



## MD500-EM1 Communication Expansion Card User Guide



Industrial  
Automation



Intelligent  
Elevator



New Energy  
Vehicle



Industrial  
Robot



Rail  
Transit



Data code 19012114 A00

# Preface

## About This Guide

The MD500 series communication expansion cards (hereinafter MD500-EM1 card) conform to Modbus-TCP protocol and feature high efficiency, flexible topology, and easy operation.

This document gives a detailed description of the MD500-EM1 card, including its specifications, dimensions, installation, wiring, communication protocol, communication parameters, and communication instances.

## Revision History

Date	Version	Description
March 2022	A00	First release

## How to Obtain

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

Log in to Inovance's website (<http://en.inovance.cn/>), choose **Support > Download**, search by keyword, and then download the PDF file.

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# General Safety Instructions

## Safety Precautions

1. This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe personal injuries, or equipment damage.
2. "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
3. Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
4. Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

## Safety Levels and Definitions



**Danger**

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



**Warning**

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



**Caution**

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

## General Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.

### Unpacking



**Warning**

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

 **Caution**

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

**Storage and Transportation**

 **Warning**

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

 **Caution**

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

**Installation**

 **Danger**

- The equipment must be operated only by professionals with electrical knowledge.

 **Warning**

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

 **Caution**

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

**Wiring** **Danger**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

 **Warning**

- Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

 **Caution**

- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

**Power-on**

 **Danger**

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

 **Warning**

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

**Operation**

 **Danger**

- The equipment must be operated only by professionals. Failure to comply will result in death or personal injuries.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.

 **Warning**

- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

### Maintenance

 **Danger**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

 **Warning**

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

### Repair

 **Danger**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

 **Warning**

- Require repair services according to the product warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries, or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

<b>Disposal</b>
<div style="display: flex; align-items: center;">  <div style="margin-left: 5px;"> <p><b>Warning</b></p> <ul style="list-style-type: none"> <li>• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.</li> <li>• Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.</li> </ul> </div> </div>

### Safety Labels

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

<b>Safety Label</b>	<b>Description</b>
	<ul style="list-style-type: none"> <li>• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage.</li> <li>• Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.</li> </ul>

# 1 Product Information

## 1.1 Applicable AC Drive

Expansion Card	Applicable AC Drive
MD500-EM1	MD500-PLUS
	MD520

## 1.2 Product Introduction

The MD500 series communication expansion cards (hereinafter MD500-EM1 card) conform to Modbus-TCP protocol and feature high efficiency, flexible topology, and easy operation. It is intended to be installed in the MD series AC drives to increase the communication efficiency and achieve networking of the drives, allowing the drive to act as a fieldbus slave controlled by the fieldbus master.

The software version of MD500-EM1 card required in this user guide is 1.00 or above. The software version can be obtained by checking parameter U0-67 on the drive after the card is installed and powered on. This user guide is applicable only to the MD500 and MD520 series AC drives. If you want to use the MD500-EM1 card on other AC drives, contact our technical engineers to confirm whether it works.

## 1.3 Appearance and Dimensions

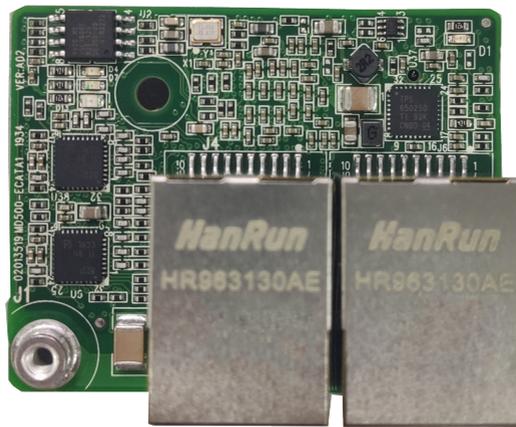


Figure 1-1 Appearance of MD500-EM1 card

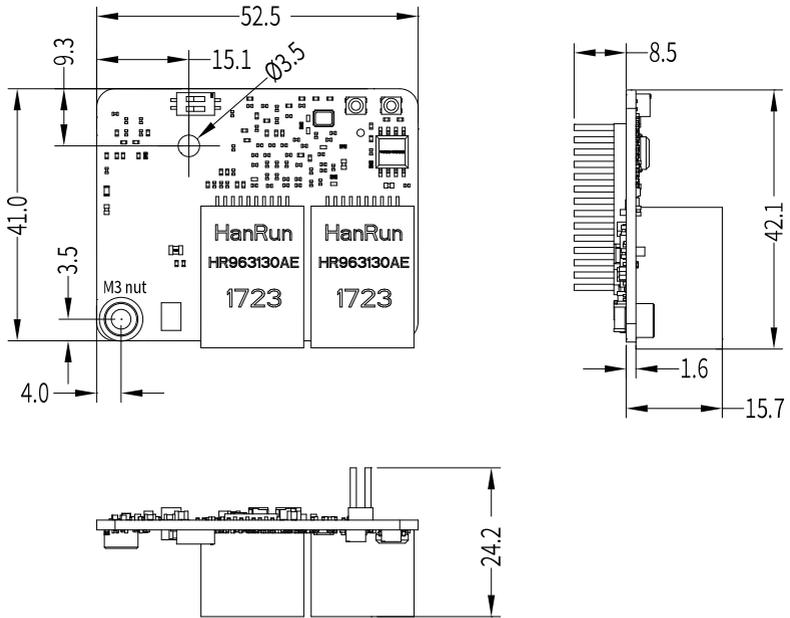


Figure 1-2 Dimensions of MD500-EM1 card (unit:mm)

## 1.4 Interface Layout and Description

The hardware layout of the MD500-EM1 card is shown in ["Table 1-1" on page 11](#). The pin header J7 on the back of the MD500-EM1 card is used to connect the AC drive. Two Ethernet interfaces J4 and J6 enable the MD500-EM1 card to communicate with the Modbus-TCP master or slave. For details about the hardware, see ["Table 1-1" on page 11](#).

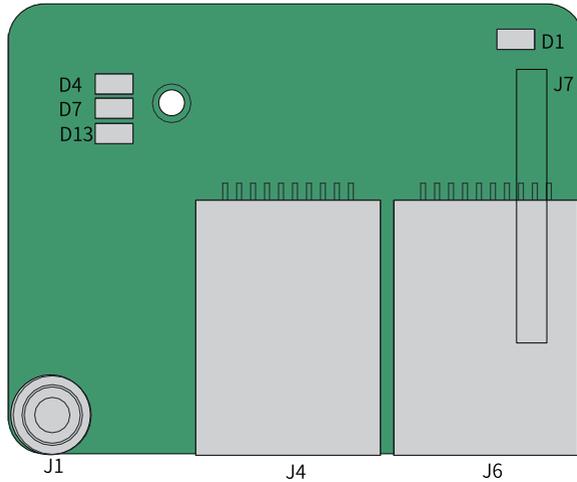


Figure 1-3 Interface layout of MD500-EM1 card

Table 1-1 Description of interfaces of MD500-EM1 card

Symbol	Hardware Name	Description
J7	Pin header	Connects to the AC drive.
J4	Network port	RJ45 socket. Enables the MD500-EM1 card to communicate with the Modbus-TCP master or slave. The definition of pins is standard. You can use either a crossover or a straight through Ethernet cable.
J6		
J1	EMC grounding terminal	Connects to the EMC ground terminal of the AC drive.
D13	Power indicator (green)	Indicates the power status. ON: Normal OFF: Abnormal (Check whether the card is installed properly.)
D1	AC drive communication status indicator (green)	For details, see <a href="#">"Table 1-2 Description of indicators of MD500-EM1 card" on page 12</a>
D4	Modbus-TCP running indicator (green)	
D7	Modbus-TCP fault indicator (red)	



- After MD500-EM1 card is installed, J2 is on the left and J3 is on the right when facing to the RJ45 interface. You can connect either J2 or J3 to the PLC.
- It is recommended to use shielded Cat 5e twisted pair cables to ensure stable operation.

Table 1-2 Description of indicators of MD500-EM1 card

Indicator	Description	Solution
D1: ON (green)	Normal	N/A
D1: OFF (green)	Abnormal communication with the AC drive	Check that FD-00 is set to 9 and FD-01 is set to 1.
D4: OFF (green), D7: ON (red)	System fault	Check the fault code of AC drive and take corresponding measures.
D4: OFF (green), D7: Blinking (red)	Waiting to get IP address	Put the expansion card into DHCP mode so that the expansion card can get IP address automatically from the DHCP server.
D4: Blinking (green), D7: Blinking (red)	Disconnected	Check that the network cable is connected properly.
D4: Blinking (green), D7: OFF (red)	Waiting to connect to master	Check that the master is running.
D4: ON (green), D7: Blinking (red)	Communication timeout	Checked that the master is running.
D4: ON (green), D7: OFF (red)	Normal	/

## 2 Installation and Wiring

### 2.1 Installation

You can insert the MD500-EM1 card into the MD500 series AC drives. Before installation, turn off the AC drive and wait about 10 minutes until the charging indicator on the AC drive becomes off. Then insert the MD500-EM1 card into the AC drive and fasten the screws to avoid damage to the signal socket between boards caused by tension of external signal cables. ["Figure 2-1 " on page 13](#) shows the installation.

Note that the ground terminals of both the MD500-EM1 card and AC drive must be connected properly, as shown in ["Figure 2-2 Ground terminal connection between the MD500-EM1 card and AC drive" on page 14](#).

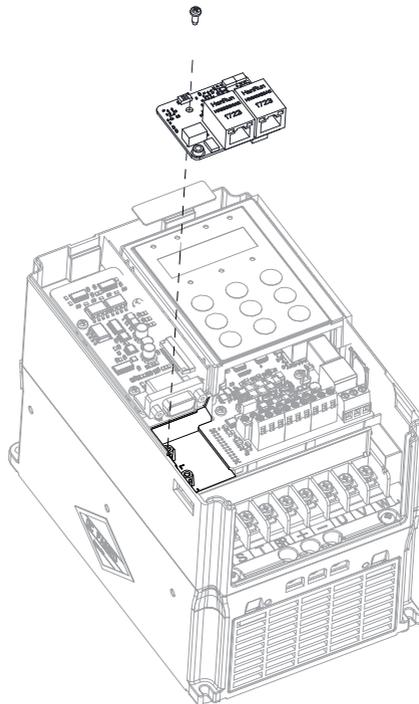


Figure 2-1 Installing the MD500-EM1 card

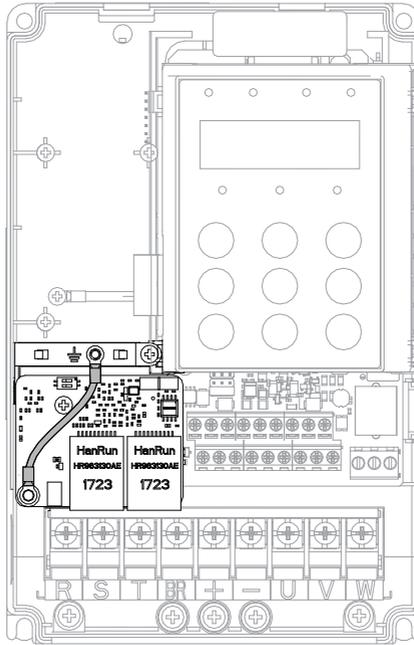


Figure 2-2 Ground terminal connection between the MD500-EM1 card and AC drive

## 2.2 Wiring

### 2.2.1 Network topology

Modbus-TCP supports multiple types of topologies including the bus type, star type, and tree type. Multiple types of networking can be achieved through the switch.



Figure 2-3 Bus-type topology

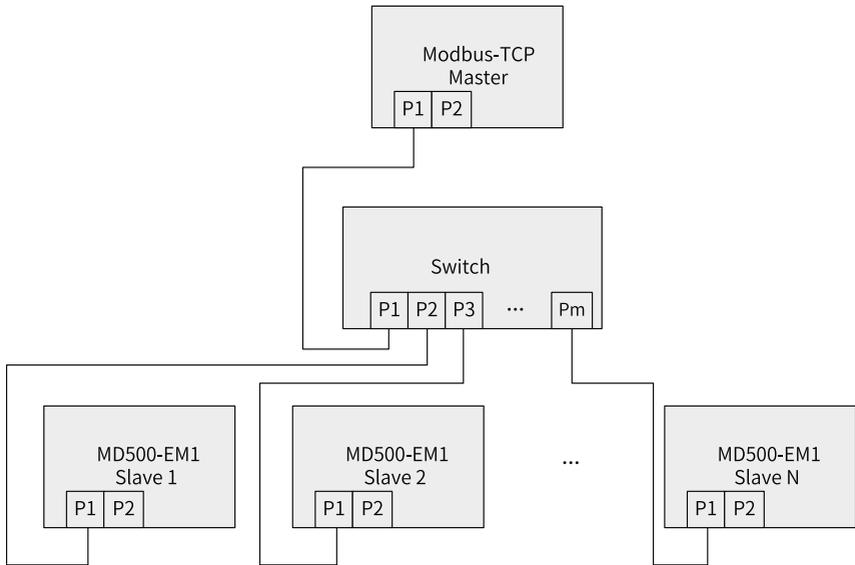


Figure 2-4 Star topology

## 2.2.2 EMC Wiring Instructions

- During on-site installation and commissioning, the signal cables and power cables must be laid in different ducts. Never bundle the signal cables and power cables together to prevent communication interference.
- Motor housing must be connected to PE terminal of the AC drive. Meanwhile, connect grounding cable of motor to motor housing reliably. Failure to comply will result in poor grounding effect.
- It is recommended to use shielded cables, with the shield connected to the PE terminal of the AC drive.

### 3 Modbus-TCP Communication Protocol

#### 3.1 Overview

Through the built-in Ethernet interface, the MD500-EM1 enables the AC drive to connect to a PC- or PLC-controlled network as a slave. The network includes one master and multiple slaves. You can carry out centralized control by using a PC or PLC. Through the Communication protocol, you can also set the running commands, modify or read parameters, and read the operating status and fault information of the AC drive.

The MD500-EM1 card supports Modbus-TCP communication protocol. This protocol defines the content and format of transmitted messages. If an error occurs when the slave receives a message, or the slave cannot complete the action required by the master, the slave responds with a fault message to the master.

#### 3.2 Communication Data Frame Format

The following figure shows the communication data format according to Modbus-TCP protocol. The AC drive only supports reading or writing word type parameters. The read command is 0x03, the write command is 0x06, and the multi-write command is 0x10.

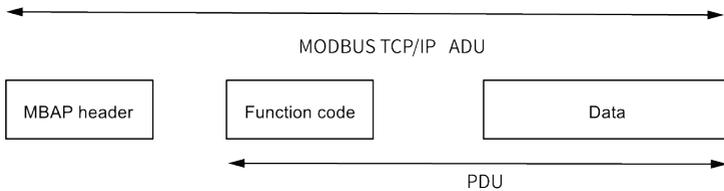
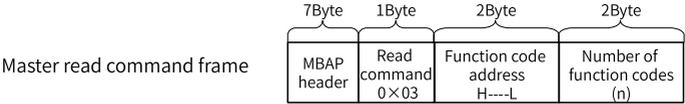


Figure 3-1 Modbus request/response over TCP/IP

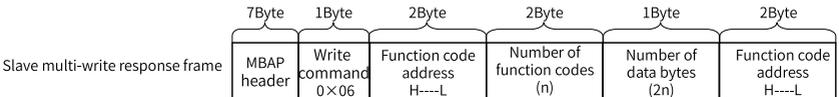
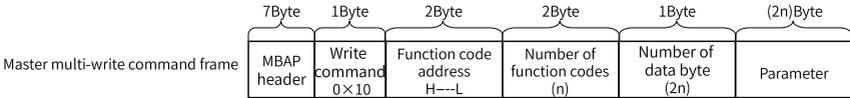
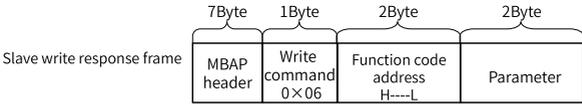
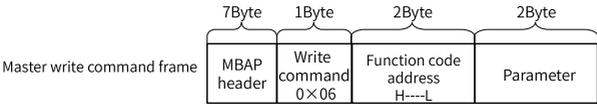
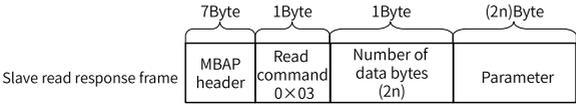
The MBAP header contains the following fields.

Field	Length	Description	Client	Server
Transaction identifier	2 bytes	Identifier of a Modbus request/response transactions	Initialized by the client	Recopied by the server from the received request
Protocol identifier	2 bytes	0 = Modbus protocol	Initiated by the client	Recopied by the server from the received request

Field	Length	Description	Client	Server
Length	2 bytes	Number of following bytes	Initialized by the client (Request)	Initialized by the server (Response)
Unit identifier	1 byte	Identification of a remote slave connected on the serial line or on other buses	Initialized by the client	The server copies the value from the received request



In theory, the host controller can read a maximum of 12 consecutive parameters. However, the last parameter it reads cannot jump to the next parameter group. Otherwise, a response error occurs.



The slave read response error command is 0x83. The write response error command is 0x86. The multi-write response error command is 0x90.

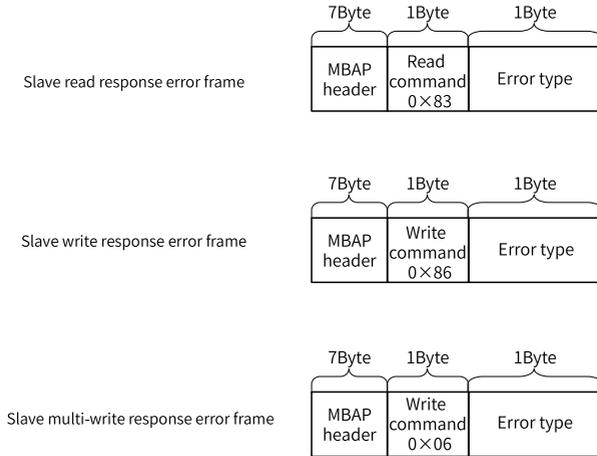


Table 3-1 Description of data frame fields

Command CMD	03: Read slave parameters; 06: Write slave parameters; 10: Multi-write slave parameters
Function code address	It is the internal parameter address of the AC drive, expressed in hexadecimal format. The parameters include functional parameters and non-functional parameters (running status and running command). During transmission, low-order bytes follow the high-order bytes.
Number of function codes	Number of parameters read in this frame. If it is 1, it indicates reading one parameter. During transmission, low-order bytes follow the high-order bytes. In the present protocol, only one parameter is read once, and this field is unavailable.
Number of data bytes	The data length is twice the number of parameters.
Parameter	Response data or data to be written. During transmission, low-order bytes follow high-order bytes.

## 4 Communication Parameters

### 4.1 Communication Card Type Setting for the AC Drive

#### Communication Card Type Setting for the MD520 Series AC Drive

After powering on the AC drive, set FD-00 to 9 and FD-01 to 3 to enable communication between the MD500-EM1 card and the AC drive.

Parameter	Name	Value Range	Value	Description
FD-00	Baud rate	Ones position 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 Tens position: Reserved Hundreds position: Reserved Thousands position: CANlink baud rate 0: 20 1: 50 2: 100 3: 125 4: 250 5: 500 6: 1 Mbps	Ones position: 9	Sets the data transfer rate between the communication extension card and the AC drive.
FD-01	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	3	Sets the format of Modbus data transmitted between the communication extension card and the AC drive.

## Communication Card Type Setting for the MD500-PLUS Series AC Drive

After powering on the AC drive, set FD-00 to 9 and FD-01 to 3 to enable communication between the MD500-EM1 card and the AC drive.

Parameter	Name	Value Range	Value	Description
FD-00	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	9	Sets the data transfer rate between the communication extension card and the AC drive.
FD-01	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	3	Sets the format of Modbus data transmitted between the communication extension card and the AC drive.

## 4.2 IP Address Setting of MD500-EM1 Card

The following table describes the IP settings of the communication card.

Parameter	Name	Value Range	Description
FD-37	DHCP enable	0: Disable DHCP 1: Enable DHCP	Sets the DHCP function of the card. Once the DHCP function is enabled, the manual IP settings do not take effect.
FD-38-FD-41	IP address	0 to 255	Sets the IP address of the card.
FD-42-FD-45	Subnet mask	0 to 255	Sets the subnet mask of the card.
FD-46-FD-49	Gateway	0 to 255	Sets the gateway of the card.

The IP address may be either static or dynamic one. You can choose the IP address allocation mode by setting FD-37. You can set the static IP address using parameters FD-37 to FD-49. For example, if you want to configure static IP address to 192.168.0.6, subnet mask to 255.255.255.0 and gateway to 192.168.0.1, use the parameter settings in the following table.

Parameter	Name	Value
FD-37	DHCP enable	0
FD-38	IP address highest byte	192
FD-39	IP address second highest byte	168
FD-40	IP address third byte	0
FD-41	IP address lowest byte	6
FD-42	Subnet mask highest byte	255
FD-43	Subnet mask second highest byte	255
FD-44	Subnet mask third byte	255
FD-45	Subnet mask lowest byte	0
FD-46	Gateway highest byte	192
FD-47	Gateway second highest byte	168
FD-48	Gateway third byte	0
FD-49	Gateway lowest byte	1

When using the DHCP BOOTP function, you can check the MAC address by either viewing the label information on the expansion card, or viewing the corresponding function code of the AC drive.

The expansion card also supports the IP address conflict detection. When the IP address of the expansion card is the same as other devices in the network, the D7 red indicator will be steady on. In this case, the value of parameter FD-58 is 84.

The IP address conflict may be detected in the following three circumstances.

No.	Circumstance	Symptom	Solution
1	Both devices support IP conflict detection, and are powered on sequentially.	The device that is powered on first retains the IP address and continues to operate, while the device that is powered on later enters conflict mode.	Check the IP address of the devices and modify the duplicate IP address.
2	Both devices support IP conflict detection, and are powered on almost at the same time.	Both devices enter IP conflict Mode at the same time.	
3	One device supports IP conflict detection, while the other does not.	No matter which device is powered on first, the device that does not support IP conflict detection will retain the IP address, while the device that supports IP conflict detection will enter conflict mode.	

### Note

- The expansion card implements active conflict detection upon power-on and DHCP IP address assignment, and it implements passive detection at other times. If the same dynamic (static) IP address is separately assigned to two devices, which are then connected to a network, neither of the two expansion cards will report an IP address conflict.
- IP address assignment by using the DHCP function will fail if an assignment conflict occurs during the process.

## 4.3 Expansion Card Parameters

Parameter	Name	Unit	Description
FD-61	First two bytes of MAC address of expansion card	1	MAC address of expansion card
FD-62	Two middle bytes of MAC address of expansion card	1	MAC address of expansion card

Parameter	Name	Unit	Description
FD-63	Last two bytes of MAC address of expansion card	1	MAC address of expansion card
FD-58	Expansion card error code	1	Expansion card error code

#### 4.4 Basic AC Drive Parameters

Parameter	Name	Description
F0-02	RUN command selection	0: Operating panel 1: Terminal 2: Communication 3: Custom
F0-03	Main frequency source X selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse setting (DI5) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication setting Other: F connector

#### 4.5 Modbus-Specific Parameter Communication Addresses

##### Modbus-Specific Parameter Communication Addresses for MD520 Series AC Drives

Table 4-1 Modbus-Specific Parameter Communication Addresses

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1000H	Communication setting value (decimal) -10000 to 10000	1010H	PID reference
1001H	Running frequency	1011H	PID feedback
1002H	Bus voltage	1012H	PLC process
1003H	Output voltage	1013H	Pulse input frequency (basic unit: 0.01 kHz)
1004H	Output current	1014H	Feedback speed (unit: 0.1 Hz)
1005H	Output power	1015H	Remaining running time
1006H	Output torque	1016H	Uncalibrated AI1 voltage

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1007H	Running speed	1017H	Uncalibrated AI2 voltage
1008H	DI input flag	1018H	Uncalibrated AI3 voltage
1009H	DO output flag	1019H	Linear speed
100AH	AI1 voltage	101AH	Current power-on time
100BH	AI2 voltage	101BH	Current running time
100CH	AI3 voltage	101CH	Pulse input frequency (unit: 1 Hz)
100DH	Counting value input	101DH	Reference value set through communication
100EH	Length value input	101EH	Actual feedback speed
100FH	Load speed	101FH	Main frequency X display
-		1020H	Auxiliary frequency Y display

Table 4-2 Modbus-specific parameter address description

Parameter Address	Parameter Description
Communication frequency reference 1 1000H	<p>Communication setting value (decimal) -10000 to +10000</p> <p>Communication setting values correspond to percentages. +10000 and -10000 correspond to +100.00% and -100.00% respectively.</p> <p>The communication references apply to the data setting through communication, such as the frequency, torque upper limit, V/f separation voltage, PID reference, and PID feedback.</p> <p>With regard to frequency, communication reference is a percentage of F0-10 (maximum frequency). With regard to torque, communication reference is a percentage of F2-10 and A2-48 (corresponding to motor 1 and motor 2, respectively).</p>
Communication frequency reference 2 7310H	<p>The write unit is Hz. The decimal place is determined by F0-22. For example, when F0-22 is set to 2, the decimal number 1000 means that the frequency reference is 10.00 Hz.</p>

Parameter Address	Parameter Description
Input of control commands to the AC drive 1 (write-only)	7311H 0: Stop mode set by F6-10 (Stop mode) 1: Forward run 2: Reverse run 3: Forward jog 4: Reverse jog 5: Coast to stop 6: Stop mode set by F6-10 (Stop mode) 7: Fault reset
Input of control commands to the AC drive 2 (write-only)	2000H 1: Forward run 2: Reverse run 3: Forward jog 4: Reverse jog 5: Coast to stop 6: Decelerate to stop 7: Fault reset
Read AC drive status 1	3000H 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault
Read AC drive status 2	7044H Bit0: Running status Bit1: Forward/Reverse state Bit2: Whether fault occurs Bit3: Whether output frequency reaches the frequency reference Bit4: Communication normal flag Bit5–7: Reserved Bit8–15: Fault code
Parameter locking password check	1F00H Parameter locking password check: If an actual password value is returned, it indicates that password check passes. If no password is set, namely, the password is 0, 0000H is returned.
Initialize parameters.	1F01H 1: Restore factory settings 4: Restore user backup parameters 501: Back up the current user parameters
DO control	2001H BIT0: DO1 control BIT1: DO2 control BIT2: RELAY1 output control BIT3: RELAY2 output control BIT4: FMR output control BIT5: VDO1 BIT6: VDO2 BIT7: VDO3 BIT8: VDO4 BIT9: VDO5
AO1 control (write-only)	2002H 0 to 7FFF indicate 0% to 100%

## Communication Parameters

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Parameter Address		Parameter Description
AO2 control (write-only)	2003H	0 to 7FFF indicate 0% to 100%
Pulse output control (write-only)	2004H	0 to 7FFF indicate 0% to 100%

Parameter Address	Parameter Address	Parameter Description
AC drive fault description	8000H	2: Overcurrent 5: Overvoltage 8: Pre-charge power fault 9: Undervoltage 10: AC drive overload 11: Motor overload 12: Input phase loss 13: Output phase loss 14: Overtemperature 15: External device fault 17: Pre-charge circuit error 18: Current sampling error 19: Motor auto-tuning error 20: Encoder/PG card erro 21: EEPROM error 22: Encoder card not activated To be continued

Parameter Address	Parameter Description
Continued	Continued 23: Output short-circuited to ground 26: Accumulative running time reached 27: User-defined fault 28: User-defined alarm 29: Accumulative power-on time reached 30: Output load lost 31: PID feedback lost during running 32: Parameter abnormal 40: Pulse-by-pulse current limit error 42: Too large speed deviation 43: Motor overspeed 45: Motor overtemperature 47: STO fault 51: Error in identifying magnetic pole position 55: Master-slave control fault 56: Self-check failure 1 57: Self-check failure 2 58: Self-check failure 3 59: Self-check failure 4 61: Braking overload 62: Brake pipe fault 63: External alarm 82: Buffer fault 85: Sequence fault 93: Motor control error 1 94: Motor control error 2 159: Fault reset error 160: Modbus timeout 161: CANOpen fault 162: CANLink fault 164: Expansion card fault 174: Abnormal-input protection

## Modbus-Specific Parameter Communication Addresses for MD520 Series AC Drives

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1000H	*Communication setting value (decimal) –10000 to 10000	1010H	PID reference
1001H	Running frequency	1011H	PID feedback
1002H	Bus voltage	1012H	PLC process
1003H	Output voltage	1013H	Pulse input frequency (basic unit: 0.01 kHz)
1004H	Output current	1014H	Feedback speed (unit: 0.1 Hz)
1005H	Output power	1015H	Remaining running time
1006H	Output torque	1016H	Uncalibrated AI1 voltage
1007H	Running speed	1017H	Uncalibrated AI2 voltage
1008H	DI input flag	1018H	Uncalibrated AI3 voltage
1009H	DO output flag	1019H	Linear speed
100AH	AI1 voltage	101AH	Current power-on time
100BH	AI2 voltage	101BH	Current running time
100CH	AI3 voltage	101CH	Pulse input frequency (basic unit: 1 Hz)
100DH	Counting value input	101DH	Current communication reference (read-only)
100EH	Length value input	101EH	Actual feedback speed
100FH	Load speed	101FH	Main frequency X display
–	–	1020H	Auxiliary frequency Y display

### Note

A communication reference is a percentage expressed as a fraction of the maximum frequency (F0-10). +10000 and –10000 correspond to +100.00% and –100.00% respectively. For torque dimension data, this percentage is F2-10 or A2-48 (digital setting of torque upper limit of the first or second motor).

Input of control commands to the AC drive (write-only)

Command Word Address	Command Definition
2000H	0001: Forward run
	0002: Reverse run
	0003: Forward jog
	0004: Reverse jog
	0005: Coast to stop
	0006: Decelerate to stop
	0007: Fault reset

Read drive state (read-only):

Status Word Address	State Word Function
3000H	0001: Forward run
	0002: Reverse run
	0003: Stop

Parameter locking password check: If an actual password is returned, password check succeeds. If no password is set, namely, the password is 0, 0000H is returned.

Password Address	Password Content
1F00H	*****

DO control (write-only)

Command Address	Command Content
2001H	BIT0: DO1 control BIT1: DO2 control BIT2: RELAY1 output control BIT3: RELAY2 output control BIT4: FMR output control BIT5: VDO1 BIT6: VDO2 BIT7: VDO3 BIT8: VDO4 BIT9: VDO5

AO1 control (write-only)

Command Address	Command Content
2002H	0 to 7FFF indicate 0% to 100%

AO2 control (write-only):

Command Address	Command Content
2003H	0 to 7FFF indicate 0% to 100%

Pulse output control (write-only)

Command Address	Command Content
2004H	0 to 7FFF indicate 0% to 100%

## AC drive fault description

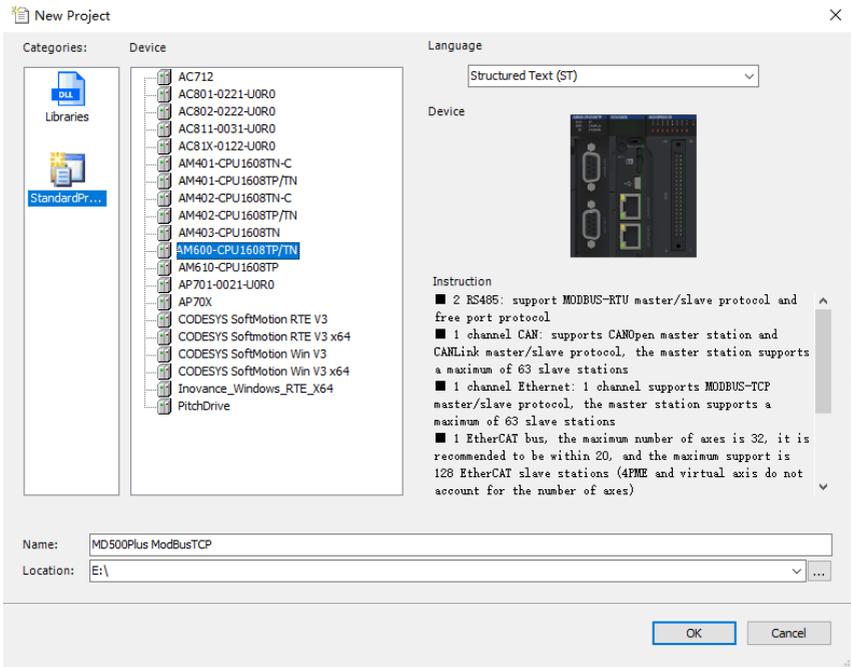
Fault Address	Fault Information	
8000H	0000: No fault 0001: Reserved 0002: Overcurrent during acceleration 0003: Overcurrent during deceleration 0004: Overcurrent at constant speed 0005: Overvoltage during acceleration 0006: Overvoltage during deceleration 0007: Overvoltage at constant speed 0008: Snubber resistor overload 0009: Undervoltage 000A: AC drive overload 000B: Motor overload 000C: Input phase loss 000D: Output phase loss 000E: Module overtemperature 000F: External fault 0010: Communication fault 0011: Contactor error 0012: Current detection fault 0013: Motor auto-tuning fault 0014: Encoder/PG card fault	0015: Parameter read-write fault 0016: AC drive hardware fault 0017: Motor short-circuited to ground 0018: Reserved 0019: Reserved 001A: Running time reach 001B: User-defined fault 1 001C: User-defined fault 2 001D: Accumulative power-on time reached 001E: Load lost 001F: PID feedback loss during running 0028: Fast current limit timeout 0029: Motor switchover error during running 002A: Excessive speed deviation 002B: Motor over-speed 002D: Motor overtemperature 005A: Encoder PPR reference error 005B: Encoder not connected 005C: Initial position error 005E: Speed feedback error

## 5 Communication Examples

### 5.1 Communication Example

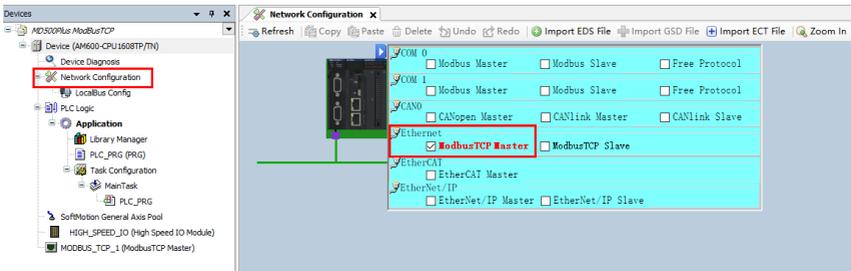
Step 1: Create a Project.

Open InoProShop, select AM600-CPU1608TP.



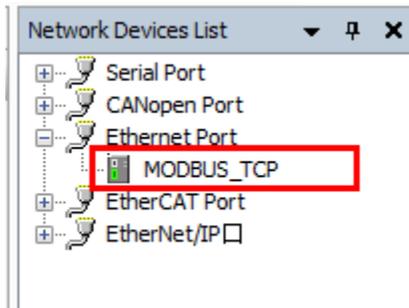
Step 2: Configure the network.

Double-click **Network Configuration** and configure the PLC as the ModbusTCP master.



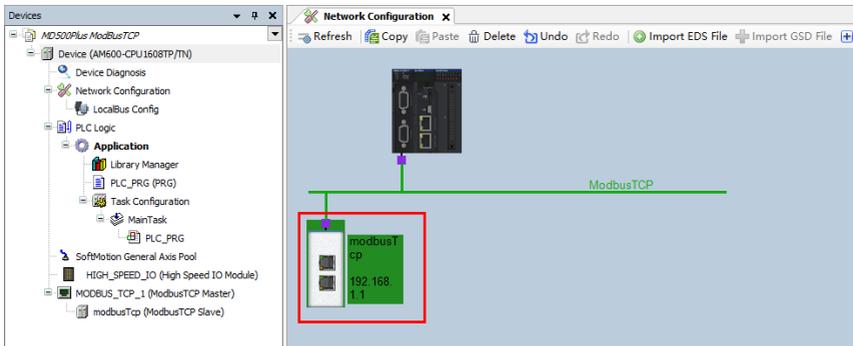
Step 3: Add a slave.

Double-click **MODBUS\_TCP**.

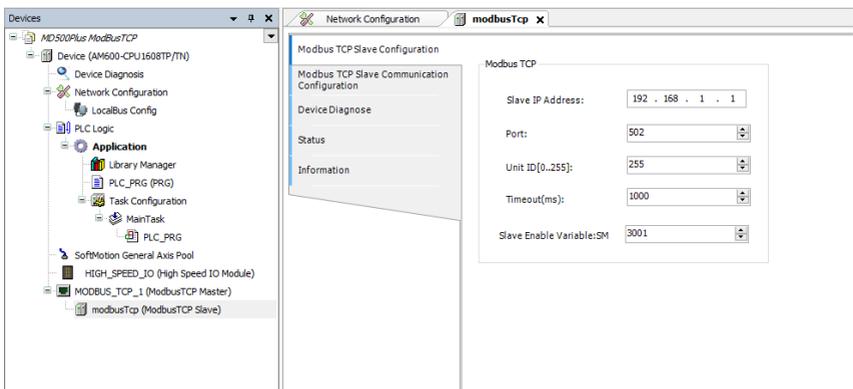


Step 4: Configure the slave.

You can double-click the slave to access the configuration interface.

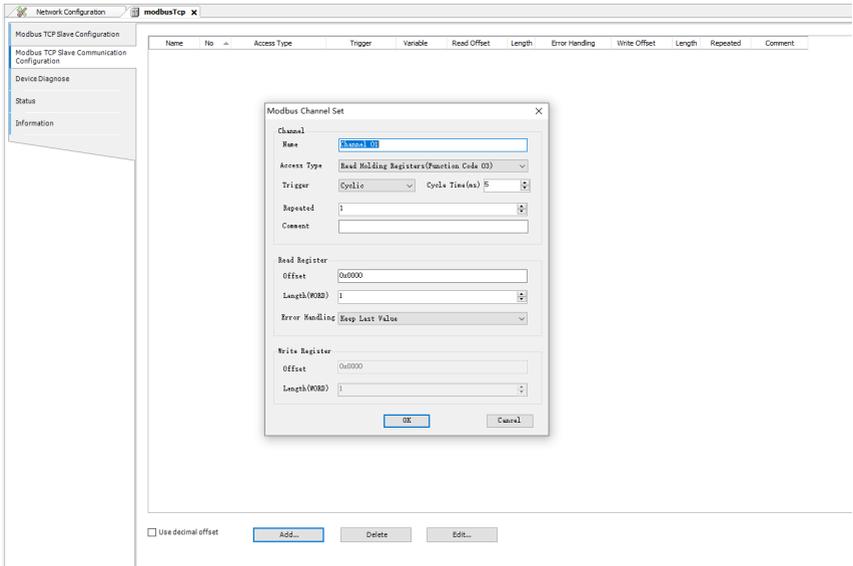


Configure the slave parameters, such as Slave IP Address, Port, Slave Enable Variable.



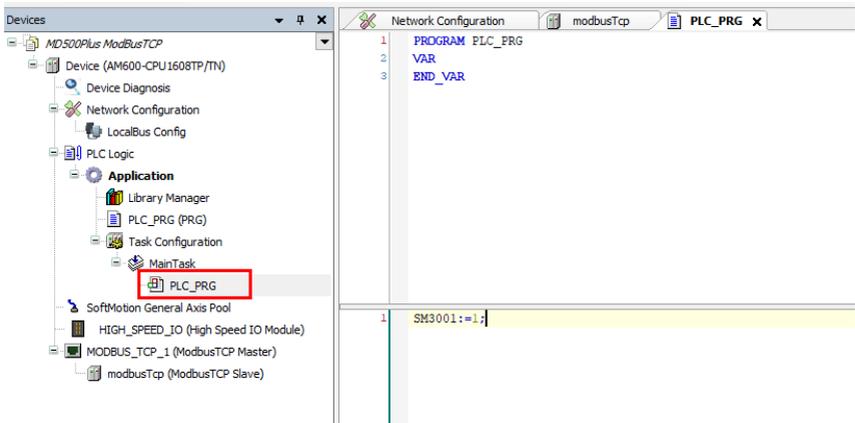
Step 5: Configure the read/write command.

Select **Modbus TCP Slave Communication Configuration** tab, and click **Add...**



Step 6: Enable the ModbusTCP communication.

Open the PLC\_PRG file and modify the Slave Enable Variable to enable the slave.



Download the project to the PLC, and you can observe the read/write variables in the **Internal I/O Mapping**.

The screenshot displays the 'Modbus TCP Slave Communication Configuration' window. The left sidebar shows a project tree where 'modbusTip (ModbusTCP Slave)' is selected under 'MODBUS\_TCP\_1 (ModbusTCP Master)'. The main window is divided into three sections: 'Modbus TCP Slave Communication Configuration', 'Device Diagnose', and 'Internal I/O Mapping'. The 'Internal I/O Mapping' section is active, showing a table of variable mappings for Channel 01. The table has columns for Variable, Mapping, Channel, Address, Type, Default Value, Unit, and Description.

Variable	Mapping	Channel	Address	Type	Default Value	Unit	Description
		Channel 01					
		Channel 01[0]	%ZWI	ARRAY [0..0] OF WORD			Read Holding Registers READ 16#F001(4#470)
		B#0	%X2.0	BOOL			
		B#1	%X2.1	BOOL			
		B#2	%X2.2	BOOL			
		B#3	%X2.3	BOOL			
		B#4	%X2.4	BOOL			
		B#5	%X2.5	BOOL			
		B#6	%X2.6	BOOL			
		B#7	%X2.7	BOOL			
		B#8	%X3.0	BOOL			
		B#9	%X3.1	BOOL			
		B#10	%X3.2	BOOL			
		B#11	%X3.3	BOOL			
		B#12	%X3.4	BOOL			
		B#13	%X3.5	BOOL			
		B#14	%X3.6	BOOL			
		B#15	%X3.7	BOOL			

## 6 Troubleshooting

### 6.1 Troubleshooting

The following table describes the faults that may occur during the usage of the MD500-EM1 card and AC drive.

Table 6-1 Fault causes and solutions

Symptom	Possible Causes	Solution
Communication failure between the MD500-EM1 card and the AC drive	<ol style="list-style-type: none"> <li>1. The AC drive does not support Modbus communication.</li> <li>2. The communication configuration of the MD500-EM1 card is incorrect.</li> <li>3. The MD500-EM1 card encountered a hardware failure.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check that the AC drive supports Modbus communication.</li> <li>2. Correctly configure the communication parameters of the MD500-EM1 card.</li> <li>3. Replace the MD500-EM1 card.</li> </ol>
Err164 communication error reported by the MD520 series AC drives during running Err16 communication error reported by the MD500-PLUS series AC drives during running	<ol style="list-style-type: none"> <li>1. The communication data is abnormal.</li> <li>2. The network cable is damaged or connected incorrectly.</li> <li>3. The AC drive suffers external interference.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check that the program of the Modbus-TCP master is normal.</li> <li>2. Check whether the network cable is connected correctly. Replace the network cable if required.</li> <li>3. Use the Cat5e shielded twisted pair (STP) network cable as required. Check that MD500-EM1 card is grounded correctly. Eliminate the external interference. Contact the agent or Inovance for technical support if necessary.</li> </ol>

To obtain the fault code, read DF-58 of the AC drive. The following table describes the faults and solutions.

Note that one fault code indicates one fault.

Fault Code	Description	Solution
0	/	/
81	Communication timeout	Check that the connecting is correct and the master runs normally.

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Fault Code	Description	Solution
82	Ethernet hardware error	Contact Inovance or the agent for technical support.
83	The MAC address is not burned or is lost.	Contact Inovance or the agent for technical support.
84	IP conflict	Check whether another device has the same IP address.
85	Link lost	Check the wiring.



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