MT2100 series remote I/O module

User 's Manual

Rev: B

Smacq Technologies. Co., Ltd
Smacq.com
Smacq.cn

Statement

Copyright

Trademark information

Smacq It is a registered trademark of Smacq Technologies. Co., Ltd.
The other products and company names mentioned in this document are trademarks or business names of their respective companies.

Other statements

- The information provided in this document may be modified and updated in subsequent versions without prior notice.
- Smacq Technologies. Co., Ltd. does not provide any express or implied warranties with respect to this document and the information contained therein, including but limited to implied warranties of the marketability and suitability for a particular purpose of the product.
- Smacq Technologies. Co., Ltd. shall not be liable for any errors or inaccurate descriptions that may be contained in this document, or for any incidental or consequential damages resulting from the information and functions provided in the manual, or from the use of this document.
- Smacq Technologies. Co., Ltd. reserves the right to change product specifications, prices, and decide whether to discontinue production.

Contact us

If you have any questions or need assistance while using this product or this document, please contact us via:

Phone: (86-10) 52482802
E-mail: service@smacq.com
Website: http://www.smacq.com
http://www.smacq.cn

Safety requirements

Warning: Only connect voltage within the specified range. If the voltage exceeds the specified range, it may cause equipment damage and even affect personal safety. The voltage range that can be connected to each port is detailed in the product specification section.

Warning: Do not attempt to operate the device in any other way not mentioned in this document. Incorrect operation of equipment may pose a danger. When the equipment is damaged, the internal security protection mechanism will also be affected.

Warning: Do not attempt to replace device components or modify the device using other methods not mentioned in this document. Do not repair the product yourself when it malfunctions.

Warning: Do not use the equipment in environments where explosions may occur or in the presence of flammable smoke. If necessary for such environments, please place the device in a suitable enclosure.

Warning: During the operation of the warning device, all chassis covers and filling panels must be closed.

Warning: For equipment with exhaust vents, do not insert foreign objects into the vents or block the air flow through the vents.

Measurement category

Warning: This device can only be used in measurement category I (CAT I).
Do not use this device to connect signals or perform measurements in measurement categories II/III/IV.

Measurement category description

Measurement Category I (CAT I) refers to measurements taken on circuits that are not directly connected to the main power supply. For example, measuring circuits that are not derived from the main power source, especially circuits derived from protected (internal) main power sources. In the latter case, the instantaneous stress will change. Therefore, users should understand the instantaneous tolerance of the device.

Measurement Category II (CAT II) refers to measurements taken on circuits directly connected to low-voltage equipment. For example, measuring household appliances, portable tools, and similar devices.

Measurement Category III (CAT III) refers to measurements conducted in building equipment. For example, measurements are taken on distribution boards, circuit breakers, circuits (including cables, busbars, junction boxes, switches, sockets) in fixed equipment, as well as industrial equipment and certain other devices (such as fixed motors permanently connected to fixed installations).

Measurement category IV (CAT IV) refers to measurements taken at the source of low-voltage equipment. For example, measurements taken on electricity meters, primary over Current protection equipment, and pulse control units.

Environment

Temperature	
Operation	0℃~55℃
Storage	-40℃~85℃
Humidity	
Operation	5% RH~95% RH, non-condensing
Storage	5% RH~95% RH, non-condensing
Pollution level	2
Highest altitude	2000m

Pollution level description

Pollution level 1: No pollution, or only dry non-conductive pollution occurs. This pollution level has no impact. For example, a clean room or an air-conditioned office environment.

Pollution level 2: Generally only dry non-conductive pollution occurs. Sometimes temporary conduction may occur due to condensation. For example: general indoor environment.

Pollution level 3: Conductive pollution occurs, or dry non-conductive pollution becomes conductive due to condensation. For example, an outdoor environment with a canopy.

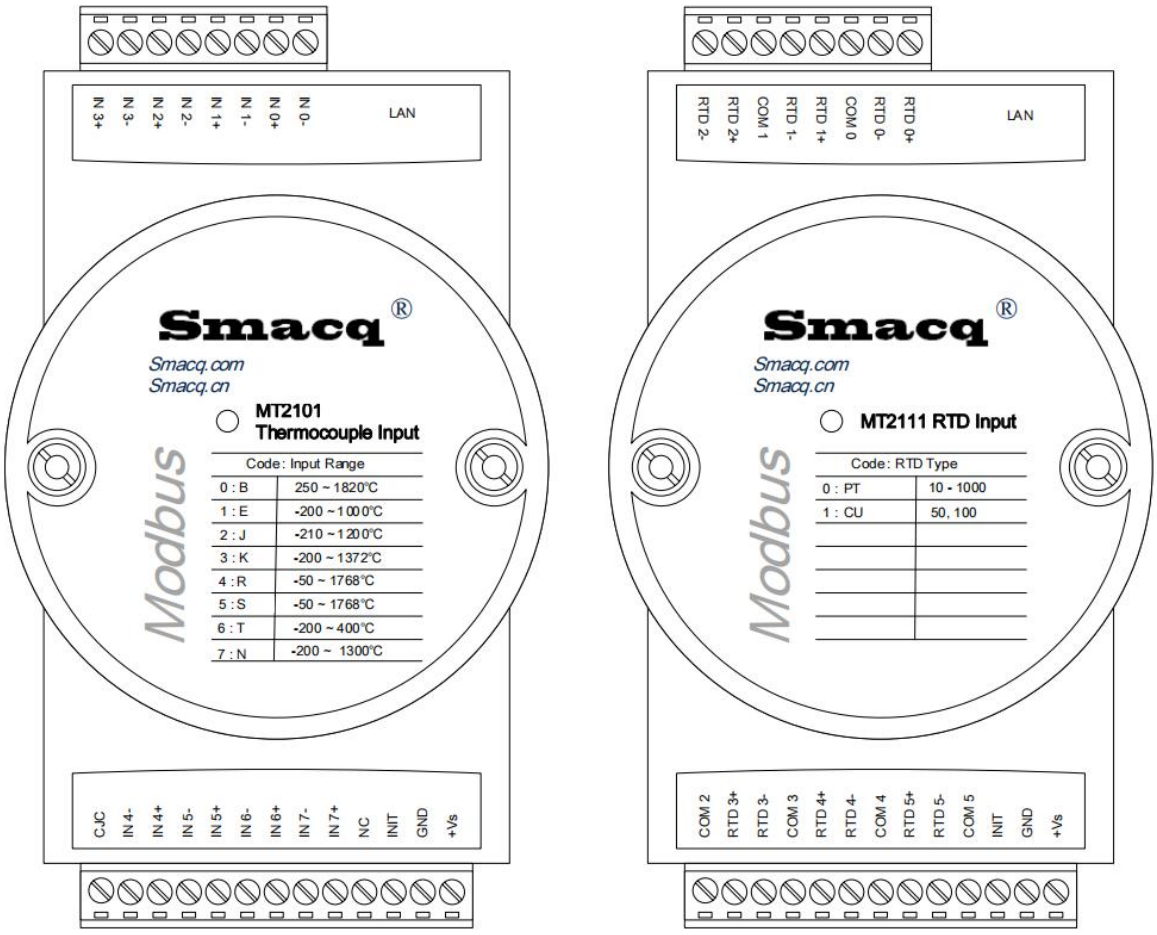
Pollution Level 4: Permanent conductive pollution caused by conductive dust, rainwater, or snow. For example: outdoor places.

Recycling precautions

Warning: Some substances contained in this product may be harmful to the environment or human health. To avoid releasing harmful substances into the environment or endangering human health, it is recommended to recycle this product using appropriate methods to ensure that most materials can be reused or recycled correctly. For information on handling or recycling, please contact local professional organizations.

1. Product Introduction

1.1. Overview



MT2100 Wiring Definition

Overview

The MT2100 series temperature acquisition remote I/O module is a set of computer interface modules based on the Modbus TCP standard protocol. MT2100 is remotely controlled through the standard Modbus TCP protocol. The M2100 series is divided two models: M2101 is 8-channel input compatible with 8 type of Thermocouples. M2111 is 6-channel input compatible with PT and CU of Resistance Temperature Detector. The 0 ℃ resistance value can be customized. The sensor type and sampling rate can be converted though programmable control.

Feature point

- 8-channel Thermocouple input
- 6-channel Resistance Temperature Detector input
- Using standard Modbus TCP protocol
- Support 8 type Thermocouple (Type: B，E，J，K，R，S，T，N)
- Support 2 type Resistance Temperature Detector (Type: PT，CU)
- Built-in Watchdog Timer will automatically reset the module in case of system failure
- 9-24V power supply voltage range
- DIN-Rail Mounting and Piggyback Stack

Applications

- Remote data acquisition
- Process monitoring
- Industrial process control
- Energy management
- Monitor
- Safety system
- Laboratory automation
- Building automation
- Product testing

1.2. Product specifications

Common Specifications

Connection	
Interface	10/100M Ethernet Adaptive (RJ45)
Network Mode	TCP SERVER (Default), TCP CLIENT, UDP
Protocol	Modbus TCP
Watchdog Timer	1s
Power Supply	
Input Voltage	9-30 VDC
Electric Current	MT2101：100mA (Max) @ 12V MT2111：100mA (Max) @ 12V

MT2101 Product Specification

Sense input	
Channels	8
Input Type	Thermocouple
Thermocouple Types	B，E，J，K，R，S，T，N
Resolution	0.1℃ (16-bit)
Integral time	100ms
Input coupling mode	DC
Voltage input impedance	10M Ω (Typical values)
Current input impedance	249Ω
Accuracy	± 2℃ (Sampling rate is Medium)
Temperature coefficient	25ppm/℃
Isolation voltage	1500V

Comparison Table of Thermocouple Types and Temperature Range

Thermocouple Types	Temperature range
B	250 ℃ ~ 1820 ℃
E	-200 ℃ ~ 1000 ℃
J	-210 ℃ ~ 1200 ℃
K	-200 ℃ ~ 1372 ℃
R	-50 ℃ ~ 1768 ℃
S	-50 ℃ ~ 1768 ℃
T	-200 ℃ ~ 400 ℃
N	-200 ℃ ~ 1300 ℃

MT2111 Product Specification

Sense input	
Channels	6
Input Type	Resistance Temperature Detector (RTD)
RTD Type	Platinum resistance (PT), copper resistance (CU)
0 ℃ resistance value (Settable)	10Ω - 1000Ω
Integral time	100ms
Accuracy	± 1℃
Resolution (Settable)	1 ℃, 0.1 ℃ (default), 0.01 ℃
Temperature coefficient	25ppm/℃
Isolation voltage	1500V

2. Product unpacking and packing list

2.1. Product unboxing

To prevent equipment damage from electrostatic discharge (ESD), please note the following:

- Please wear a grounded wristband or touch a grounded object first to ensure that the human body is grounded.
- Before removing the equipment from the packaging, please first place the anti-static packaging in contact with a grounded object.
- Do not touch the exposed pins of the connector.
- Please place the device inside an anti-static rod when not in use.

If the product is damaged after unpacking, please contact us promptly.

2.2. Packing list

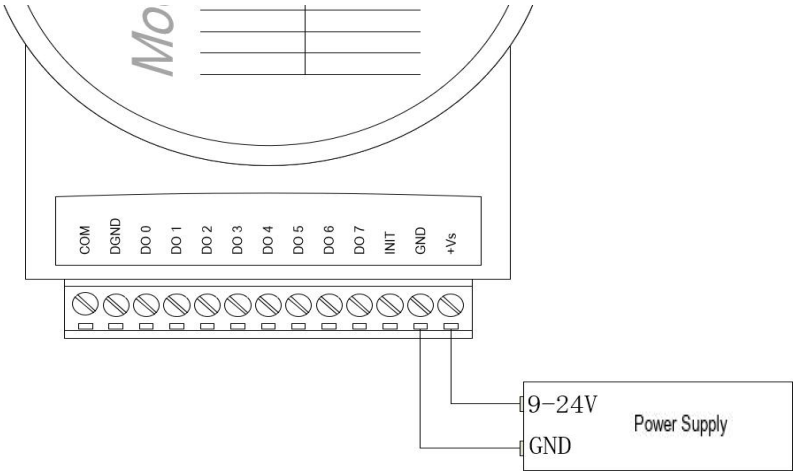
Name	Specification Description	Quantity
MT2100	MT2100 Remote I/O Module	1
Include Attachments		
Wiring terminals	13 Pin/Green/3.81	1
Wiring terminals	8 Pin/Green/3.81	1

3.Installation and simple testing

3.1. Hardware install

Before installation and debugging, the following equipment needs to be prepared:

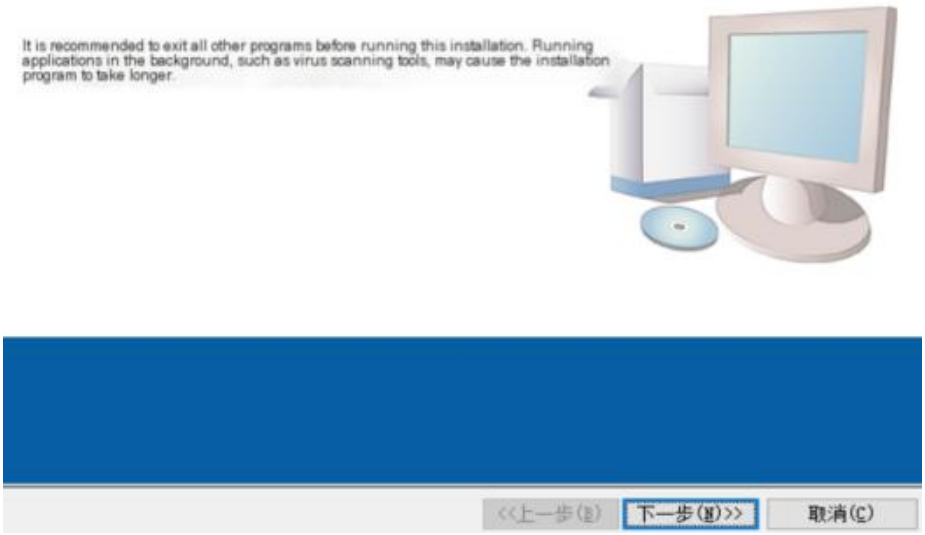
- MT2100 Remote I/O Module
- A Windows series computer with Ethernet interface
- A DC Power Supply (9-24V)



Power Connection Diagram

3.2. Software installation

We provide an application for configuring, detecting, and easy-to-use MT2100 series remote I/O modules, which can only be installed on the Windows desktop operating system. Double click to run setup. exe for installation.



Software installation diagram

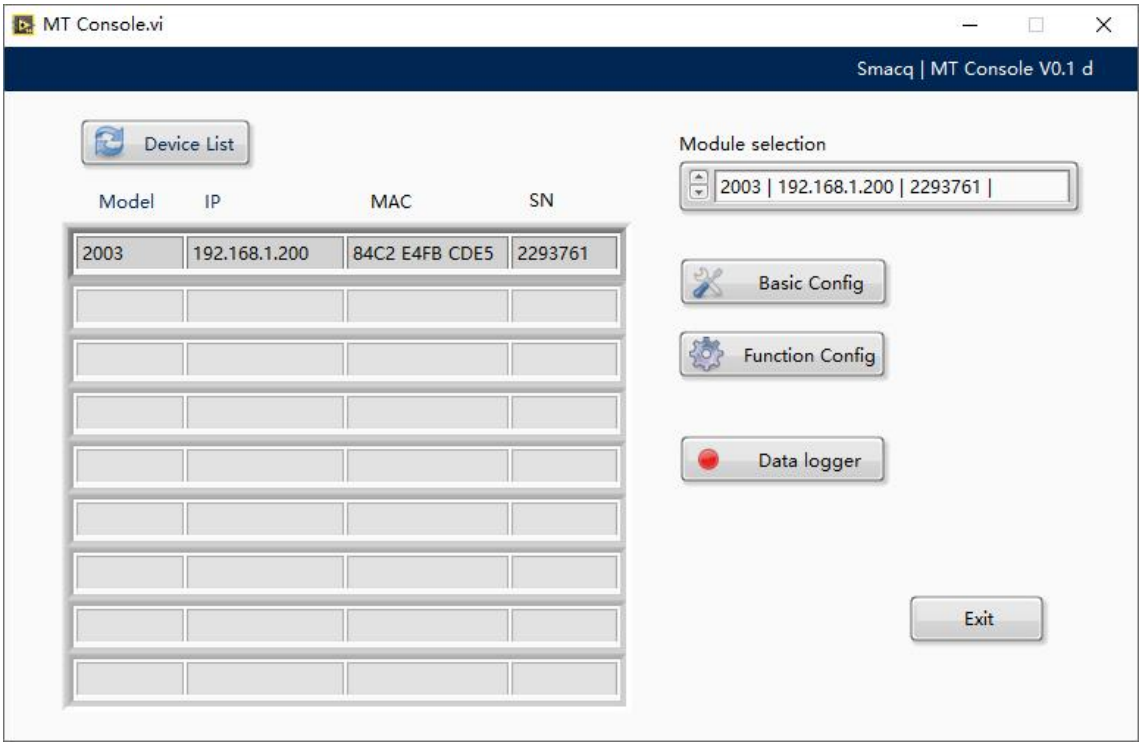
3.3. Simple testing

The MT2100 series remote I/O module is set to its initial value before leaving the factory, as shown in the table below. If the settings of the MT2100 series remote I/O module have been modified and the settings have been forgotten, a wire can be used to connect the Initiate and GND terminals, and then the power of the MT2100 can be turned on. The LED indicator of the MT2100 will flash three times at a frequency of 1Hz, and then disconnect the connection between the Initiate and GND. At this time, the MT2100 remote I/O module will be restored to its factory default values.

Table 1 Default Value List

Parameter	**Default value**
IP address	192.168.1.200
Gateway	192.168.1.1
Subnet mask	255.255.255.0
DHCP	CLOSE
Network mode	TCP SERVER
Local port	502
Random Local Port	CLOSE
Target IP	192.168.1.100
Target Port	1000

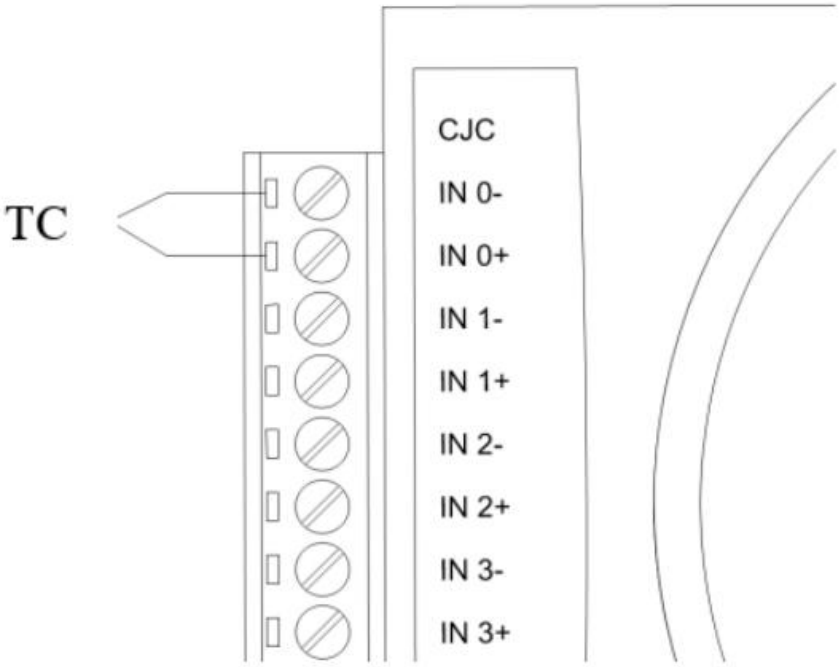
Run the MT Console configuration software.



MT series DAQ setting software

4. Thermocouple input

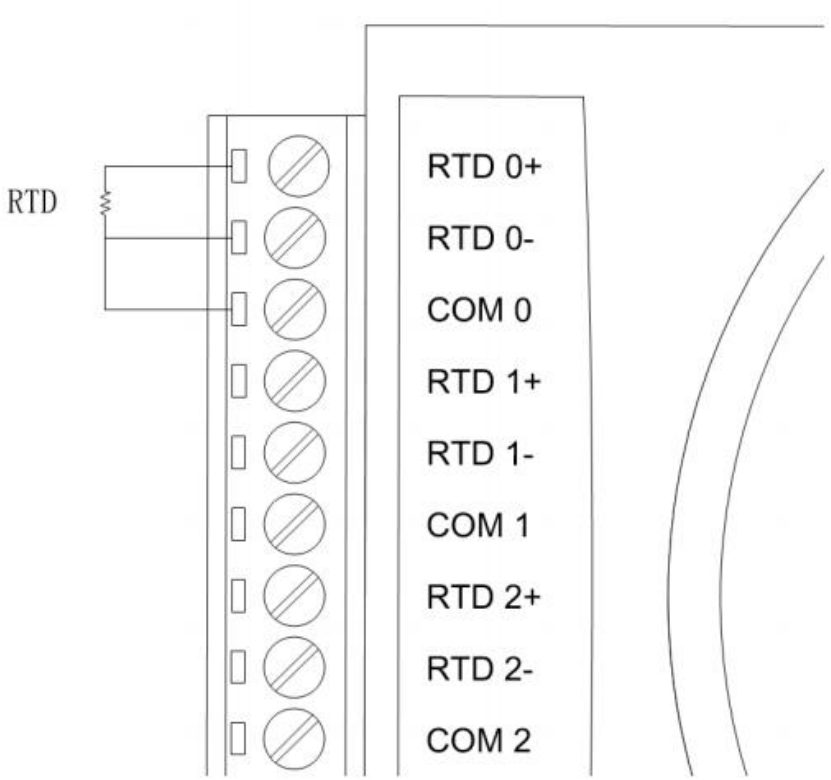
The MT2101 is equipped with 8-channel thermocouple input. Each channel needs to be configured according to the type of thermocouple connected.



Schematic diagram of thermocouple connection

5. Resistance Temperature Detector input

The MT2111 is equipped with 6-channel Resistance Temperature Detector input. Each channel needs to be configured according to the type of RTD (platinum and copper) connected.



Schematic diagram of Resistance Temperature Detector connection

6. Programming instructions

The MT2100 series remote I/O module is a set of computer interface modules based on Modbus TCP, and its programming rules follow The relevant conventions of Modbus TCP protocol.

MODBUS TCP Command Message Description

For the convenience of users who are using the Modbus TCP protocol for the first time, several commonly used Modbus command messages are briefly illustrated here. If you are already familiar with the Modbus TCP protocol, you can directly view the following mapping table.

01 Function code

Used to read the status of the coil (DO)

To read the status of 8 coils starting from address 1 of a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x06	0x01	0x01	0x0000	0x0008

The module **returns** the following data:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x05	0x01	0x01	0x01	0x05

The state of each coil corresponds to one bit of data, and 8 coils correspond exactly to one byte of data. If 9-16 coils of data are read at a time, the byte count is 2, and so on. The binary representation of data 0x05 is 00000101, indicating that DO0 and DO2 states are 1, and the remaining DO states are 0.

02 Function code

Used to read discrete quantity (DI) states

To read the 8 discrete states of a module starting from address 10001, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x06	0x01	0x02	0x0000	0x0008

The module **returns** the following data:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x05	0x01	0x02	0x01	0x05

Each discrete state corresponds to one bit of data, and 8 coils correspond to exactly 1 byte of data. If 9-16 coils of data are read at a time, the number of bytes is 2, and so on. The binary representation of data 0x05 is 00000101, indicating that DI0 and DI2 are in the 1 state, and the remaining DO states are in the 0 state.

03 Function code

Used for reading and holding registers

To read the status of three registers starting from address 40201 in a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x06	0x01	0x03	0x00C8	0x0003

The module **returns** the following data:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Number of coils
0x 0000 0000 00	0x09	0x01	0x03	0x06	0x0001 0023 0005

0x0001 represents the data of register 40201, 0x0023 represents the data of register 40202, and 0x0005 represents the data of register 4020 For the specific meaning of the data, please refer to the Modbus mapping table.

04 Function code

Used for reading input registers

To read the status of the three registers starting from address 30101 in a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Register address	No.of registers
0x 0000 0000 00	0x06	0x01	0x04	0x0064	0x0003

The module **returns** the following data:

Fixed message header*	Remaining bytes	Slave address**	Function code	Byte count	Data
0x 0000 0000 00	0x09	0x01	0x04	0x06	0x0001 0023 0005

0x0001 is the data of register 30101, 0x0023 is the data of register 30102, and 0x0005 is the data of register 30103 For the specific meaning of the data, please refer to the Modbus mapping table.

05 Function code

Used for writing a single coil (DO)

To control the coil status of address 1 in a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Coil address	Coil status
0x0000 0000 00	0x06	0x01	0x05	0x0000	0xFF00 (set to 1) 0x0000 (set to 0)

The module **returns** the same data as the **sent** content.

06 Function code

Used for writing and holding registers

If it is necessary to write register data with address 40201 to a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address**	Function code	Register address	Data
0x0000 0000 00	0x06	0x01	0x06	0x00C8	0x001C

The module **returns** the same data as the sent content.

15 (0x0F) Function code

Used for writing multiple coils (DO)

To read the status of the 8 coils starting from address 1 of a module, the host **sends** the following command:

Fixed message header*	Remaining bytes	Module address* *	Function code	Coil address	Number of coils	Byte count	Data
0x0000 0000 00	0x06	0x01	0x0F	0x0000	0x0008	0x01	0x05

The module **returns** the following data:

Fixed message header*	Remaining bytes	Slave address**	Function code	Byte count	Data
0x0000 0000 00	0x05	0x01	0x0F	0x0000	0x0008

The state of each coil corresponds to one bit of data, and 8 coils correspond exactly to one byte of data. If data is written to 9-16 coils at a time, the byte count is 2, and so on. The binary representation of data 0x05 is 00000 101, indicating that DO0 and DO2 states are 1, and the remaining DO states are 0.

16 (0x10) Function code

Used to write multiple hold registers

If you need to read the data from two registers of a module starting from address 40201, the host **sends** the following command:

Fixed message header*	Remaining words Number of sections	Module address**	Function code	Register address	Register quantity	Byte count	Data
0x0000 0000 00	0x06	0x01	0x10	0x00C8	0x0002	0x04	0x0001 0023

The data of each register corresponds to 2 bytes of data, and the data of 2 registers is 4 bytes, and so on. 0x0001 is the data of register 40101, and 0x0023 is the data of register 40102.

The module **returns** the following data:

Fixed message header*	Remaining bytes	Slave address**	Function code	Register address	Number of registers
0x0000 0000 00	0x05	0x01	0x10	0x00C8	0x0002

*The header of Modbus TCP generally uses a fixed set of five 0X00 bytes, which can also represent specific meanings. You can refer to the Modbus TCP protocol manual by yourself, and detailed explanations will not be provided here.

**The MT2100 series remote I/O module has a fixed slave address of 0x01 and does not involve any other addresses, so the protocol will not be explained in detail.

MT2100 Series Remote I/O Module Universal Function Modbus Mapping Table

Address 4X	Function	Explain	Attribute	Command
40201	Model number		Read	0x03
40202-40203	Serial number		Read	0x03
40204	Version number		Read	0x03

MT2101 Series Remote I/O Module Modbus Mapping Table

Thermocouple input register list

Address 3X	Channel	Function	Attribute	Command
30101	IN 0	TC input register	Read	0x04
30102	IN 1	TC input register	Read	0x04
30103	IN 2	TC input register	Read	0x04
30104	IN 3	TC input register	Read	0x04
30105	IN 4	TC input register	Read	0x04
30106	IN 5	TC input register	Read	0x04
30107	IN 6	TC input register	Read	0x04
30108	IN 7	TC input register	Read	0x04

The register value is a 16-bit integer data in units of 0.1 ℃. For example, if the return data is 2483, it represents 248.3 ℃.

Thermocouple input type registers list

Address 4X	Channel	Function	Attribute	Command
40101	IN 0	TC type register	Write/Read	0x03,0x06,0x10
40102	IN 1	TC type register	Write/Read	0x03,0x06,0x10
40103	IN 2	TC type register	Write/Read	0x03,0x06,0x10
40104	IN 3	TC type register	Write/Read	0x03,0x06,0x10
40105	IN 4	TC type register	Write/Read	0x03,0x06,0x10
40106	IN 5	TC type register	Write/Read	0x03,0x06,0x10
40107	IN 6	TC type register	Write/Read	0x03,0x06,0x10
40108	IN 7	TC type register	Write/Read	0x03,0x06,0x10

Thermocouple type value and register setting value comparison list

Thermocouple type	register setting value (Decimal)
B	0
E	1
J	2
K	3 (Default)
R	4
S	5
T	6
N	7

Thermocouple channel sampling rate registers list

Address 4X	Channel	Function	Attribute	Command
40121	IN 0	Sampling rate registers	Write/Read	0x03,0x06,0x10
40122	IN 1	Sampling rate registers	Write/Read	0x03,0x06,0x10
40123	IN 2	Sampling rate registers	Write/Read	0x03,0x06,0x10
40124	IN 3	Sampling rate registers	Write/Read	0x03,0x06,0x10
40125	IN 4	Sampling rate registers	Write/Read	0x03,0x06,0x10
40126	IN 5	Sampling rate registers	Write/Read	0x03,0x06,0x10
40127	IN 6	Sampling rate registers	Write/Read	0x03,0x06,0x10
40128	IN 7	Sampling rate registers	Write/Read	0x03,0x06,0x10

Sampling rate register setting value comparison list

Sampling rate	register setting value (Decimal)
Lowest	0
Low	1
Medium	2 (Default)
High	3
Highest	4

Restore Analog Input Channel Defaults Values Registers List

Address 4X	Channel	Function	Attribute	Command
40181	IN 0-7	Write data **1** to this address, all input channel TC type and sampling rate configure to default values.	Write	0x06,0x10

MT2111 RemoteIO Module Modbus Mapping Table

RTD input register list

Address 3X	Channel	Function	Attribute	Command
30101	RTD 0	RTD input register	Read	0x04
30102	RTD 1	RTD input register	Read	0x04
30103	RTD 2	RTD input register	Read	0x04
30104	RTD 3	RTD input register	Read	0x04
30105	RTD 4	RTD input register	Read	0x04
30106	RTD 5	RTD input register	Read	0x04

The return value is a 16-bit integer data in resolution units. For example, in the case of a resolution of 0.1 ℃, the return data is 2483, which is represented as 248.3 ℃.

Temperature Resolution Register List

Address 4X	Channel	Function	Attribute	Command
40061	RTD 0	Temperature Resolution Register	Write/Read	0x03,0x06,0x10
40062	RTD 1	Temperature Resolution Register	Write/Read	0x03,0x06,0x10
40063	RTD 2	Temperature Resolution Register	Write/Read	0x03,0x06,0x10
40064	RTD 3	Temperature Resolution Register	Write/Read	0x03,0x06,0x10
40065	RTD 4	Temperature Resolution Register	Write/Read	0x03,0x06,0x10
40066	RTD 5	Temperature Resolution Register	Write/Read	0x03,0x06,0x10

Temperature resolution and register setting value comparison list

Temperature resolution (Unit)	Register setting value (Decimal)
1℃	0
0.1℃	1 (Default)
0.01℃	2

RTD type register list

Address 4X	Channel	Function	Attribute	Command
40081	RTD 0	RTD type register	Write/Read	0x03,0x06,0x10
40082	RTD 1	RTD type register	Write/Read	0x03,0x06,0x10
40083	RTD 2	RTD type register	Write/Read	0x03,0x06,0x10
40084	RTD 3	RTD type register	Write/Read	0x03,0x06,0x10
40085	RTD 4	RTD type register	Write/Read	0x03,0x06,0x10
40086	RTD 5	RTD type register	Write/Read	0x03,0x06,0x10

RTD type and register value comparison list

RTD type	register setting value (Decimal)
platinum resistor (PT)	0 (Default)
copper resistor (CU)	1

RTD 0℃ resistance value register list

Address 4X	Channel	Function	Attribute	Command
40101	RTD 0	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10
40102	RTD 1	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10
40103	RTD 2	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10
40104	RTD 3	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10
40105	RTD 4	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10
40106	RTD 5	0 ℃ Resistance Value Register	Write/Read	0x03,0x06,0x10

The setting value is an unsigned 16-bit integer, and the numerical value represents the resistance value. Taking PT100 as an example, if the resistance value at 0 ℃ is 100 ohms, then it is set to 100.

Restore Input Channel Defaults Values Registers List

Address 4X	Channel	Function	Attribute	Command
40181	RTD 0-7	Write data **1** to this address, all input channel: RTD type and 0 ℃ resistance and temperature resolution configure to default values.	Write	0x06,0x10

7. After sales service and warranty

Smacq Technologies. Co., Ltd. promises that its products are under warranty. If the product malfunctions during normal use, we will provide free repair or replacement of parts for the user. For detailed warranty instructions, please refer to the warranty instructions inside the packaging box.

Except for the warranties mentioned in this manual and warranty instructions, our company does not provide any other express or implied warranties, including but not limited to any implied warranties regarding the merchant ability and fitness for a particular purpose of the product.

For more technical support and service details, or if you have any questions while using this product and this document, please feel free to contact us:

Phone: (86-10) 52482802
E-mail: service@smacq.com
Website: http://www.smacq.com
http://www.smacq.cn

8. Ordering information

Main Equipment

Model	Description
MT2101	8-channel Thermocouple input (Type: B，E，J，K，R，S，T，N)
MT2111	6-channel Resistance Temperature Detector input (Type: PT, CU)

Standard Accessories

Model	Description
TB13-3.81	Bolt terminal connector, 13 positions, 3.81mm
SDIN	DIN-Rail mounting bracket

9. Document Revision History

Date	Edition	Remarks
2022.08.08	Rev: A	First release.
2024.07.03	Rev: B	Modify some commands with incorrect instructions.