



Modbus TCP Communication Expansion Card User Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code PS00019543

Preface

Introduction

The SI-EM card implements Modbus communication based on Ethernet and uses TCP/IP network to exchange high-speed data between devices. It complies with the international Modbus TCP industrial Ethernet standard.

This guide describes the AC drive, technical specifications, interface, and dimensions of the product. Installation, wiring, communication, troubleshooting, and so on.

Note

- The drawings in this guide are shown for illustration only and may be different from the product. Actual products may vary.
- The user guide is subject to change due to product upgrade, specification modification as well as efforts to the accuracy and convenience of the guide.

Revision history

Revision date	Version	Revision
2025-04	A00	First release of the manual.

Access to the guide

This guide is not shipped with the product. To obtain the electronic PDF file, you can obtain it by:

- Log in to the official website of Inovance (www.inovance.com), "Service and Support - Download", search for keywords, and download.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below, install the Inovance app on your hand, and search for MD800 in the app to get the manual.



Warranty disclaimer

If the product fails or is damaged under normal use, Inovance provides warranty services within the warranty period (see the order form for warranty period). After the warranty period expires, the maintenance fee will be charged.

During the warranty period, maintenance costs will be charged for damage caused by the following conditions.

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, and abnormal voltage.
- Damage caused by unintended use of the product

- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

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

For detailed warranty descriptions, see the Product Warranty Card.

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1 Product Information

1.1 Introduction

The SI-EM card implements Modbus communication based on Ethernet and uses TCP/IP network to exchange high-speed data between devices. It complies with the international Modbus TCP industrial Ethernet standard.

This module is mainly used on MD800 series AC drives. By using MD800-SI-EM, the MD800 series AC drives are used as Modbus TCP industrial Ethernet servers and are controlled by Modbus TCP industrial Ethernet clients. It improves the communication efficiency of the system and enriches the networking functions of the MD800 series AC drive.



Figure 1-1 Appearance of the SI-EM card

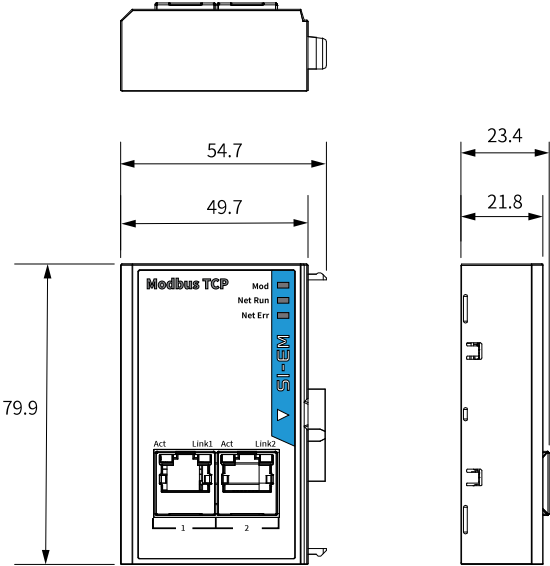
1.2 Adaptable AC drive

Card model	Ordering code	Adaptable AC drive
SI-EM	01040333	MD800

1.3 Technical Specifications

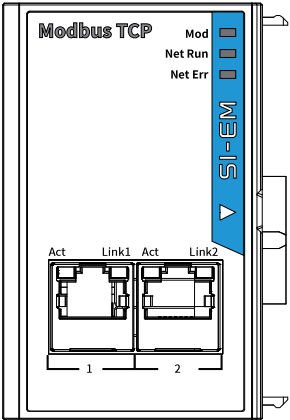
Project	Technical Specifications
Communication protocol	Modbus TCP protocol
Network setup time (LINK)	2s
Physical layer	100BASE-TX
Baud rate	100 Mbit/s (100 Base-TX)
Duplex mode	Full duplex
Topology	Linear
Transmission medium	Shielded cables of Cat 5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Communication port	502 (TCP)
Maximum number of parameters read at a time	12
Minimum communication period (ms)	Number of devices connected to the communication card x 6
The maximum number of slaves that can be connected	253
Bit error rate	10^{-10} Ethernet standard

1.4 Overall dimensions



1.5 Interface Description

Terminal layout



The Modbus TCP card (SI-EM) is connected to the Modbus TCP master with a standard Ethernet RJ45 socket. The pin signal definition is consistent with that of the standard Ethernet port. Both cross-wires and direct cables are available.

Description of the interface

Table 1–1 Description of the interface functions of the SI-EM card

Terminal identification	Terminal name	Description
Port1	Input terminal	• After installation, Port1 is on the left and Port2 is on the right from the front view of the card. • To ensure stability, use a Category 5 shielded twisted pair network cable. • To improve communication immunity, install the communication card in the expansion card slot 2 position.
Port2	Output terminal	

Description of the status indicators

Table 1-2 Description of the status indicators

Indicator		Description of the status	Solution
Mod	Steady green	Communication is normal	None
	Solid red	SI-EM card communication with master timeout	Check the connector for interference
	Red indicator flashing slowly	Communication between the SI-EM card and the power supply unit times out.	1. Check whether the communication card is installed properly 2. Check whether the power supply unit is normal
	Red indicator flashing quickly	The SI-EM card is faulty.	Troubleshoot the fault according to the fault code on the power supply unit display panel
Net Run Net Err	Steady green The red light is off	The SI-EM card is connected successfully	None
	Flashing green Red indicator OFF	Wait for the SI-EM card to connect	1. Check whether the network cable is connected properly and whether the master is running 2. Assign an IP address to the device by setting the IP function code on the panel
	Flashing green Flashes red	The connection is disconnected or times out	1. Check whether the network cable is connected properly and whether the device is online 2. Check whether a fault code is displayed on the operating panel of the power supply unit
	Green indicator OFF Solid red	The system is faulty	Check whether a fault code is displayed on the operating panel of the power supply unit

2 Instructions for Installation

- Switch off the power supply of the AC drive before installation. Wait about 10 minutes and wait until the charging indicator of the AC drive is completely off.
- Check whether the SI-EM card is firmly inserted into the AC drive to avoid damage to the interboard signal socket caused by external signal cable tension.
- The SI-EM card does not support hot-swapping.

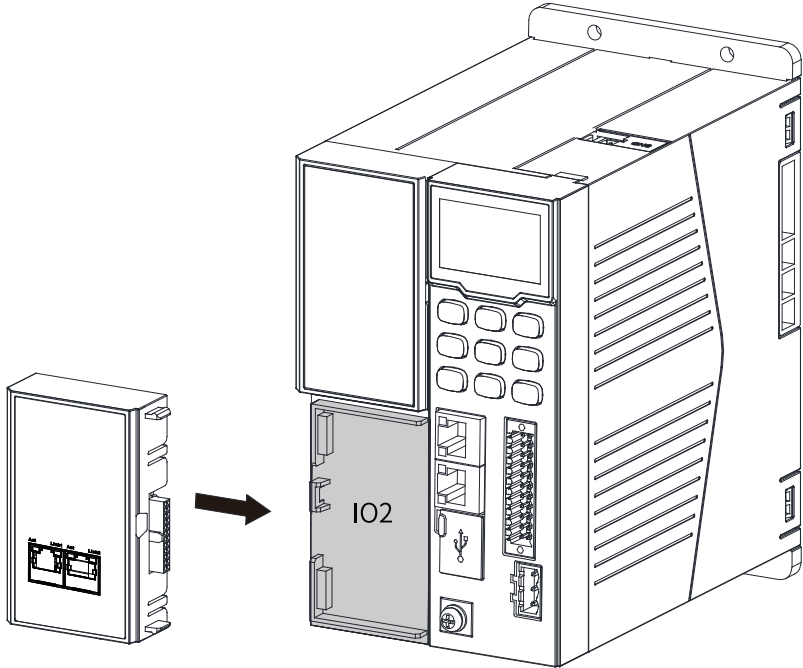


Figure 2-1 Install the SI-EM card

3 Electrical Connection

The supported topology of the Modbus TCP Ethernet bus includes bus type, star type, and tree type. Multiple networking can be implemented.

The following figure shows the Modbus TCP connection topology.

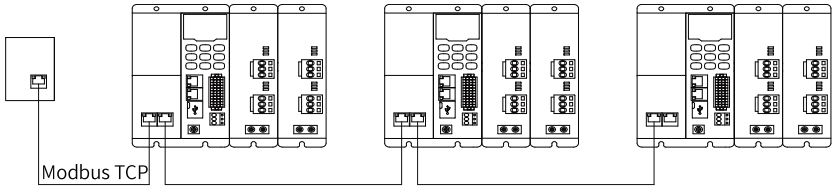


Figure 3-1 Modbus TCP bus connection topology

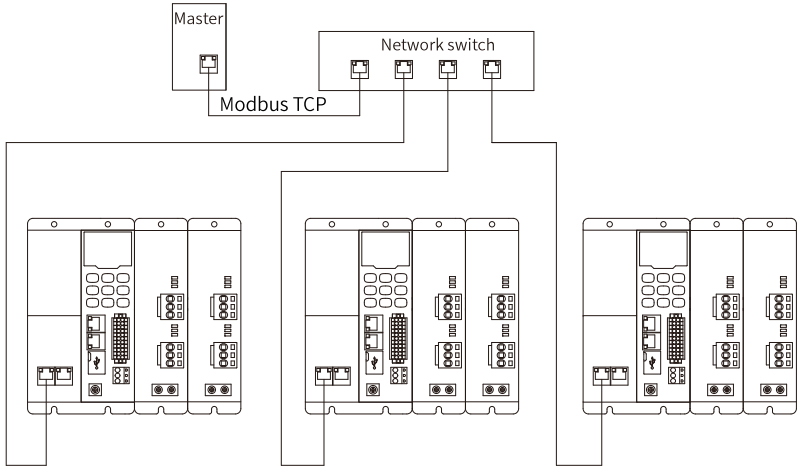


Figure 3-2 Modbus TCP star connection topology

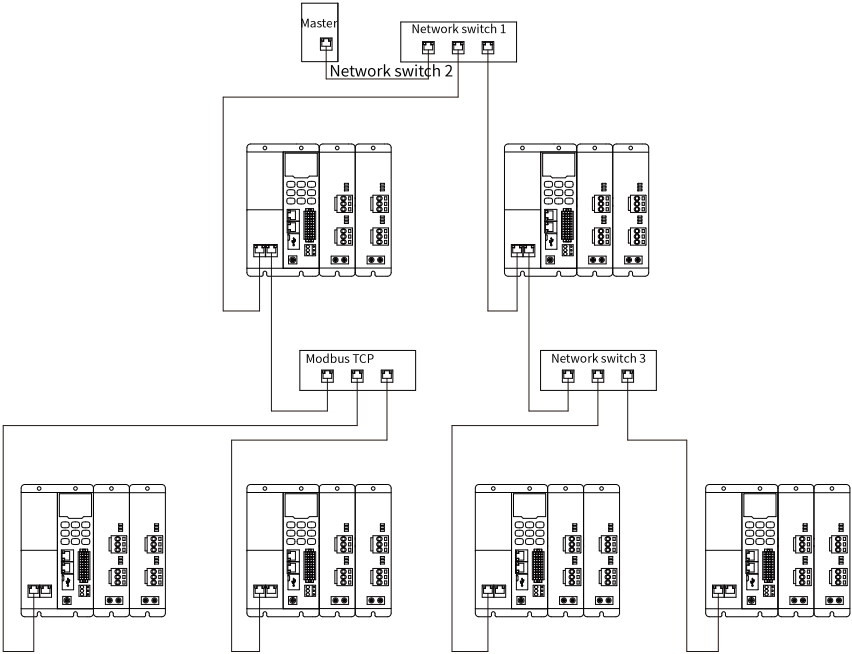


Figure 3-3 Modbus TCP tree connection topology

4 Modbus TCP Communication Protocol

4.1 Introduction

The SI-EM card implements Modbus communication based on Ethernet and uses TCP/IP network to exchange high-speed data between devices. It complies with the international Modbus TCP industrial Ethernet standard.

This module is mainly used on MD800 series AC drives. By using MD800-SI-EM, the MD800 series AC drives are used as Modbus TCP industrial Ethernet servers and are controlled by Modbus TCP industrial Ethernet clients. It improves the communication efficiency of the system and enriches the networking functions of the MD800 series AC drive.

4.2 Communication Data Frame Structure

The following figure shows the communication data format of the Modbus TCP protocol. The AC drive supports reading or writing only of word type parameters, and does not support reading or writing of bytes or bits. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is 0x10.

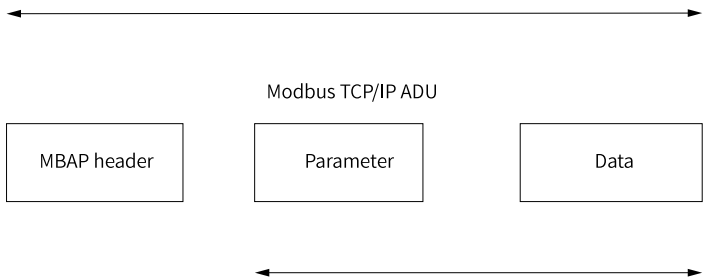
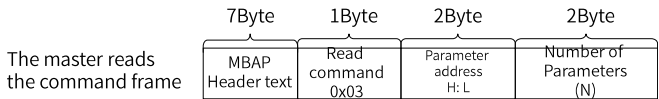


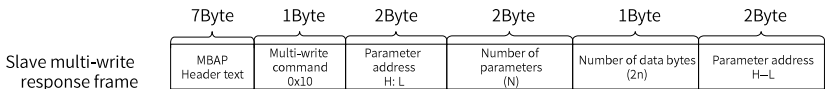
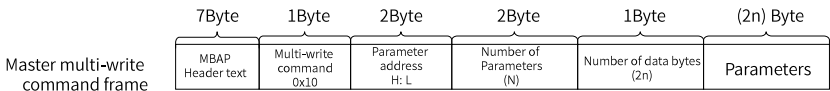
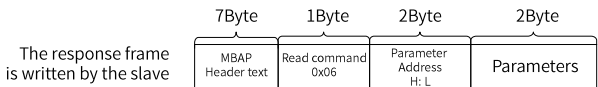
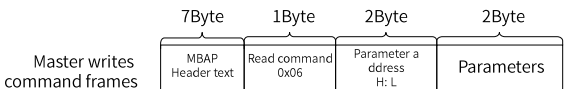
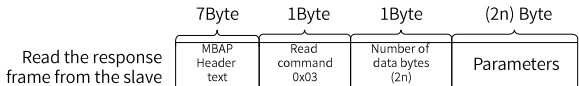
Figure 4-1 Modbus request/response over TCP/IP

The MBAP header includes the following fields.

Field	Length	Description	Client	Server
Transaction meta identifier	2 bytes	Identifier of the Modbus request/response transaction	Started by the client	The server recopies from the accepted request
Protocol identifier	2 bytes	0: Modbus protocol	The client starts	The server recopies from the accepted request
Length	2 bytes	The number of bytes below	Client startup (request)	The server (response) starts
Unit identifier	1 byte	Identifier of the remote slave connected on a serial link or other bus	The client starts	The server recopies from the accepted request



In theory, the host controller can read or write a maximum of 12 consecutive parameters. However, these parameters must be in the same group. Otherwise, a response error occurs.



The read response error command of the slave is 0x83, the write response error command is 0x86, and the multi-write response error command is 0x90

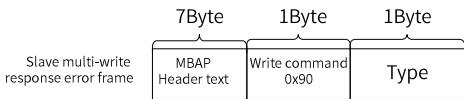
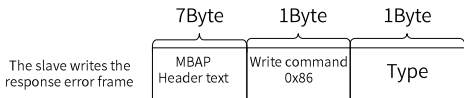
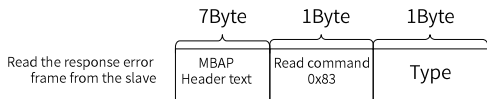


Table 4-1 Table of data frame field descriptions

Command code 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, the high byte is before the low byte is after the high byte.
Number of Parameters	The number of parameters read in this frame. If 1 is used, it indicates that 1 parameter is read. During transmission, the high byte is before the low byte is after the high byte. This protocol can only override one parameter at a time. This field is not available.
Number of data bytes	Data length, which is twice the number of parameters
Parameter	The data that is answered or to be written is transmitted with the high byte first. Low byte after

5 Parameter Configuration

AC drive SI-EM card setting

After installing the SI-EM card to the AC drive, you need to complete the following parameter configuration to enable the SI-EM card to communicate properly with the AC drive. Other non-essential function codes can be set according to actual application requirements.

Table 5-1 Parameters of power supply unit

Function code	Name	Set the range	Set value	Meaning
FD-10	Communication protocol selection	1: CANopen 2: CANlink 3: Communication card mode	3	Set to 1 for CANopen communication. Set to 2 for CANlink communication. If it is set to 3, the communication card mode is selected.
F0-01	Product No.	800	800	The product number corresponding to the drive can be read to determine whether it is MD800
F0-02	Software version	0.00 to 655.35	05.04	You can read this parameter to obtain the power supply version
FD-91	Communication card version	0.00 to 655.35	5.00	Indicates the communication expansion card software version.

The IP address of the SI-EM card is set

Table 5-2 IP address setting function code

Function code	Name	Set the range	Parameter description
AD-00	DHCP/BOOTP function	0: Disable 1: Enable	The SI-EM card does not support the DHCP function. The setting is invalid
AD-01	The highest byte of the IP address	1 to 254	Sets the highest byte of the IP address, ranging from 1 to 254 (0x01 to 0xFE) (displayed in decimal).
AD-02	The second highest byte of the IP address	0 to 254	Set the second highest byte of the IP address in the range 0 to 254 (0x00 to 0xFE) (displayed in decimal).
AD-03	The third byte of the IP address	0 to 254	Set the third byte of the IP address in the range 0 to 254 (0x00 to 0xFE) (displayed in decimal).

Function code	Name	Set the range	Parameter description
AD-04	The lowest byte of the IP address	1 to 253	Sets the lowest byte of the IP address, ranging from 1 to 253 (0x01 to 0xFD) (displayed in decimal).
AD-05	The highest byte of the subnet mask	0 to 255	Sets the highest byte of the subnet mask, ranging from 0 to 255 (0x00 to 0xFF) (displayed in decimal).
AD-06	The second highest byte of the subnet mask		
AD-07	Third byte of the subnet mask		
AD-08	The lowest byte of the subnet mask		
AD-09	The highest byte of the gateway	1 to 254	Sets the highest byte of the gateway, ranging from 1 to 254 (0x01 to 0xFE) (displayed in decimal)
AD-10	The second highest byte of the gateway	0 to 254	Set the second-highest byte of the gateway in the range 0 to 254 (0x00 to 0xFE) (displayed in decimal).
AD-11	Third byte of the gateway	0 to 254	Set the third byte of the gateway in the range 0 to 254 (0x00 to 0xFE) (displayed in decimal).
AD-12	The lowest byte of the gateway	0 to 254	Set the lowest byte of the gateway, ranging from 0 to 254 (0x00 to 0xFE) (displayed in decimal).
AD-16	Modbus TCP communication timeout	0.0 to 60.0	Defines the maximum time interval between two consecutive successful Modbus TCP communication. When 0.0s is set, the Modbus communication timeout parameter is invalid.

Note

The communication card can connect up to nine clients. The clients can communicate with the power supply unit or the drive unit by connecting different target IP points. The power supply unit IP is set to the preceding parameters. The first three segments of the power supply unit are consistent with the power supply unit. The lowest byte is calculated by the communication card based on the power supply unit IP. The calculation method is as follows:

Power supply unit IP: 192.168.1.n

Inverter i IP = 192.168.1.[(n-1) x 16+i+1]

Example:

Power supply unit IP = 192.168.1.1

Actual power supply IP = 192.168.1. [(1-1) x 16+1] = 192.168.1.1

Inverter 1 = 192.168.1. [(1-1) x 16+1+1] = 192.168.1.2

Inverter 2 = 192.168.1. [(1-1) x 16+2+1] = 192.168.1.3

Inverter 8 = 192.168.1. [(1-1) x 16+8+1] = 192.168.1.9

6 Communication Instance

Software acquisition and hardware wiring

1. Log in to Inovance's official website <http://www.inovance.com/support/download.html> and AC801 programming software InoProShop.
2. Connect the AC 810 LAN port A or B to the AC drive SI-EM card port 1 or 2 using a standard network cable.

Specific examples

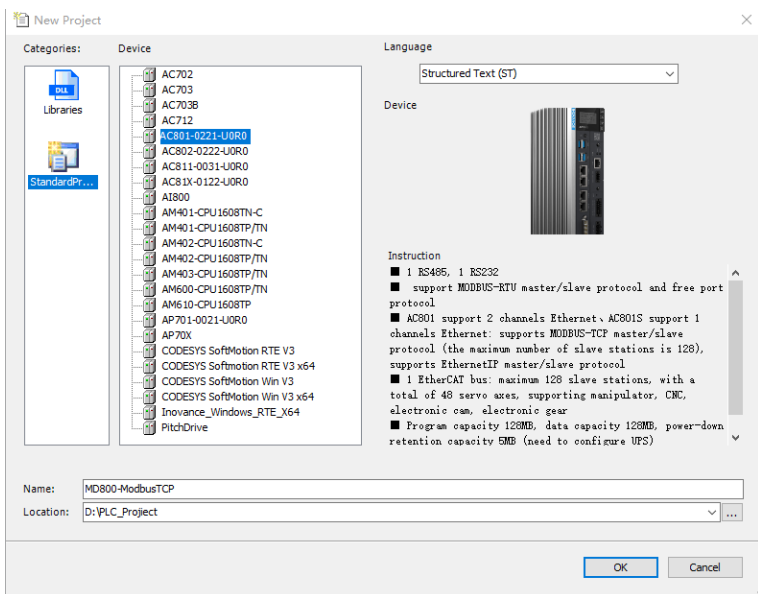
This communication configuration example uses InoProShop v1.7.3. The master is AC810. Before communication configuration, set the following settings:

Set the IP address of the SI-EM card. The corresponding function codes are AD-00 to AD-16. See "[Parameter Configuration](#)" on page 15 "IP address setting of SI-EM card" in.

The communication configuration steps are as follows:

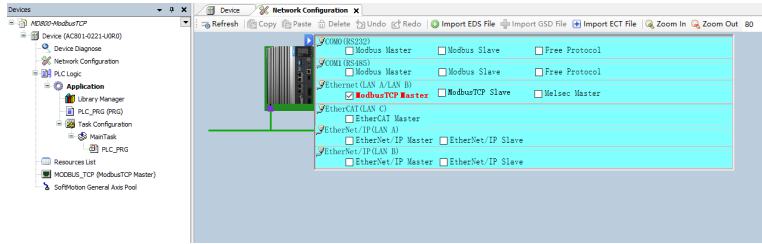
1. Creating a project

Open InoProShop to create a project. Select AC801-0221-U0R0 for the device model.



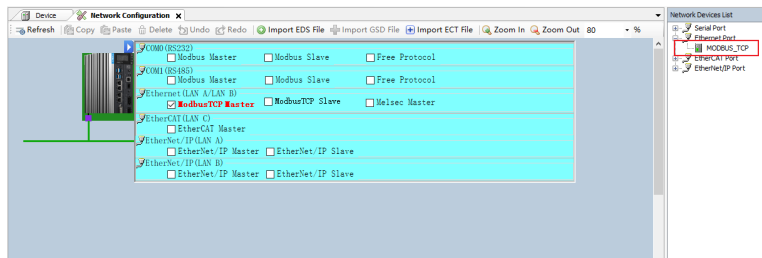
2. Configure the network

Double-click **Network Configuration** in the left pane and configure the PLC as the Modbus TCP master.



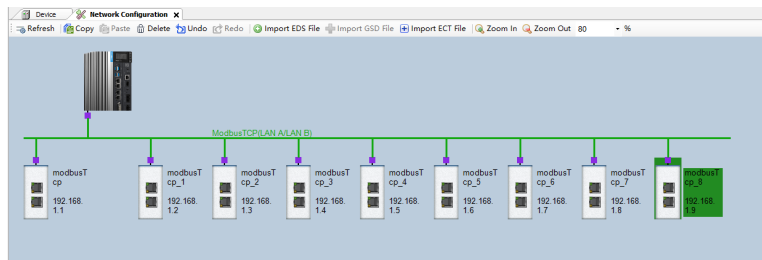
3. Add a slave station

Double-click Modbus_TCP on the right to add a slave based on the actual number of power supply units.

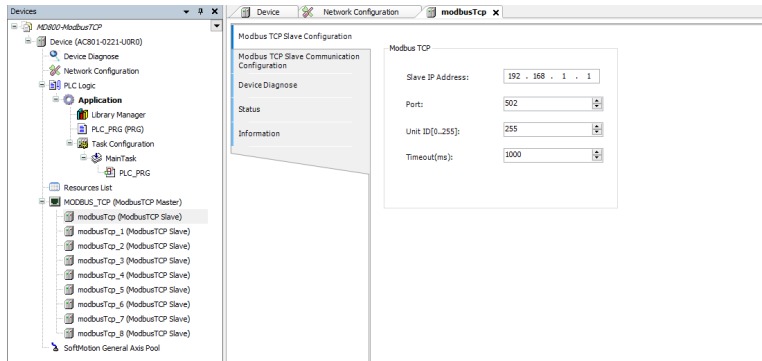


4. Configure the slave information

Double-click the slave to access the configuration interface.

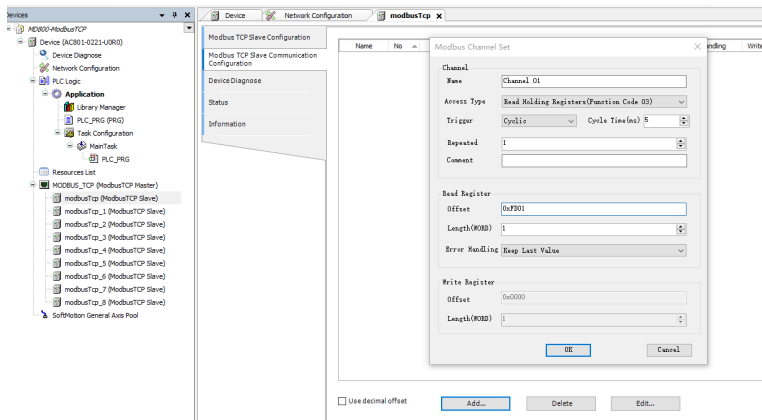


Configure the slave IP address, port, and timeout parameters in the following screens.



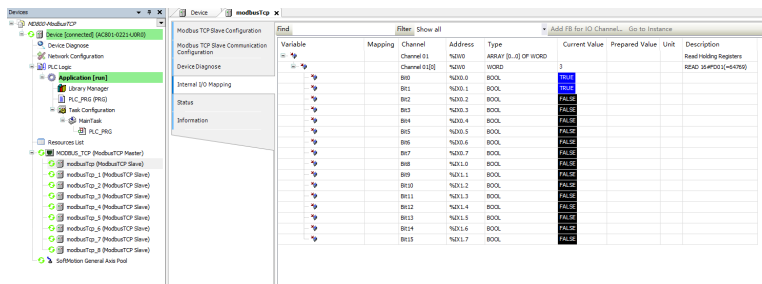
5. Configure read-write commands

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



6. Enable Modbus TCP communication

Download the project to the PLC. You can observe the read/write variables in the **Internal I/O Mapping** tab.



7 Troubleshooting

The following table describes the faults that occur during the use of the SI-EM card and AC drive.

Table 7-1 Modbus TCP card communication fault code

Fault code	Cause	Solution	Reset mode
E16.71	The master station is offline during communication card operation	Check whether the communication card is in poor contact with the PLC. Ensure that the connection is normal. Check whether the network cable complies with the Category 5 shielded cable. Check the grounding and EMC interference. Check whether the master station is abnormal.	When FD-06 is set to 1, it can be reset automatically. When FD-06 is set to 0, it needs to be reset manually.
E16.72	The internal slave is offline during the communication card running	Check and ensure that both the connection between the communication card and the power supply unit, as well as the connection between the power supply unit and the drive unit, are normal.	
E16.81	Communication card connection failure	Check the communication link and ensure that the wiring is connected properly and the master station is running properly	
E16.82	Ethernet hardware error	Contact the agent or Inovance.	
E16.83	MAC address unconfigured	Contact the agent or Inovance.	
E16.84	IP address conflict	Ensure that the IP of other devices is different from that of this device.	
E16.84	Link lost	Check whether the network cable is loose or in poor contact	

8 Certification and Standard Compliance

8.1 Compliance List

The following table lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification Name	Directive Name		Standards compliance
CE Certification	EMC Directive	2014/30/EU	EN IEC 61800-3
KC certification	-		KN 61800-3

Note

The product meets the requirements of the latest version of instructions and standards of the CE certification.

8.2 CE Certification

8.2.1 Precautions for Compliance with European Standards



Figure 8-1 CE mark

- The CE mark indicates that the product complies with the EMC directive when it is used for commercial trade (production, import, and sales) in Europe.
- The CE mark is required for commercial trade (production, import, and sales) in Europe.
- This product complies with the EMC directives and is labeled with the CE mark.
- Machines and devices installed with this product must also meet CE requirements.
- When the CE mark is affixed to the end of the product, the customer who assembled the product shall be responsible for verifying whether the machinery and devices of the final product comply with CE certification.

8.2.2 Requirements for Compliance with EMC Directive

- The drive is applicable to the first environment and second environment and complies with EMC directive 2014/30/EU and standard EN IEC 61800-3.



If the product is used in the first environment, it may generate radio interference. In addition to CE compliance requirements, measures should be taken to prevent interference when necessary.

- To enable the drive to comply with the EMC directive and standards, install an EMC filter on the input side and use shielded cables on the output side. Ground the filter properly. Ground the shield of the output cable in 360 degrees.



The manufacturer of the system with the product installed must ensure that the system meets the requirements of the European EMC Directive, and ensure that the system meets the requirements of the standard EN IEC 61800-3 according to the application environment of the system.

Introduction to EMC standards:

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems. EMC includes the following requirements:

- The electromagnetic interference generated by a device during normal operation must be restricted within a certain limit.
- The device must have sufficient immunity to electromagnetic interference in the environment and can work properly in the environment with electromagnetic interference, which is described as electromagnetic sensitivity.

EN IEC 61800-3 defines the following two environments:

- First environment: It includes domestic premises. It also includes establishments directly connected without intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes.

- Second environment: It includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Devices are divided into the following four categories based on the intended application environment.

- C1 equipment: power drive system (PDS) with the rated voltage lower than 1000 V, which is intended for use in the first environment
- C2 equipment: PDS with the rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and is intended to be installed and commissioned only by professionals when used in the first environment.
- C3 equipment: PDS with the rated voltage lower than 1000 V, which is intended for use in the second environment and not intended for use in the first environment
- C4 equipment: PDS with the rated voltage equal to or higher than 1000 V or rated current equal to or higher than 400 A, or intended for use in complex systems in the second environment

8.3 KC certification



Applicant Suzhou Inovance Technology Co., Ltd.
Communication Expansion Card
Model MD520-CCLink
Made In China
Manufacturer
Suzhou Inovance Technology Co.,Ltd.

A 급기기 (업무용 방송통신기자재)
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