned RPDO	RW	YES	UINT16	-	0 to 0xFFFF	0x1610
1C13	Sync Manager 2_Assigned TPDO							
	00	Number of assigned TPDOs	RW	NO	UINT8	-	0 to 0x02	0x02
	01	Index for Object 1 of assigned TPDO	RW	YES	UINT16	-	0 to 0xFFFF	0x1A00
	02	Index for Object 2 of assigned TPDO	RW	YES	UINT16	-	0 to 0xFFFF	0x1A10

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default
1C32	Sync Manager 2 Synchronization Output							
	00	Number of synchronization parameters	RO	NO	UINT8	-	-	0x20
	01	Synchronization type	RO	NO	UINT16	-	-	0x0002
	02	Cycle Time	RO	NO	UINT32	ns	-	0
	04	Synchronization types supported	RO	NO	UINT16	-	-	0x0004
	05	Minimum cycle time	RO	NO	UINT32	ns	-	0x000F4240
	06	Calc and copy time	RO	NO	UINT32	ns	-	-
	09	Delay time	RO	NO	UINT32	ns	-	-
	20	Sync error	RO	NO	BOOL	-	-	-
1C33	Sync Manager 2 Synchronization Output							
	00	Number of synchronization parameters	RO	NO	UINT8	-	-	0x20
	01	Synchronization type	RO	NO	UINT16		-	0x0002
	02	Cycle Time	RO	NO	UINT32	ns	-	0
	04	Synchronization types supported	RO	NO	UINT16	-	-	0x0004
	05	Minimum cycle time	RO	NO	UINT32	ns	-	0x000F4240
	06	Calc and copy time	RO	NO	UINT32	ns	-	-
	09	Delay time	RO	NO	UINT32	ns	-	-
	20	Sync error	RO	NO	BOOL	-	-	-

Object Group 6000h

Object group 6000h contains objects related to the supported sub-protocol DSP 402.

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
603F	00	Error code	RO	TPDO	UINT16	-	-	-	-	-
6040	00	Control word	RW	RPDO	UINT16	-	0 to 0xFFFF	0	During running	Immediate
6041	00	Status word	RO	TPDO	UINT16	-	-	-	-	-
605A	00	Quick stop option code	RW	NO	INT16	-	0 to 0x07	0x02	During running	Upon stop
605C	00	Disable operation option code	RW	NO	INT16	-	0 to 0x01	0	During running	Upon stop
605D	00	Halt option code	RW	NO	INT16	-	0x01 to 0x03	0x01	During running	Upon stop
605E	00	Fault reaction option code	RW	NO	INT16	-	0 to 0x02	0x02	During running	Upon stop
6060	00	Modes of operation	RW	RPDO	INT8	-	0 to 0x0A	0	During running	Immediate
6061	00	Modes of operation display	RO	TPDO	INT8	-	-	-	-	-

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
6062	00	Position demand internal value	RO	TPDO	INT32	Reference unit	-	-	-	-
6063	00	Position actual value	RO	TPDO	INT32	Encoder unit	-	-	-	-
6064	00	Position actual value	RO	TPDO	INT32	Reference unit	-	-	-	-
6065	00	Following error window	RW	RPDO	UINT32	Reference unit	0 to 0xFFFFFFFF	0x00300000	During running	Immediate
6066	00	Following error time out	RW	RPDO	UINT32	ms	0 to 0xFFFF	0	During running	Immediate
6067	00	Position window	RW	RPDO	UINT32	Reference unit	0 to 0xFFFFFFFF	0x000002DE	During running	Immediate
6068	00	Position window time	RW	RPDO	UINT16	ms	0 to 0xFFFF	0	During running	Immediate
606C	00	Velocity actual value	RO	TPDO	INT32	Reference unit/s	-	-	-	-
606D	00	Velocity window	RW	RPDO	UINT16	rpm	0 to 0xFFFF	0x0A	During running	Immediate
606E	00	Velocity window time	RW	RPDO	UINT16	ms	0 to 0xFFFF	0	During running	Immediate
606F	00	Velocity threshold	RW	RPDO	UINT16	rpm	0 to 0xFFFF	0x0A	During running	Immediate
6070	00	Velocity threshold time	RW	RPDO	UINT16	ms	0 to 0xFFFF	0	During running	Immediate
6071	00	Target torque	RW	RPDO	INT16	0.1%	0xF448 –0x0BB8	0	During running	Immediate
6072	00	Max torque	RW	RPDO	UINT16	0.1%	0 to 0x0BB8	0x0BB8	During running	Immediate
6074	00	Max torque	RO	TPDO	INT16	0.1%	-	0	-	-
6077	00	Torque actual value	RO	TPDO	INT16	0.1%	-	0	-	-
607A	00	Target position	RW	RPDO	INT32	Reference unit	0x80000000 to 0x7FFFFFFF	0	During running	Immediate
607C	00	Home offset	RW	RPDO	INT32	Reference unit	0x80000000 to 0x7FFFFFFF	0	During running	Immediate
607D	Software Absolute Position Limit									
	00	Highest sub-indexes supported	RO	NO	UINT8	-	-	0x02	-	-
	01	Min position limit	RW	RPDO	INT32	Reference unit	0x80000000 to 0x7FFFFFFF	0x80000000	During running	Immediate
	02	Max position limit	RW	RPDO	INT32	Reference unit	0x80000000 to 0x7FFFFFFF	0x7FFFFFFF	During running	Immediate
607E	00	Polarity	RW	RPDO	UINT8	-	0 to 0xFF	0	During running	Immediate
607F	00	Max profile velocity	RW	RPDO	UINT32	Reference unit/s	0 to 0xFFFFFFFF	0x06400000	During running	Immediate
6081	00	Profile velocity	RW	RPDO	UINT32	User speed unit	0 to 0xFFFFFFFF	0	During running	Immediate
6083	00	Profile acceleration	RW	RPDO	UINT32	Reference unit/s2	0 to 0xFFFFFFFF	0x682AAAA6	During running	Immediate
6084	00	Profile deceleration	RW	RPDO	UINT32	Reference unit/s2	0 to 0xFFFFFFFF	0x682AAAA6	During running	Immediate

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
6085	00	Quick stop deceleration	RW	RPDO	UINT32	User acceleration unit	0 to 0xFFFFFFFF	0xAD9C71C0	During running	Immediate
6086	00	Motion profile type	RW	RPDO	INT16	-	0x8000 to 0x7FFF	0	During running	Immediate
6087	00	Torque slope	RW	RPDO	UINT32	0.1%/s	0 to 0xFFFFFFFF	0xFFFFFFFF	During running	Immediate
6091	Gear Ratio									
	00	Highest sub-indexes supported	RO	NO	UINT8	Uint8	-	0x02	-	-
	01	Motor resolution	RW	RPDO	UINT32	-	0 to 0xFFFFFFFF	20-bit encoder: 1 23-bit encoder: 8	During running	Immediate
	02	Shaft revolutions	RW	RPDO	UINT32	-	1–0xFFFFFFFF	1	During running	Immediate
6098	00	Homing methods	RW	RPDO	INT8	-	0x01 to 0x023	0x01	During running	Immediate
6099	Homing speed									
	00	Highest sub-indexes supported	RO	NO	UINT8	-	-	0x02	-	-
	01	Speed during search for switch	RW	RPDO	UINT32	Reference unit/s	0 to 0xFFFFFFFF	0x001AAAAB	During running	Immediate
	02	Speed during search for zero	RW	RPDO	UINT32	Reference unit/s	0 to 0xFFFFFFFF	0x0002AAAB	During running	Immediate
609A	00	Homing acceleration	RW	RPDO	UINT32	Reference unit/s2	0 to 0xFFFFFFFF	0x682AAAA6	During running	Immediate
60B0	00	Position offset	RW	RPDO	INT32	Reference unit	0x80000000 to 0x7FFFFFFF	0	During running	Immediate
60B1	00	Velocity offset	RW	RPDO	INT32	Reference unit/s	0x80000000 to 0x7FFFFFFF	0	During running	Immediate
60B2	00	Torque offset	RW	RPDO	INT16	0.1%	0xF448–0x0BB8	0	During running	Immediate
60B8	00	Touch probe function	RW	RPDO	UINT16	-	0 to 0xFFFF	0	During running	Immediate
60B9	00	Touch probe status	RW	RPDO	UINT16	-	-	0	-	-
60BA	00	Touch probe pos1 pos value	RW	RPDO	INT32	Reference unit	-	0	-	-
60BB	00	Touch probe pos1 neg value	RW	RPDO	INT32	Reference unit	-	0	-	-
60BC	00	Touch probe pos2 pos value	RW	RPDO	INT32	Reference unit	-	0	-	-
60BD	00	Touch probe pos2 neg value	RW	RPDO	INT32	Reference unit	-	0	-	-
60D5	0x00	Touch probe 1 positive edge counter	RO	RPDO	UINT16	-	-	0	-	-
60D6	0x00	Touch probe 1 negative edge counter	RO	RPDO	UINT16	-	-	0	-	-

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
60D7	0x00	Touch probe 2 positive edge counter	RO	RPDO	UINT16	-	-	0	-	-
60D8	0x00	Touch probe 2 negative edge counter	RO	RPDO	UINT16	-	-	0	-	-
60E0	00	Positive torque limit value	RW	RPDO	UINT16	0.1%	0 to 0x0BB8	0x0BB8	During running	Immediate
60E1	00	Negative torque limit value	RW	RPDO	UINT16	0.1%	0 to 0x0BB8	0x0BB8	During running	Immediate
60E3	Supported Homing Methods									
	00	Highest sub-indexes supported	RO	NO	UINT8	-	-	0x1F	-	-
	01	1st supported homing method	RO	NO	UINT16	-	-	0x0301	-	-
	02	2nd supported homing method	RO	NO	UINT16	-	-	0x0302	-	-
	03	3rd supported homing method	RO	NO	UINT16	-	-	0x0303	-	-
	04	4th supported homing method	RO	NO	UINT16	-	-	0x0304	-	-
	05	5th supported homing method	RO	NO	UINT16	-	-	0x0305	-	-
	06	6th supported homing method	RO	NO	UINT16	-	-	0x0306	-	-
	07	7th supported homing method	RO	NO	UINT16	-	-	0x0307	-	-
	08	8th supported homing method	RO	NO	UINT16	-	-	0x0308	-	-
	09	9th supported homing method	RO	NO	UINT16	-	-	0x0309	-	-
	0A	10th supported homing method	RO	NO	UINT16	-	-	0x030A	-	-
	0B	11th supported homing method	RO	NO	UINT16	-	-	0x030B	-	-
	0C	12th supported homing method	RO	NO	UINT16	-	-	0x030C	-	-
	0D	13th supported homing method	RO	NO	UINT16	-	-	0x030D	-	-
	0E	14th supported homing method	RO	NO	UINT16	-	-	0x030E	-	-

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
60E3	0F	15th supported homing method	RO	NO	UINT16	-	-	0x030Fh	-	-
	10	16th supported homing method	RO	NO	UINT16	-	-	0x0310	-	-
	11	17th supported homing method	RO	NO	UINT16	-	-	0x0311	-	-
	12	18th supported homing method	RO	NO	UINT16	-	-	0x0312	-	-
	13	19th supported homing method	RO	NO	UINT16	-	-	0x0313	-	-
	14	20th supported homing method	RO	NO	UINT16	-	-	0x0314	-	-
	15 years	21th supported homing method	RO	NO	UINT16	-	-	0x0315	-	-
	16	22th supported homing method	RO	NO	UINT16	-	-	0x0316	-	-
	17	23th supported homing method	RO	NO	UINT16	-	-	0x0317	-	-
	18	24th supported homing method	RO	NO	UINT16	-	-	0x0318	-	-
	19	25th supported homing method	RO	NO	UINT16	-	-	0x0319	-	-
	1A	26th supported homing method	RO	NO	UINT16	-	-	0x031A	-	-
	1B	27th supported homing method	RO	NO	UINT16	-	-	0x031B	-	-
	1C	28th supported homing method	RO	NO	UINT16	-	-	0x031C	-	-
	1D	29th supported homing method	RO	NO	UINT16	-	-	0x031D	-	-
	1E	30th supported homing method	RO	NO	UINT16	-	-	0x031E	-	-
	1F	31th supported homing method	RO	NO	UINT16	-	-	0x031F	-	-

Index (hex)	Sub-index (hex)	Name	Access	PDO Mapping	Data Type	Unit	Data Range	Default	Change Condiction	Effective Condition
60E6	00	Additional position encoder resolution – encoder increments	RW	NO	UINT16	-	0 to 1	0	During running	Immediate
60F4	00	Following error actual value	RO	RPDO	INT32	Reference unit	-	-	-	-
60FC	00	Position demand internal value	RO	TPDO	INT32	Encoder unit	-	-	-	-
60FD	00	Digital inputs	RO	RPDO	UINT32	-	-	-	-	-
60FE	Digital Output									
	00	Highest sub-index supported	RO	NO	UINT8	-	-	0x02	-	-
	01	Physical output	RW	RPDO	UINT32	-	0 to 0xFFFFFFFF	0	During running	Immediate
	02	Bit mask	RW	NO	UINT32	-	0 to 0xFFFFFFFF	0	During running	Immediate
60FF	00	Target velocity	RW	RPDO	INT32	Reference unit/s	0x80000000 to 0x7FFFFFFF	0	During running	Immediate
6502	00	Supported drive modes	RO	NO	UINT32	-	-	0x000003AD	-	-

Object Group 2000h

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2000	01h	H00-00	Motor SN	-	0 to 65535	14000	1	16 bits	At stop	Power-on again
	03h	H00-02	Customized motor SN	-	0 to 0xFFFFFFFF	0	1	32 bits	-	-
	05h	H00-04	Encoder version SN	-	0 to 65535	0	0.1	16 bits	-	-
	06h	H00-05	Bus motor SN	-	0 to 65535	0	1	16 bits	-	-
	09h	H00-08	Serial encoder type	-	0 to 65535	0	1	16 bits	At stop	Power-on again
	0Ah	H00-09	Rated voltage	0: 220 V 1: 380 V	0 to 1	0	1	16 bits	At stop	Power-on again
	0Bh	H00-10	Rated power	-	1 to 65535	75	0.01KW	16 bits	At stop	Power-on again
	0Ch	H00-11	Rated current	-	1 to 65535	470	0.01A	16 bits	At stop	Power-on again
	0Dh	H00-12	Rated torque	-	10 to 65535	239	0.01Nm	16 bits	At stop	Power-on again
	0Eh	H00-13	Maximum torque	-	10 to 65535	716	0.01Nm	16 bits	At stop	Power-on again
	0Fh	H00-14	Rated speed	-	100 to 6000	3000	1 RPM	16 bits	At stop	Power-on again
	10h	H00-15	Maximum motor rotational speed	-	100 to 6000	6000	1 RPM	16 bits	At stop	Power-on again
	11h	H00-16	Rotor inertia	-	1 to 65535	130	0.01 $kgcm^2$	16 bits	At stop	Power-on again

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2000	12h	H00-17	Number of pole pairs of PMSM	-	2 to 360	5	1	16 bits	At stop	Power-on again
	13h	H00-18	Stator resistance	-	1 to 65535	500	0.001Ω	16 bits	At stop	Power-on again
	14h	H00-19	Stator inductance Lq	-	1 to 65535	327	0.01mH	16 bits	At stop	Power-on again
	15h	H00-20	Stator inductance Ld	-	1 to 65535	387	0.01mH	16 bits	At stop	Power-on again
	16h	H00-21	Line back EMF coefficient	-	1 to 65535	3330	0.01 mV/ rpm	16 bits	At stop	Power-on again
	17h	H00-22	Torque coefficient Kt	-	1 to 65535	51	0.01 Nm/ Arms	16 bits	At stop	Power-on again
	18h	H00-23	Electrical constant Te	-	1 to 65535	654	0.01 ms	16 bits	At stop	Power-on again
	19h	H00-24	Mechanical constant Tm	-	1 to 65535	24	0.01 ms	16 bits	At stop	Power-on again
	1Dh	H00-28	Position offset of absolute encoder	-	0 to 4294967295	8192	1	32 bits	At stop	Power-on again
	1Fh	H00-30	Choosing encoder (HEX)	19: Inovance 20-bit serial encoder	0 to 0x0FFF	0x0013	1	16 bits	At stop	Power-on again
	20h	H00-31	Encoder PPR	-	1– 1073741824	8388608	1p/Rev	32 bits	At stop	Power-on again
	22h	H00-33	Electrical angle of Z signal	-	0 to 3600	1800	0.1°	16 bits	At stop	Power-on again
	26h	H00-37	Absolute encoder function setting position	-	0 to 0xFFFF	0	1	16 bits	At stop	Power-on again
2001h/H01: Drive Parameters										
2001	01h	H01-00	MCU software version SN	-	0 to 65535	0	0.1	16 bits	-	-
	02h	H01-01	FPGA software version	-	0 to 65535	0	0.1	16 bits	-	-
	03h	H01-02	FPGA customized SN	-	0 to 65535	0	0.1	16 bits	-	-
	04h	H01-03	CPU0 software version SN	-	0 to 65535	0	0.1	16 bits	-	-
	05h	H01-04	CPU1 software version SN	-	0 to 65535	0	0.1	16 bits	-	-
	08h	H01-07	Software test version SN	-	0 to 65535	0	0.01	16 bits	-	-
	0Bh	H01-10	Drive serial number	10001: T3R5 10002: T5R4 10003: T8R4 10004: T012 10005: T017 10006: T021 10007: T026	0 to 65535	10004	1	16 bits	At stop	Power-on again

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2001	0Ch	H01-11	Drive voltage class	-	-	380	1 V	16 bits	-	-
	0Dh	H01-12	Drive rated power	-	-	300	0.01 kW	32 bits	-	-
	0Fh	H01-14	Drive maximum output power	-	-	300	0.01 kW	32 bits	-	-
	11h	H01-16	Drive rated output current	-	-	1190	0.01 A	32 bits	-	-
	13h	H01-18	Drive maximum output current	-	-	2380	0.01 A	32 bits	-	-
	15h	H01-20	Carrier frequency	-	4000 to 20000	8000	1 HZ	16 bits	At stop	Power-on again
	16h	H01-21	Dead zone time	-	1 to 2000	300	0.01 us	16 bits	At stop	Power-on again
	17h	H01-22	D-axis coupling voltage compensation coefficient	-	0 to 60000	500	0.1%	16 bits	During running	Immediate
	18h	H01-23	Q-axis back EMF compensation coefficient	-	0 to 60000	500	0.1%	16 bits	During running	Immediate
	19h	H01-24	D-axis current loop gain	-	0 to 20000	500	1 HZ	16 bits	During running	Immediate
	1Ah	H01-25	D-axis current loop integral compensation factor	-	1 to 10000	100	0.01	16 bits	During running	Immediate
	1Bh	H01-26	Current sampling Sinc3 filter data extraction rate	0: Extraction rate of 32 1: Extraction rate of 64 2: Extraction rate of 128 3: Extraction rate of 256	0 to 3	0	1	16 bits	At stop	Power-on again
	1Ch	H01-27	Q-axis current loop gain	-	0 to 20000	500	1 HZ	16 bits	During running	Immediate
	1Dh	H01-28	Q-axis current loop integral compensation factor	-	1 to 10000	100	0.01	16 bits	During running	Immediate
	1Eh	H01-29	Q-axis coupling voltage compensation coefficient	-	0 to 60000	500	0.1%	16 bits	During running	Immediate
	1Fh	H01-30	Bus voltage gain adjustment	-	500 to 1500	1000	0.1%	16 bits	At stop	Power-on again
	21h	H01-32	UV sampling relative gain	-	1 to 65535	32768	1	16 bits	At stop	Power-on again
	23h	H01-34	Drive unit over-temperature point	-	0 to 1500	760	0.1°C	16 bits	During running	Immediate
	25h	H01-36	Current sensor range	-	0 to 999999	6250	0.01 A	32 bits	At stop	Power-on again

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2001	27h	H01-38	FPGA phase current protective threshold	-	0 to 1000	900	0.1%	16 bits	At stop	Power-on again
	29h	H01-40	DC bus overvoltage protective point	-	0 to 2000	820	1 V	16 bits	-	-
	2Ah	H01-41	DC bus voltage discharge point	-	0 to 2000	760	1V	16 bits	At stop	Immediate
	2Bh	H01-42	DC bus voltage under pressure point	-	0 to 2000	350	1 V	16 bits	At stop	Immediate
	35h	H01-52	D-axis proportional gain in performance first mode	-	0 to 20000	2000	1 HZ	16 bits	During running	Immediate
	36h	H01-53	D-axis integral gain in performance first mode	-	1 to 10000	100	0.01	16 bits	During running	Immediate
	37h	H01-54	Q-axis proportional gain in performance first mode	-	0 to 20000	2000	1 HZ	16 bits	During running	Immediate
	38h	H01-55	Q-axis integral gain in performance first mode	-	1 to 10000	100	0.01	16 bits	During running	Immediate
	39h	H01-56	Current loop low pass cutoff frequency	-	0 to 65535	11000	1 HZ	16 bits	At stop	Power-on again
	3Dh	H01-60	FPGA scheduling frequency selection	0:32KHZ 1:16KHZ	0 to 1	0	1	16 bits	At stop	Power-on again
	3Eh	H01-61	Command scheduling frequency selection	0:4KHZ 1:2KHZ 2:1KHZ	0 to 2	0	1	16 bits	At stop	Power-on again
2002h/H02 Basic control parameters										
2002	01h	H02-00	Control mode selection	0: Speed mode 1: Position mode 2: Torque mode 9: EtherCAT mode 255: The axis is not used	0 to 255	9	1	16 bits	At stop	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2002	02h	H02-01	Absolute system selection	0: Incremental mode 1: Absolute position linear mode 2: Absolute position rotation mode	0 to 2	0	1	16 bits	At stop	Power-on again
	03h	H02-02	Rotating direction	0: CCW as the forward direction 1: CW as the forward direction	0 to 1	0	1	16 bits	At stop	Power-on again
	08h	H02-07	Stop mode at limit switch signal	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position locking state 2: Stop at zero speed, keeping de-energized state	0 to 2	1	1	16 bits	At stop	Immediate
	09h	H02-08	Stop mode at NO.1 fault	0: Coast to stop, keeping de-energized state 1: DB Stop, keeping de-energized state 2: DB Stop, keeping DB state	0 to 2	0	1	16 bits	At stop	Immediate
	0Ah	H02-09	Delay from brake output on to command received	-	0 to 500	250	1 ms	16 bits	During running	Immediate
	0Bh	H02-10	Delay from brake output off to motor de-energized	-	50 to 1000	150	1 ms	16 bits	During running	Immediate
	0Ch	H02-11	Motor speed threshold at brake output off in rotating state	-	20 to 3000	30	1 RPM	16 bits	During running	Immediate
	0Dh	H02-12	Delay from S-ON off to brake output off in the rotating state	-	1 to 1000	500	1 ms	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2002	10h	H02-15	LED warning display selection	0: Immediate output a warning message 1: Without outputting a warning message	0 to 1	0	1	16 bits	At stop	Immediate
	11h	H02-16	Brake enabling switch	0: Off 1: On	0 to 1	0	1	16 bits	At stop	Immediate
	1Fh	H02-30	User Password	-	0 to 65535	0	1	16 bits	During running	Immediate
	20h	H02-31	Parameter initialization	0: No operation 1: Restore factory settings 2: Clear the fault record	0 to 2	0	1	16 bits	At stop	Immediate
	21h	H02-32	H0B group function code selection	-	0 to 99	50	1	16 bits	During running	Immediate
	24h	H02-35	Panel data refresh rate	-	0 to 20	0	1 HZ	16 bits	During running	Immediate
	2Ah	H02-41	Factory password	-	0 to 65535	0	1	16 bits	During running	Immediate
2003h/H03 Terminal input parameters										
2003	03h	H03-02	DI1 terminal function selection	Description: It consists of three digits, the first one (from left to right) indicates the axis number, and the last two digits indicate the terminal function. The last two digits are defined as follows: 0: No definition 01: S-ON 14: Forward limit switch 15: Reverse limit switch 31: Home switch 38: Probe 1 39: Probe 2	0 to 65535	0	1	16 bits	During running	Upon stop

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2003	04h	H03-03	DI1 terminal logic selection	0: Indicates that low level is valid 1: Indicates that high level is valid 2: Indicates that the rising edge is valid 3: Indicates that the falling edge is valid 4: Indicates that the rising and falling edges are valid	0 to 4	0	1	16 bits	During running	Upon stop
	05h	H03-04	DI2 terminal function selection	0 to 39 Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	06h	H03-05	DI2 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
	07h	H03-06	DI3 terminal function selection	(0 to 39) Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	08h	H03-07	DI3 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
	09h	H03-08	DI4 terminal function selection	0 to 39 Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	0Ah	H03-09	DI4 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
	0Bh	H03-10	DI5 terminal function selection	0 to 39 Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	0Ch	H03-11	DI5 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2003	0Dh	H03-12	DI6 terminal function selection	0 to 39 Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	0Eh	H03-13	DI6 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
	0Fh	H03-14	DI7 terminal function selection	0 to 39 Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	10h	H03-15	DI7 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
	11h	H03-16	DI8 terminal function selection	(0 to 39) Please refer to the description of the H03-02 option	0 to 65535	0	1	16 bits	During running	Upon stop
	12h	H03-17	DI8 terminal logic selection	0 to 4 Please refer to the description of the H03-03 option.	0 to 4	0	1	16 bits	During running	Upon stop
2004h/H04 Terminal output parameters										
2004	01h	H04-00	DO1 terminal function selection	Description: It consists of three digits, the first one (from left to right) indicates the axis number, and the last two digits indicate the terminal function. The last two digits are defined as follows: 0: No definition 01: Servo ready 02: Motor rotation 10: Warning 11: Fault	0 to 65535	0	1	16 bits	During running	Upon stop

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2004	02h	H04-01	DO1 terminal logic selection	0: Indicates L low level output when active (optocoupler is on) 1: Indicates H high level output when active (optocoupler is off)	0 to 1	0	1	16 bits	During running	Upon stop
	03h	H04-02	DO2 terminal function selection	0 to 11 Please refer to the description of the H04-00 option	0 to 65535	0	1	16 bits	During running	Upon stop
	04h	H04-03	DO2 terminal logic selection	0 to 1 Please refer to the description of the H04-01 option	0 to 1	0	1	16 bits	During running	Upon stop
2005h/H05 Position control parameters										
2005	05h	H05-04	Time constant of first-order low-pass filter	-	0 to 65535	0	0.1 ms	16 bits	At stop	Immediate
	07h	H05-06	Time constant of moving average filter	-	0 to 1280	0	0.1 ms	16 bits	At stop	Immediate
	14h	H05-19	Speed feedforward control selection	0: No speed feedforward 1: Internal speed feedforward 2: 60B1 used as speed feedforward	0 to 2	1	1	16 bits	At stop	Immediate
	24h	H05-35	Duration limit of homing	-	0 to 65535	50000	0.01s	16 bits	During running	Immediate
	2Fh	H05-46	Position offset in absolute position linear mode (low 32 bits)	-	0 to 4294967295	0	1	32 bits	At stop	Power-on again
	31h	H05-48	Position offset in absolute position linear mode (high 32 bits)	-	-2147483648–2147483647	0	1	32 bits	At stop	Power-on again
	33h	H05-50	Electronic gear ratio numerator	-	1 to 65535	1	1	16 bits	At stop	Immediate
	34h	H05-51	Electronic gear ratio denominator	-	1 to 65535	1	1	16 bits	At stop	Immediate
	35h	H05-52	Pulses within one revolution of load in absolute position rotating mode (low 32 bits)	-	0 to 4294967295	0	1p	32 bits	At stop	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2005	37h	H05-54	Pulses within one revolution of load in absolute position rotating mode (high 32 bits)	-	0 to 128	0	1p	32 bits	At stop	Immediate
2006h/H06 Speed Control Parameters										
2006	03h	H06-02	Speed reference selection	0: Number set 1: Multispeed	0 to 1	0	1	16 bits	At stop	Immediate
	04h	H06-03	Speed reference	-	-6000 to 6000	200	1 RPM	16 bits	During running	Immediate
	06h	H06-05	Acceleration ramp time of speed reference	-	0 to 65535	0	1 ms	16 bits	During running	Immediate
	07h	H06-06	Deceleration ramp time of speed reference	-	0 to 65535	0	1 ms	16 bits	During running	Immediate
	09h	H06-08	Forward speed limit	-	0 to 6000	6000	1 RPM	16 bits	During running	Immediate
	0Ah	H06-09	Reverse speed limit	-	0 to 6000	6000	1 RPM	16 bits	During running	Immediate
	0Ch	H06-11	Torque feedforward control selection	0: No torque feedforward 1: Internal torque feedforward 2: 60B2 is used as the external torque feedforward	0 to 2	1	1	16 bits	During running	Immediate
	0Dh	H06-12	Jog speed acceleration ramp time	-	0 to 65535	10	1 ms	16 bits	During running	Immediate
	11h	H06-16	Motor rotation speed threshold	-	0 to 1000	20	1 RPM	16 bits	During running	Immediate
2007h/H07 Torque control parameters										
2007	04h	H07-03	Torque reference operating panel setting	-	-3000 to 3000	0	0.1%	16 bits	During running	Immediate
	06h	H07-05	Time constant of torque reference filter	-	0 to 3000	79	0.01 ms	16 bits	During running	Immediate
	07h	H07-06	2nd time constant of torque reference filter	-	0 to 3000	79	0.01 ms	16 bits	During running	Immediate
	0Ah	H07-09	Internal forward torque limit	-	0 to 3000	3000	0.1%	16 bits	During running	Immediate
	0Bh	H07-10	Internal reverse torque limit	-	0 to 3000	3000	0.1%	16 bits	During running	Immediate
	10h	H07-15	Emergency stop torque	-	0 to 3000	1000	0.1%	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2007	14h	H07-19	Internal speed limit value for torque control	-	0 to 6000	3000	1 RPM	16 bits	During running	Immediate
	15h	H07-20	Internal speed negative limit value in torque control	-	0 to 6000	3000	1 RPM	16 bits	During running	Immediate
	16h	H07-21	Base value for torque reached	-	0 to 3000	0	0.1%	16 bits	During running	Immediate
	17h	H07-22	Torque value outputted when the torque reached DO signal is turned on,	-	0 to 3000	200	0.1%	16 bits	During running	Immediate
	18h	H07-23	Torque value outputted when the torque reached DO signal is turned off	-	0 to 3000	100	0.1%	16 bits	During running	Immediate
2008h/H08 Gain Parameters										
2008	01h	H08-00	Speed loop gain	-	1 to 20000	250	0.1 Hz	16 bits	During running	Immediate
	02h	H08-01	Time constant of speed loop integration	-	15 to 51200	3183	0.01 ms	16 bits	During running	Immediate
	03h	H08-02	Position loop gain	-	0 to 20000	400	0.1 Hz	16 bits	During running	Immediate
	04h	H08-03	2nd gain of speed loop	-	1 to 20000	400	0.1 Hz	16 bits	During running	Immediate
	05h	H08-04	2nd time constant of speed loop integration	-	15 to 51200	2000	0.01 ms	16 bits	During running	Immediate
	06h	H08-05	2nd gain of position loop	-	0 to 20000	640	0.1 Hz	16 bits	During running	Immediate
	09h	H08-08	2nd gain mode setting	0: The 1st gain is fixed and the P/PI switchover is performed using bit 26 of 60FE. 1: The 1st and 2nd gain switchovers are valid, and the switchover condition is H0809.	0 to 1	1	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2008	0Ah	H08-09	Gain switchover condition	0: The 1st gain is fixed (PS) 2: Large torque command (PS) 3: Large speed reference (PS) 4: Large speed reference change rate (PS) 5: Speed reference high-speed/ low-speed thresholds (PS) 6: Large position deviation (P) 7: Position reference available (P) 8: Positioning incomplete (P) 9: Actual speed (P) 10: Position reference + actual available speed (P)	0 to 10	0	1	16 bits	During running	Immediate
	0Bh	H08-10	Gain switchover delay	-	0 to 10000	50	0.1 ms	16 bits	During running	Immediate
	0Ch	H08-11	Gain switchover level	-	0 to 20000	50	1	16 bits	During running	Immediate
	0Dh	H08-12	Gain switchover hysteresis	-	0 to 20000	30	1	16 bits	During running	Immediate
	0Eh	H08-13	Position gain switchover time	-	0 to 10000	30	0.1 ms	16 bits	During running	Immediate
	10h	H08-15	Load/Rotor inertia ratio	-	0 to 12000	100	0.01	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2008	13h	H08-18	Time constant of speed feedforward filter	-	0 to 6400	50	0.01 ms	16 bits	During running	Immediate
	14h	H08-19	Speed feedforward gain	-	0 to 1000	0	0.1%	16 bits	During running	Immediate
	15h	H08-20	Time constant of torque feedforward filter	-	0 to 6400	50	0.01 ms	16 bits	During running	Immediate
	16h	H08-21	Torque feedforward gain	-	0 to 2000	0	0.1%	16 bits	During running	Immediate
	17h	H08-22	Speed feedback filter option	0: Moving average filter disabled 1: 2 moving average filters on speed feedback2: 4 moving average filters on speed feedback 3: 8 moving average filters on speed feedback 4: 16 moving average filters on speed feedback	0 to 4	0	1	16 bits	At stop	Immediate
	18h	H08-23	Cutoff frequency of speed feedback low-pass filter	-	100 to 4000	4000	1 HZ	16 bits	During running	Immediate
	19h	H08-24	PDFF control coefficient	-	0 to 1000	1000	0.1%	16 bits	During running	Immediate
2009h/H09 Self-adjustment parameters										
2009	01h	H09-00	Self-adjustment mode selection	0: Parameter self-adjustment is invalid. manually adjust the gain parameters. 1: Parameter self-adjustment mode, gain parameters tuned automatically based on the stiffness table 2: Positioning mode, gain parameters tuned automatically based on the stiffness table	0 to 2	0	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2009	02h	H09-01	Stiffness level selection	-	0 to 31	12	1	16 bits	During running	Immediate
	03h	H09-02	Mode selection of adaptive notch	0: The adaptive notches are no longer updated. 1: An adaptive notch is active (Group 3 notches). 2: Two adaptive notches are active (Group 3 and Group 4 notches). 3: Test only the resonance point shown in H0924. 4: Clear the adaptive notches, and restore the value of group 3 and group 4 notches to their default settings.	0 to 4	0	1	16 bits	During running	Immediate
	04h	H09-03	Online inertia auto-tuning mode	0: Disabled 1: Enabled, change slowly 2: Enabled, change always 3: Enabled, change quickly	0 to 3	0	1	16 bits	During running	Immediate
	05h	H09-04	Suppression mode of low-frequency resonance	0: Manually set the parameters of the low frequency resonance suppression filter. 1: Automatically set the parameters of the low frequency resonance suppression filter.	0 to 1	0	1	16 bits	During running	Immediate
	06h	H09-05	Offline inertia auto-tuning mode	0: Positive and negative triangular wave mode 1: JOG mode	0 to 1	0	1	16 bits	At stop	Immediate
	07h	H09-06	Maximum speed for inertia auto-tuning	-	100 to 1000	500	1 RPM	16 bits	At stop	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2009	08h	H09-07	Time constant of accelerating to max. speed for inertia auto-tuning	-	20 to 800	125	1 ms	16 bits	At stop	Immediate
	09h	H09-08	Interval after an inertia auto-tuning	-	50 to 10000	800	1 ms	16 bits	At stop	Immediate
	0Ah	H09-09	Motor revolutions for an inertia autotuning	-	0 to 65535	0	0.01	16 bits	-	-
	0Dh	H09-12	Group 1 notch frequency	-	50 to 4000	4000	1 Hz	16 bits	During running	Immediate
	0Eh	H09-13	Group 1 notch width level	-	0 to 20	2	1	16 bits	During running	Immediate
	0Fh	H09-14	Group 1 notch depth level	-	0 to 99	0	1	16 bits	During running	Immediate
	10h	H09-15	Group 2 notch frequency	-	50 to 4000	4000	1 Hz	16 bits	During running	Immediate
	11h	H09-16	Group 2 notch width level	-	0 to 20	2	1	16 bits	During running	Immediate
	12h	H09-17	Group 2 notch depth level	-	0 to 99	0	1	16 bits	During running	Immediate
	13h	H09-18	Group 3 notch frequency	-	50 to 4000	4000	1 Hz	16 bits	During running	Immediate
	14h	H09-19	Group 3 notch width level	-	0 to 20	2	1	16 bits	During running	Immediate
	15h	H09-20	Group 3 notch depth level	-	0 to 99	0	1	16 bits	During running	Immediate
	16h	H09-21	Group 4 notch frequency	-	50 to 4000	4000	1 Hz	16 bits	During running	Immediate
	17h	H09-22	Group 4 notch width level	-	0 to 20	2	1	16 bits	During running	Immediate
	18h	H09-23	Group 4 notch depth level	-	0 to 99	0	1	16 bits	During running	Immediate
	19h	H09-24	Obtained resonance frequency	-	0 to 2000	0	1 Hz	16 bits	-	-
	1Fh	H09-30	Torque disturbance compensation gain	-	-1000 to 1000	0	0.1%	16 bits	During running	Immediate
	20h	H09-31	Time constant of torque disturbance observer filter	-	0 to 2500	50	0.01 ms	16 bits	During running	Immediate
	21h	H09-32	Constant torque compensation value	-	-1000 to 1000	0	0.1%	16 bits	During running	Immediate
	22h	H09-33	Positive friction compensation value	-	-1000 to 1000	0	0.1%	16 bits	During running	Immediate
	23h	H09-34	Reverse friction compensation value	-	-1000 to 1000	0	0.1%	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
2009	27h	H09-38	Frequency of low-frequency resonance	-	10 to 1000	1000	0.1Hz	16 bits	During running	Immediate
	28h	H09-39	Filter setting of low-frequency resonance	-	0 to 10	2	1	16 bits	At stop	Immediate
200Ah/H0A Fault and Protection Parameters										
200A	01h	H0A-00	Power input phase loss protection	0: Enable faults and inhibit warnings. 1: Enable faults and warnings. 2: Disable faults and warnings.	0 to 2	0	1	16 bits	During running	Immediate
	02h	H0A-01	Absolute position limit	0: Disable absolute position limit 1: Enable absolute position limit 2: Enable absolute position limit after homing attaining	0 to 2	0	1	16 bits	At stop	Immediate
	04h	H0A-03	Retentive at power failure	0: Do not perform power-down save 1: Perform power-down save 2: Do not perform power-down save, shield control power supply undervoltage fault	0 to 2	0	1	16 bits	During running	Immediate
	05h	H0A-04	Motor overload protection gain	-	50 to 300	100	1	16 bits	At stop	Immediate
	07h	H0A-06	Overload motor level	-	0 to 400	0	1	16 bits	At stop	Immediate
	08h	H0A-07	Enable UVW phase sequence auto-tuning	0: Do not recognize UVW phase sequence while performing angle auto-tuning. 1: Recognize UVW phase sequence while performing angle auto-tuning.	0 to 1	1	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200A	09h	H0A-08	Overspeed threshold	-	0 to 10000	0	1 RPM	16 bits	During running	Immediate
	0Dh	H0A-12	Enable runaway protection function	0: Disable runaway protection 1: Enable runaway protection	0 to 1	1	1	16 bits	During running	Immediate
	0Eh	H0A-13	Initial angle auto-tuning mode selection	0: Use Z signal for auto-tuning 1: Do not use the Z signal for jogging auto-tuning 2: Voltage injection auto-tuning 3: Voltage injection using Z signal angle auto-tuning	0 to 3	0	1	16 bits	At stop	Immediate
	10h	H0A-15	Motor rotation threshold	-	1 to 1000	5	1 RPM	16 bits	During running	Immediate
	11h	H0A-16	Position deviation threshold for low-frequency resonance suppression	-	1 to 1000	5	1p	16 bits	During running	Immediate
	14h	H0A-19	Time constant of probe 1 filter	-	0 to 630	200	1 us	16 bits	During running	Immediate
	15h	H0A-20	Time constant of probe 2 filter	-	0 to 630	200	1 us	16 bits	During running	Immediate
	16h	H0A-21	STO function shield switch	0: Enable STO function. 1: Shield STO function.	0 to 1	0	1	16 bits	At stop	Immediate
	17h	H0A-22	Sigma_Delta filter time	-	0 to 3	1	1	16 bits	At stop	Power-on again
	18h	H0A-23	TZ signal filter time	-	0 to 31	15 years	125 ns	16 bits	At stop	Power-on again
	1Ah	H0A-25	Filter time constant of speed feedback display value	-	0 to 5000	50	1 ms	16 bits	At stop	Immediate
	1Bh	H0A-26	Enabling motor overload shielding	0: Show motor overload warnings. 1: Shield motor overload warnings (E2.909) and faults (E2.620).	0 to 1	0	1	16 bits	At stop	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200A	21h	H0A-32	Time threshold for locked rotor over-temperature protection	-	10 to 65535	200	1 ms	16 bits	During running	Immediate
	22h	H0A-33	Locked rotor over-temperature protection	0: Disabled 1: Enabled	0 to 1	1	1	16 bits	During running	Immediate
	25h	H0A-36	Encoder multi-turn overflow fault shield	0: Do not shield 1: Shield	0 to 1	0	1	16 bits	At stop	Immediate
200Bh/H0B monitor parameters										
200B	01h	H0B-00	Actual motor speed	-	-9999 to 9999	0	1 RPM	16 bits	-	-
	02h	H0B-01	Speed reference	-	-9999 to 9999	0	1 RPM	16 bits	-	-
	03h	H0B-02	Internal torque reference	-	-3000 to 3000	0	0.1%	16 bits	-	-
	04h	H0B-03	Input signal (DI signal) monitoring	-	0 to 0x00FF	0	1	16 bits	-	-
	06h	H0B-05	Output signal (DO signal) monitoring	-	0 to 0x0003	0	1	16 bits	-	-
	08h	H0B-07	Absolute position counter	-	-2147483648–2147483647	0	1p	32 bits	-	-
	0Ah	H0B-09	Mechanical angle	-	-	0 to 3600	0	0.1°	16 bits	-
	0Bh	H0B-10	Electric angle	-	-	0 to 3600	0	0.1°	16 bits	-
	0Dh	H0B-12	Average load ratio	-	-	0 to 65535	0	0.1%	16 bits	-
	10h	H0B-15	Position follow-up deviation (encoder unit)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	12h	H0B-17	Feedback pulse counter	-	-2147483648–2147483647	0	1p	32 bits	-	-
	14h	H0B-19	Total power-on time	-	0 to 4294967295	0	0.1s	32 bits	-	-
	19h	H0B-24	Phase current effective value	-	0 to 65535	0	0.01 A	32 bits	-	-
	1Bh	H0B-26	Bus voltage	-	0 to 65535	0	0.1 V	16 bits	-	-
	1Ch	H0B-27	Module temperature	-	0 to 65535	0	1□	16 bits	-	-
	1Dh	H0B-28	Absolute encoder fault information given by FPGA	-	0 to 0xFFFF	0	1	16 bits	-	-
	1Eh	H0B-29	System status information given by FPGA	-	0 to 0xFFFF	0	1	16 bits	-	-

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200B	1Fh	H0B-30	System failure information given by FPGA	-	0 to 0xFFFF	0	1	16 bits	-	-
	20h	H0B-31	Encoding internal fault information	-	0 to 0xFFFF	0	1	16 bits	-	-
	22h	H0B-33	Fault record	-	0 to 9	0	1	16 bits	During running	Immediate
	23h	H0B-34	Fault code of the selected fault record	-	0 to 0xFFFF	0	1	16 bits	-	-
	24h	H0B-35	Time stamp upon displayed fault	-	0 to 4294967295	0	0.1s	32 bits	-	-
	26h	H0B-37	Motor speed upon displayed fault	-	-9999 to 9999	0	1 RPM	16 bits	-	-
	27h	H0B-38	Motor phase U current upon displayed fault	-	-32768 to 32767	0	0.01 A	16 bits	-	-
	28h	H0B-39	Motor phase V current upon displayed fault	-	-32768 to 32767	0	0.01 A	16 bits	-	-
	29h	H0B-40	Bus voltage upon displayed fault	-	0 to 65535	0	0.1 V	16 bits	-	-
	2Ah	H0B-41	Input terminal state upon displayed fault	-	0 to 0x00FF	0	1	16 bits	-	-
	2Ch	H0B-43	Output terminal state upon displayed fault	-	0 to 0x0002	0	1	16 bits	-	-
	2Eh	H0B-45	Internal fault code	-	0 to 0xFFFF	0	1	16 bits	-	-
	2Fh	H0B-46	Absolute encoder error information given by FPGA when the fault is selected	-	0 to 0xFFFF	0	1	16 bits	-	-
	30h	H0B-47	System status information given by FPGA when the fault is selected	-	0 to 0xFFFF	0	1	16 bits	-	-
	31h	H0B-48	System failure information given by FPGA when the fault is selected	-	0 to 0xFFFF	0	1	16 bits	-	-

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200B	32h	H0B-49	Encoding internal fault information when the fault is selected	-	0 to 0xFFFF	0	1	16 bits	-	-
	34h	H0B-51	Internal fault code when the fault is selected	-	0 to 0xFFFF	0	1	16 bits	-	-
	36h	H0B-53	Position follow-up deviation (reference unit)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	38h	H0B-55	Actual motor speed	-	-60000 to 60000	0	0.1 RPM	32 bits	-	-
	3Ah	H0B-57	Control power bus voltage	-	0 to 65535	0	0.1 V	16 bits	-	-
	3Bh	H0B-58	Mechanical absolute position (low 32 bits)	-	0 to 4294967295	0	1p	32 bits	-	-
	3Dh	H0B-60	Mechanical absolute position (high 32 bits)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	47h	H0B-70	Number of the absolute encoder turns	-	0 to 65535	0	1	16 bits	-	-
	48h	H0B-71	Position of absolute encoder within one turn	-	0 to 2147483647	0	1p	32 bits	-	-
	4Eh	H0B-77	Encoder position (low 32 bits)	-	0 to 4294967295	0	1p	32 bits	-	-
	50h	H0B-79	Encoder position (high 32 bits)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	52h	H0B-81	Rotating load single-turn position (low 32 bits)	-	0 to 4294967295	0	1p	32 bits	-	-
	54h	H0B-83	Rotating load single-turn position (high 32 bits)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	56h	H0B-85	Rotating load single-turn position (reference unit)	-	-2147483648–2147483647	0	1p	32 bits	-	-
	5Bh	H0B-90	Function code group number with abnormal parameter	-	0 to 0xFFFF	0	1	16 bits	-	-
	5Ch	H0B-91	Offset in function code group with abnormal parameter	-	0 to 65535	0	1	16 bits	-	-

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200Dh/H0D Auxiliary Function Parameters										
200D	01h	H0D-00	Software reset	0: No operation 1: Enabled	0 to 1	0	1	16 bits	At stop	Immediate
	02h	H0D-01	Fault reset	0: No operation 1: Fault reset	0 to 1	0	1	16 bits	During running	Immediate
	04h	H0D-03	Encoder initial angle auto-tuning	0: No operation 1: Enable	0 to 1	0	1	16 bits	At stop	Immediate
	05h	H0D-04	Encoder ROM read/write	0: No operation 1: Write ROM 2: Read ROM	0 to 2	0	1	16 bits	At stop	Immediate
	06h	H0D-05	Emergency stop	0: No operation 1: Emergency stop	0 to 1	0	1	16 bits	During running	Immediate
	0Dh	H0D-12	UV phase current balance correction	0: Disable 1: Enable	0 to 1	0	1	16 bits	At stop	Immediate
	15h	H0D-20	Absolute encoder reset function	0: No operation 1: Fault 2: Reset faults and multi-turn data	0 to 2	0	1	16 bits	At stop	Immediate
200Eh/H0E Communication Function Parameters										
200E	01h	H0E-00	Node address	-	1 to 127	1	1	16 bits	During running	Immediate
	02h	H0E-01	Whether to save data to E2PROM if written via communication	0: Do not save data to EEPROM when writing function code and object dictionary. 1: Save data to EEPROM only when writing function code. 2: Save data to EEPROM only when writing object dictionary. 3: Save data to EEPROM both when writing function code and object dictionary.	0 to 3	pin 3	1	16 bits	During running	Immediate
	03h	H0E-02	Shaft address	-	1 to 127	1	1	16 bits	-	-

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
	09h	H0E-08	Servo node address selection	0: Node address determined by function code H0E-00 1: Node address determined by DIP switch 1	0 to 1	0	1	16 bits	During running	Immediate
	0Bh	H0E-10	CAN communication mode	0: Not selected 1: CANopen 2: CANlink	0 to 2	1	1	16 bits	During running	Immediate
	0Ch	H0E-11	CAN baud rate	0: 20K 1: 50K 2: 100K 3: 125K 4: 250K 5: 500K 6: 1M	0 to 6	5	1	16 bits	During running	Immediate
	0Dh	H0E-12	Number of CAN frames per unit time	-	0 to 65535	0	1	16 bits	-	-
	0Eh	H0E-13	Maximum CAN reception errors per unit time	-	0 to 255	0	1	16 bits	-	-
	0Fh	H0E-14	Maximum CAN send errors per unit time	-	0 to 255	0	1	16 bits	-	-
	10h	H0E-15	CAN bus disengagement times per unit time	-	0 to 65535	0	1	16 bits	-	-
	11h	H0E-16	CAN configuration mode	-	0 to 1	0	1	16 bits	During running	Immediate
	15h	H0E-20	EtherCAT slave station name	-	0 to 65535	0	1	16 bits	-	-
	16h	H0E-21	EtherCAT slave site alias	-	0 to 65535	0	1	16 bits	At stop	Immediate
	17h	H0E-22	Permissible interruption loss times of EtherCAT synchronization	-	1 to 20	9	1	16 bits	During running	Immediate
	18h	H0E-23	EtherCAT synchronization detection mode	0: Standard mode 1: Surplus mode	0 to 1	0	1	16 bits	During running	Immediate
	19h	H0E-24	Number of times of synchronization loss	-	0 to 65535	0	1	16 bits	-	-

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200E	1Ah	H0E-25	Maximum EtherCAT port 0 invalid frames and errors per unit time	-	0 to 0xFFFF	0	1	16 bits	-	-
	1Bh	H0E-26	Maximum EtherCAT port 1 invalid frames and errors per unit time	-	0 to 0xFFFF	0	1	16 bits	-	-
	1Ch	H0E-27	Maximum EtherCAT port forwarding errors per unit time	-	0 to 0xFFFF	0	1	16 bits	-	-
	1Dh	H0E-28	Maximum EtherCAT data frame processing unit errors per unit time	-	0 to 0x0255	0	1	16 bits	-	-
	1Eh	H0E-29	Maximum EtherCAT port 0 link losses per unit time	-	0 to 0xFFFF	0	1	16 bits	-	-
	1Fh	H0E-30	EtherCAT host type selection	-	0 to 3	2	1	16 bits	At stop	Immediate
	20h	H0E-31	EtherCAT synchronization mode settings	-	0 to 2	1	1	16 bits	At stop	Power-on again
	21h	H0E-32	EtherCAT synchronous error threshold	-	0 to 2000	500	1	16 bits	At stop	Immediate
	22h	H0E-33	EtherCAT state machine status	-	0 to 8	0	1	16 bits	-	-
	23h	H0E-34	Number of times the CSP position reference increment becomes too large	-	0 to 7	1	1	16 bits	During running	Immediate
	29h	H0E-40	EOE enabled	0: Disable 1: Enable	0 to 1	0	1	16 bits	During running	Immediate
	2Ah	H0E-41	EOE IP address highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	2Bh	H0E-42	EOE IP address second highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	2Ch	H0E-43	EOE IP address second lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	2Dh	H0E-44	EOE IP address lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200E	2Eh	H0E-45	EOE subnet mask highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	2Fh	H0E-46	EOE subnet mask second highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	30h	H0E-47	EOE subnet mask second lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	31h	H0E-48	EOE subnet mask lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	32h	H0E-49	EOE default gateway highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	33h	H0E-50	EOE default gateway second highest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	34h	H0E-51	EOE default gateway second lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	35h	H0E-52	EOE default gateway lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	36h	H0E-53	EOE uses the MAC highest byte	-	0 to 0x00FF	0	1	16 bits	-	-
	37h	H0E-54	EOE uses the MAC second byte	-	0 to 0x00FF	0	1	16 bits	-	-
	38h	H0E-55	EOE uses the MAC third byte	-	0 to 0x00FF	0	1	16 bits	-	-
	39h	H0E-56	EOE uses the MAC fourth byte	-	0 to 0x00FF	0	1	16 bits	-	-
	3Ah	H0E-57	EOE uses the MAC fifth byte	-	0 to 0x00FF	0	1	16 bits	-	-
	3Bh	H0E-58	EOE uses the MAC lowest byte	-	0 to 0x00FF	0	1	16 bits	-	-
	3Dh	H0E-60	Ethernet IP automatic acquisition enabled	0: Disable 1: Enable	0 to 1	0	1	16 bits	During running	Immediate
	3Eh	H0E-61	Ethernet IP address highest byte	-	0 to 255	192	1	16 bits	During running	Immediate
	3Fh	H0E-62	Ethernet IP address second-highest byte	-	0 to 255	168	1	16 bits	During running	Immediate
	40h	H0E-63	Ethernet IP address second-lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	41h	H0E-64	Ethernet IP address lowest byte	-	0 to 255	2	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200E	42h	H0E-65	Ethernet subnet mask highest byte	-	0 to 255	255	1	16 bits	During running	Immediate
	43h	H0E-66	Ethernet subnet mask second highest byte	-	0 to 255	255	1	16 bits	During running	Immediate
	44h	H0E-67	Ethernet subnet mask second lowest byte	-	0 to 255	255	1	16 bits	During running	Immediate
	45h	H0E-68	Ethernet subnet mask lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	46h	H0E-69	Ethernet default gateway highest byte	-	0 to 255	192	1	16 bits	During running	Immediate
	47h	H0E-70	Ethernet default gateway second highest byte	-	0 to 255	168	1	16 bits	During running	Immediate
	48h	H0E-71	Ethernet default gateway second lowest byte	-	0 to 255	0	1	16 bits	During running	Immediate
	49h	H0E-72	Ethernet default gateway lowest byte	-	0 to 255	1	1	16 bits	During running	Immediate
	51h	H0E-80	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	0 to 9	9	1	16 bits	During running	Immediate
	52h	H0E-81	Modbus data format	0: No parity, 2-stop bits (8-N-2) 1: Even parity, 1-stop bit (8-E-1) 2: Odd parity, 1-stop bit (8-O-1) 3: No parity, 1-stop bit (8-N-1)	0 to 3	pin 3	1	16 bits	During running	Immediate
	53h	H0E-82	Modbus response delay	-	0 to 20	0	1	16 bits	During running	Immediate

Parameter group			Name	Option Description	Setting Range	Default	Min. Unit	Width	Change method	Effective Way
Hexadecimal		Decimal								
Group	Index	Parameter								
200E	54h	H0E-83	Modbus communication timeout	-	0 to 600	0	1	16 bits	During running	Immediate
	5Bh	H0E-90	Modbus version SN	-	0 to 65535	0	0.01	16 bits	-	-
	5Ch	H0E-91	CANopen version SN	-	0 to 65535	0	0.01	16 bits	-	-
	5Dh	H0E-92	CANlink version SN	-	0 to 65535	0	0.01	16 bits	-	-
	5Eh	H0E-93	EtherCAT COE version SN	-	0 to 65535	0	0.01	16 bits	-	-
	5Fh	H0E-94	EtherCAT EOE version SN	-	0 to 65535	0	0.01	16 bits	-	-
	60h	H0E-95	Ethernet version SN	-	0 to 65535	0	0.01	16 bits	-	-

SDO Abort Transfer Code

Abort code	Function description
0503 0000	Toggle bit not alternated.
0504 0000	SDO protocol timed out.
0504 0001	Client/server command specifier invalid or unknown
0504 0005	Out of memory.
0601 0000	Unsupported access to an object.
0601 0001	Attempt to read a write-only object.
0601 0002	Attempt to write a read-only object.
0602 0000	The object does not exist in the object dictionary.
0604 0041	The object cannot be mapped to the PDO.
0604 0042	The number and length of the objects to be mapped exceed PDO length.
0604 0043	General parameter incompatibility.
0604 0047	General internal incompatibility in the device.
0606 0000	Access failed due to a hardware error.
0607 0010	The data type does not match andthe length of service parameter does not match.
0607 0012	The data type does not match and the service parameter is too long.
0607 0013	The data type does not match and the service parameters is too short.
0609 0011	The sub-index does not exist.
0609 0030	Invalid value for parameter.
0609 0031	The value of the written parameter is too large.
0609 0032	The value of the written parameter is too small.
0609 0036	The maximum value is less than the minimum value.
0800 0000	General error
0800 0020	Data cannot be transferred or stored to the application.
0800 0021	Data cannot be transferred or stored to the application because of local control.
0800 0022	Data cannot be transferred or stored to the application because of the present device state.
0800 0023	Dynamic object dictionary generation fails or no object dictionary is present.
0800 0024	The value does not exist.

Appendix 2 General Wiring Diagram IS810N-INT Series Servo System User Manual (Brief)

Appendix 2 General Wiring Diagram