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# MD580-SI-EM1 Modbus TCP Communication Expansion Card

## User Guide

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

Data code 19012457A01

# Preface

## Introduction

The MD580–SI-EM1 communication expansion card complies with IEC61158-1 Type15, the internationally recognized Modbus TCP industrial Ethernet standard. The card is mainly used on the MD580 series AC drive. The AC drive with the card can work as a Modbus TCP Industrial Ethernet server and provide Modbus TCP Industrial Ethernet client control services. This effectively improves the communication efficiency and enriches the networking functions of the MD580.

This guide describes the applicable AC drives, technical specifications, interfaces, dimensions, installation, wiring, communication, and troubleshooting of this product.

## Revision History

| Revision date | Version | Description |
|---|---|---|
| November 2024 | A01 | Made minor corrections. |
| December 2023 | A00 | Initial release. |

## Access to the Guide

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

- Do keyword search under Service and Support at *http://www.inovance.com*.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

## Warranty Disclaimer

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

Within the warranty period, maintenance will be charged for the following damage:

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

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

For details, see the Product Warranty Card.

# Table of Contents

# 1 Product Information

## 1.1 Introduction

The Modbus TCP industrial Ethernet communication module (hereinafter referred to as MD580–SI-EM1 module) conforms to the Modbus TCP industrial Ethernet communication standard. This module can be applied to MD580 series drives to allow MD580 to serve as a Modbus TCP industrial Ethernet server, receiving control from the Modbus TCP industrial Ethernet client. This effectively improves the communication efficiency and enriches the networking functions of the MD580.

Features:

- Supports switch networking.
- Does not support DHCP-based IP address allocation.
- Supports the minimum HMBT communication period of 6 ms.
- Supports reading of up to 127 parameters per time.
- Supports connection of up to two Modbus TCP clients. The minimum communication period is doubled to 12 ms when two clients are connected.
- Supports up to 100 m node-to-node transmission distance.


Figure 1-1 MD580-SI-EM1 card appearance

## 1.2 Applicable AC Drives

| Card Model | Order No. | Applicable AC Drive |
|---|---|---|
| MD580-SI-EM1 | 01040192 | MD580 |

## 1.3 Technical Specifications

| Item | Description |
|---|---|
| Ambient temperature | -10°C to +55°C |
| Storage temperature | -40°C to +70°C |
| Ambient humidity | 5% RH to 95% RH, without condensation |
| Operating environment | No corrosive gases |
| Installation method | Snap-fit joint and screw tightening |
| IP rating | IP20 |
| Heat dissipation | Natural ventilation |

## 1.4 Outline Dimensions

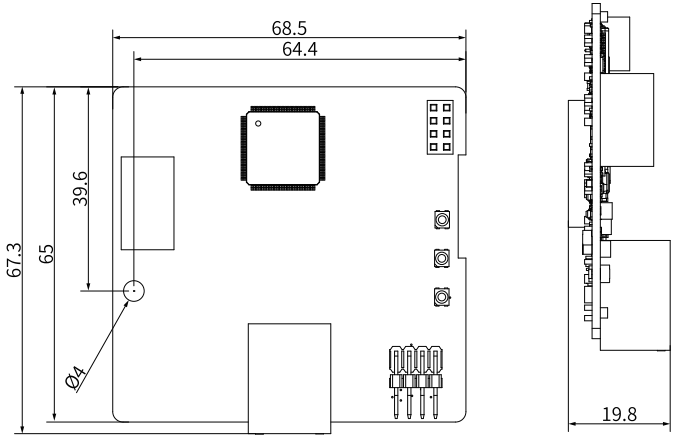



Figure 1-2 MD580-SI-EM1 card dimensions (unit: mm)

## 1.5 Interface Description

**Interface layout**

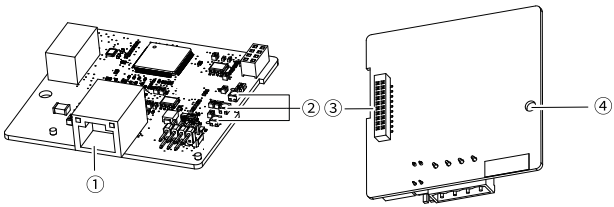



Figure 1-3 MD580-SI-EM1 card interface layout

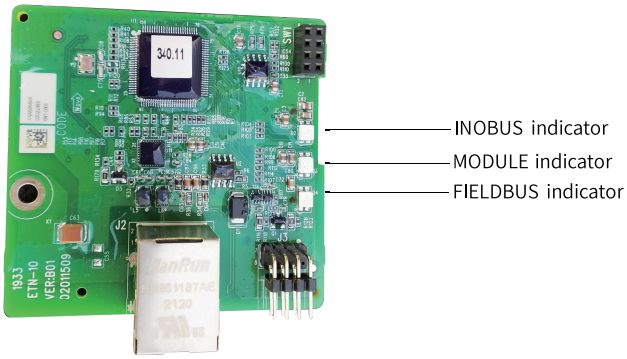
## Interface Description

Table 1–1 MD580-SI-EM1 card interface function description

| No. | Name | Description |
|---|---|---|
| ① | Modbus TCP communication terminal X1 | Communication terminal 1 |
| ② | Status indicator | Indicates module and bus operation status |
| ③ | Slot terminal | Used for electrical connection between the module and the MD580 |
| ④ | Retaining screw hole | Fastens the module to the MD580 drive and ensures proper connection of the PE layer |

## Status indicators

The MD580-SI-EM1 card provides three status indicators to indicate bus communication faults. See the following table for troubleshooting instructions.



| Indicator | Status | Description | Solution |
|---|---|---|---|
| INOBUS | Flashing in green | Handshaking between the MD580-SI-EM1 module and the drive fails. | Check that only n2-00 or n3-00 is set to 9, not both. |
| | | | Check that n18-00 is set properly. |
| | | | Check that the MD580-SI-EM1 socket is intact. |
| MODULE | Flashing in green | Protocol stack starting | Wait. |
| | Flashing in red | MAC address error | The MD580-SI-EM1 does not have a MAC address. Change the MAC address. |
| | Steady red | Protocol stack startup timeout | Power on the module again or replace the module. |
| | Flashing in orange | MD580 communication parameter setting error (failed to obtain the IP) | Set the correct card slot in the software tool to activate Modbus TCP card and power on the module again. |
| FIELDBUS | Steady green | TCP connection established without data exchange | Modbus TCP command operation has not started. |
| | Flashing in orange | Abnormal response | The Modbus TCP operation on the client is abnormal (for example, reading an illegal address). Adjust the PLC program based on the error code. |
| | Flashing in red | INOBUS response timeout | Power on again. |

# 2 Installation Instructions

## Installation precautions

Before installation or removal, ensure that the module is powered off to avoid damage to the module.

- Protect the MD580-SI-EM1 module from falling or shock to avoid damage to the module.
- Do not disassemble the MD580-SI-EM1 module to avoid damage to the module.
- Tighten the screws according to the required torque to avoid damage or loose fastening.

## Tightening torque for screws and screw fasteners

The screws must be installed according to the tightening torque listed below.

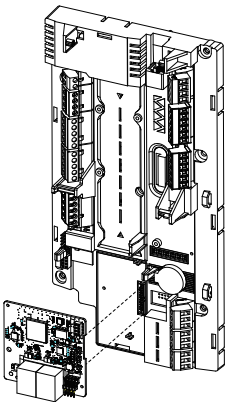
Table 2–1 Tightening torque for grounding screw

| Thread | Tightening torque |
|---|---|
| M3 | 0.55 N·m |

## Installation procedure

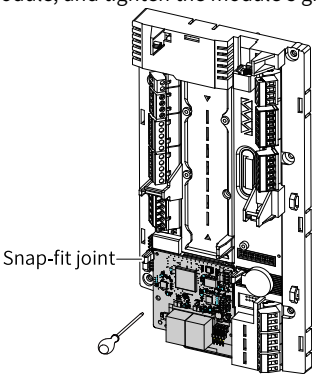
The MD580-SI-EM1 module can be installed in the expansion slot of the MD580. The installation steps are as follows:

1. Place the module into the corresponding expansion slot of the MD580.



2. Align the slot terminals of the module with the terminals on the control board, press firmly to ensure the snap-fit joints on both sides of the control board bracket securely

fasten the module, and tighten the module's grounding screw using a #1 Phillips screwdriver.




3. The installation is completed.

### Removal procedure

1. Disconnect all power supplies, and properly unplug all cables connected to the module.
2. Remove the grounding screw of the MD580-SI-EM1 module by using the 1# Phillips screwdriver.
3. Release the snap-fit joints on both sides of the MD580-SI-EM1 module, then pull the module outward.

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## *Note*

To meet EMC requirements and guarantee reliable operation of the module, tighten the screws to ensure reliable grounding.

The MD580-SI-EM1 module and the MD580 AC drive are electrically connected through slots. Ensure that they are installed in place and electrically connected effectively.

The maintenance work must be done by professional personnel.

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# 3 Electrical Connection

## 3.1 Electrical Connection

The MD580-SI-EM1 module is connected to the PLC using the standard Ethernet RJ45 socket. Assignment of the module pin are the same as those of the standard Ethernet pins. The MD580-SI-EM1 module can be connected using crossover cables or straight-through cables.

**Electrical connection for one module**

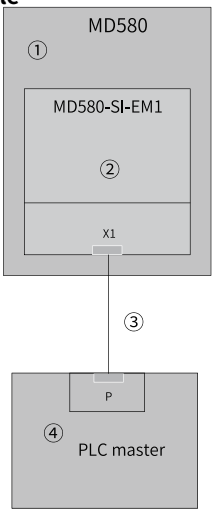



Figure 3-1 Electrical connection for one module

| No. | Name |
|---|---|
| ① | MD580 AC drive |
| ② | MD580-SI-EM1 industrial Ethernet module |
| ③ | Network cable |
| ④ | PLC master |

## Electrical connection for multiple modules

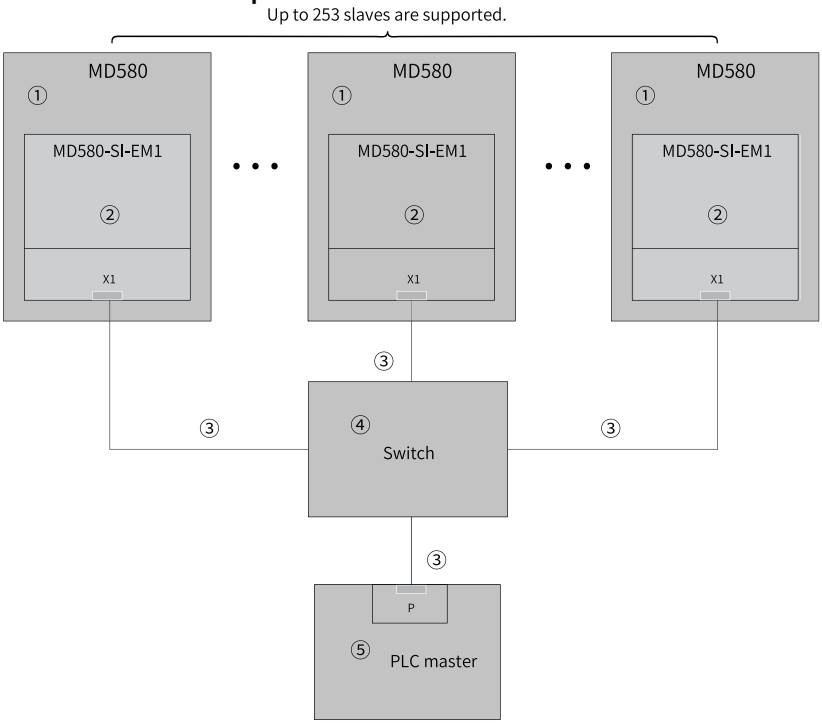



Figure 3-2 Electrical connection for multiple modules

| No. | Name |
|---|---|
| ① | MD580 AC drive |
| ② | MD580-SI-EM1 industrial Ethernet module |
| ③ | Network cable |
| ④ | Switch |
| ⑤ | PLC master |

# 4 Modbus TCP Communication Protocol

## 4.1 Introduction

The MD580-SI-EM1 expansion card utilizes the Ethernet interface, acting as a communication slave to connect to the PC/PLC-controlled network with a single master and multiple slaves. You can carry out centralized control through a PC or PLC and set the operation commands, modify or read parameters, and read the operating status and fault information of the drive through the communication protocol.

The MD580-SI-EM1 expansion card supports the Modbus TCP slave communication protocol. This communication protocol defines the content and format of message transmitted during communication. If the slave encounters an error upon receiving a message or fails to complete the action required by the master, it responds with a fault message to the master.

## 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.

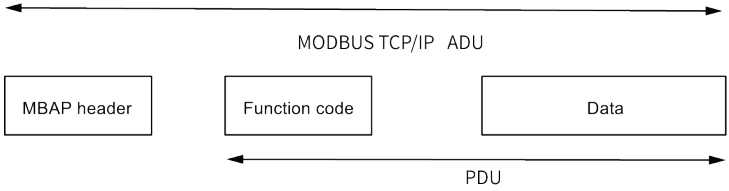


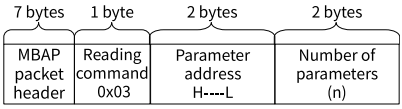

Figure 4-1 Modbus request/response over TCP/IP

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 | Recopied by the server from the received request |
| Protocol identifier | 2 bytes | 0 = Modbus protocol | Started by the client | Recopied by the server from the received request |

| Field | Length | Description | Client | Server |
|---|---|---|---|---|
| Length | 2 bytes | Number of following bytes | Started by the client (request) | Started by the server (response) |
| Unit identifier | 1 bytes | Identifier of the remote slave connected on a serial link or other bus | Started by the client | Recopied by the server from the received request |

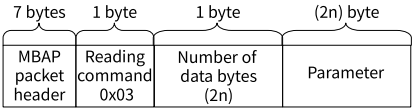
Reading command frame of master



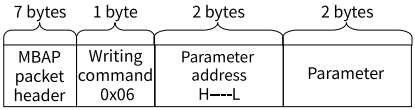

In theory, the host controller can read or write a maximum of 127 consecutive parameters. However, these parameters must be in the same group. Otherwise, an error will be reported in the response.

When writing multiple consecutive parameters or a single parameter in the host controller, note that the parameters to be written must have the "writable" attribute, which can be viewed through the IDS background software. When the function code parameter attribute is configured as "modifiable only during shutdown", it indicates that the parameter can only be written when the drive is not in operation. When configured as "unrestricted modification", the parameter is readable and writable. When configured as "non-modifiable", the parameter is read-only.

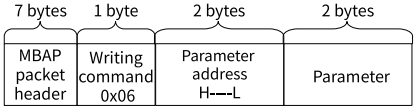
Reading response frame of slave



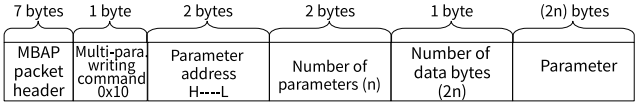

Writing command frame of master



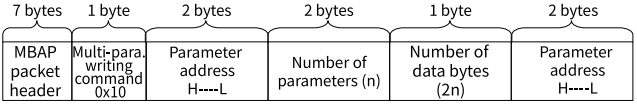

Writing response frame of slave




Multiple parameter writing command frame of master

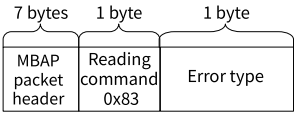



Multiple parameter writing response frame of slave

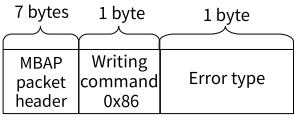



The command for a reading error responded by the slave is 0x83. The command for a writing error responded by the slave is 0x86. The command for a multi-data writing error responded by the slave is 0x90.

Reading response error frame of slave




Writing response error frame of slave




Multi-parameter writing response error frame of slave

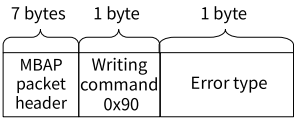


Table 4–1 Data frame fields

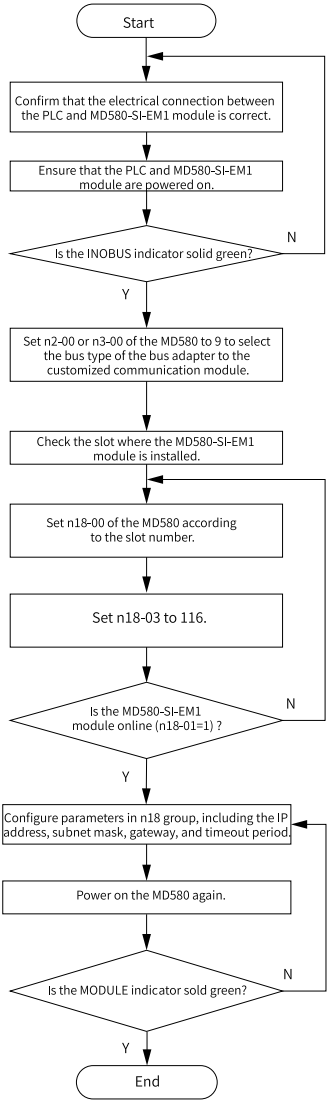
| | |
|---|---|
| Command Code (CMD) | 03: Read a parameter of the slave; 06: Write a parameter of the slave; 10: Write multiple parameters of the slave |
| Parameter Address | It is the internal parameter address of the AC drive, expressed in hexadecimal format. The parameters include functional parameters and non-functional parameters (such as running status and running command). Low-order bytes follow high-order bytes during transmission. |
| Number of Parameters | Indicates the number of parameters read in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission. Only one parameter can be modified at a time. |
| Number of Data Bytes | Data length, which is twice the number of parameters |
| Parameter | Response data or data to be written (Low-order bytes follow high-order bytes during transmission.) |

# 5 Parameter Configuration

## 5.1 Parameter Configuration

### Parameter configuration process

After installing the MD580-SI-EM1 module to the MD580 AC drive, you must complete communication configurations to enable the module to communicate with the MD580.



## Parameter configuration

| Parameter | Description | Default Value | Setting Value | Description |
|---|---|---|---|---|
| n2-00 | Bus type for fieldbus adapter A | 0 | 9 | Set only one of the two parameters to 9. |
| n3-00 | Bus type for fieldbus adapter B | 0 | 9 | |
| n18-00 | Expansion slot | 0 | 0: Disabled<br>1: Expansion slot 1_1<br>2: Expansion slot 1_2<br>3: Expansion slot 1_3 | Select an expansion slot as needed.<br>Typically, set this parameter to 1 (Expansion Slot 1_1). |
| n18-01 | Online status | 0 | 0: Offline<br>1: Online | - |
| n18-02 | Expansion slot module type | 0 | - | ID type display |
| n18-03 | Custom communication module ID setting | 0 | - | Set this parameter based on n18-02. |
| n18-11 to n18-13 | Customized communication module parameters 1 to 3 | Reserved customized communication module parameters | - | - |
| n18-14 to n18-17 | Customized communication module parameters 4 to 7 | Specifies the IP address of the Modbus TCP communication | Value range: 0 to 255 | Set the parameters according to actual needs. |
| n18-18 to n18-21 | Customized communication module parameters 9 to 12 | Specifies the subnet mask of the Modbus TCP communication | Value range: 0 to 255 | Set the parameters according to actual needs. |
| n18-22 to n18-25 | Customized communication module parameters 13 to 16 | Specifies the gateway of the Modbus TCP communication | Value range: 0 to 255 | Set the parameters according to actual needs. |
| n18-27 | Customized communication module parameter 18 | Specifies the timeout interval for receiving the Modbus TCP data in the unit of 100 ms<br>0: Disable timeout detection | Value range: 0 to 255 | Set the parameters according to actual needs. |

## IP address configuration example

The MD580-SI-EM1 module does not require a station number. but requires a unique MAC address and IP address for identification.

IP address configuration example:

| Parameter | Description | Default Value | Category |
|---|---|---|---|
| n18-14 | Customized communication module parameter 4 | 192 | IP address |
| n18-15 | Customized communication module parameter 5 | 168 | |
| n18-16 | Customized communication module parameter 6 | 0 | |
| n18-17 | Customized communication module parameter 7 | 2 | |
| n18-18 | Customized communication module parameter 8 | 255 | Subnet mask |
| n18-19 | Customized communication module parameter 9 | 255 | |
| n18-20 | Customized communication module parameter 10 | 255 | |
| n18-21 | Customized communication module parameter 11 | 0 | |

| Parameter | Description | Default Value | Category |
|---|---|---|---|
| n18-22 | Customized communication module parameter 12 | 192 | Gateway |
| n18-23 | Customized communication module parameter 13 | 168 | |
| n18-24 | Customized communication module parameter 14 | 0 | |
| n18-25 | Customized communication module parameter 15 | 1 | |

# 6 Communication Configuration Instance

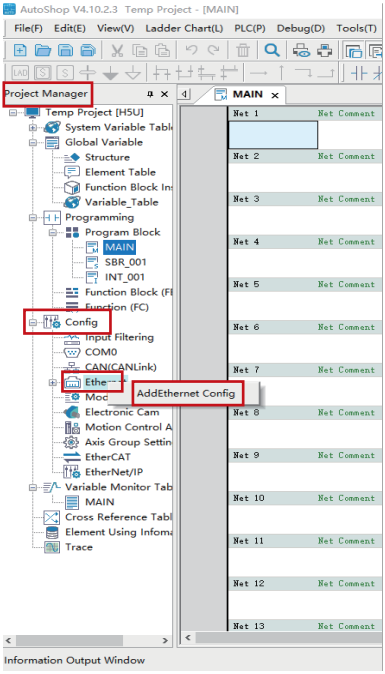
## 6.1 Configuration for Modbus TCP Communication Between AC Drive and H5U

### Software acquisition

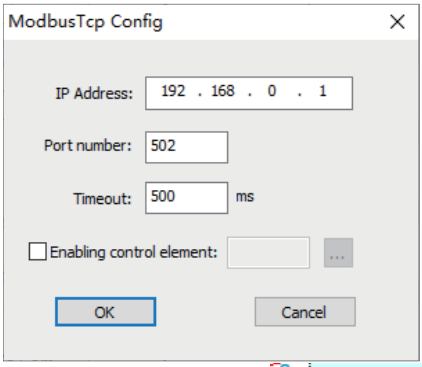
Log in to the Inovance official website (https://newweb.inovance.com/hc/serviceSupport/download) to obtain the H5U programming software.

### Master and slave configuration

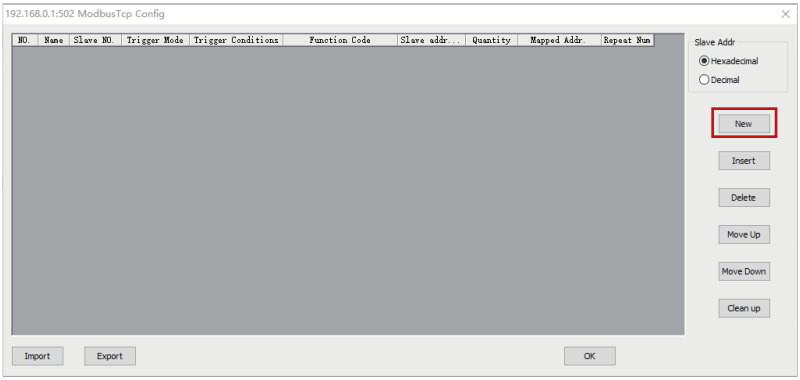
1. Open the PLC programming software AutoShop, click "New Project", confirm that "Series and models" is set to "H5U Series", then click "OK" to enter the programming interface. Go to "Project Manager" > "Config" > "Ethernet", right-click and select "AddEthernet Config", as shown in the following figure.



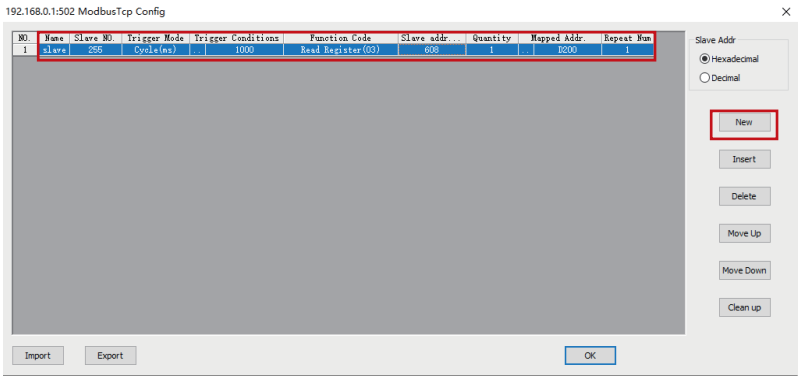

2. In the "ModbusTcp Config" screen, set the IP address, and click "OK." Note that the set IP address must be in the same network segment as the IP address of the card (the first three nodes are the same).




3. To configure the Modbus information, double click [0]192.168.0.1:502 (the set IP address in the preceding step).
4. In the "ModbusTcp Config" screen, click "New".




5. Set parameters such as "Trigger Mode", "Function Code", and "Quantity" to add one record. Click "New" and set related parameters to add more records. After all required records are added, click "OK".



6. Download configuration: Once all the master and slave settings are completed, the configuration needs to be downloaded to the PLC. Click  for compilation first, and then click  for download.

# 7 Troubleshooting for Communication

The MD580-SI-EM1 communication card module uses three status indicators to indicate bus communication faults. See the following table for troubleshooting instructions.

| Indicator | Status | Description | Solution |
|---|---|---|---|
| INOBUS | Flashing in green | Handshaking between the MD580-SI-EM1 module and the drive fails. | Check that only n2-00 or n3-00 is set to 9, not both. |
| | | | Check that n18-00 is set properly. |
| | | | Check that the MD580-SI-EM1 socket is intact. |
| MODULE | Flashing in green | Protocol stack starting | Wait. |
| | Flashing in red | MAC address error | The MD580-SI-EM1 does not have a MAC address. Change the MAC address. |
| | Steady red | Protocol stack startup timeout | Power on the module again or replace the module. |
| | Flashing in orange | MD580 communication parameter setting error (failed to obtain the IP) | Set the correct card slot in the software tool to activate Modbus TCP card and power on the module again. |
| FIELDBUS | Steady green | TCP connection established without data exchange | Modbus TCP command operation has not started. |
| | Flashing in orange | Abnormal response | The Modbus TCP operation on the client is abnormal (for example, reading an illegal address). Adjust the PLC program based on the error code. |
| | Flashing in red | INOBUS response timeout | Power on again. |

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