SPT1□□□-MC Series Thermocouple Data Acquisition Module User Manual

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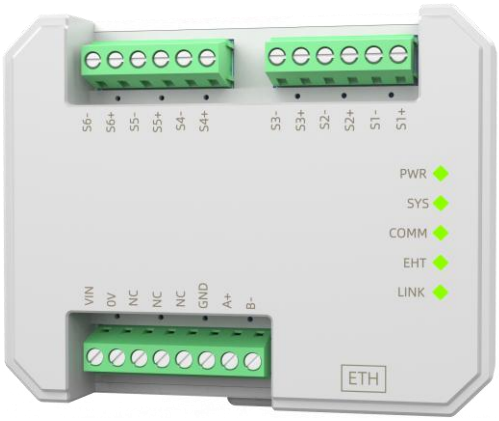
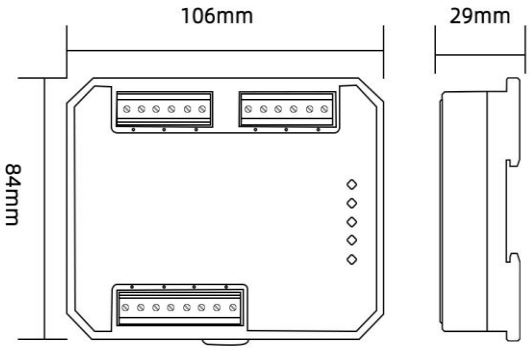
I. Precautions

- Do not operate this product beyond its design limits under any circumstances.
- The power supply for this product is 24V DC. Strictly prohibit the use of 220V AC power.
- This product should be installed in a safe location. The shell's maximum withstand temperature is +85°C.
- When used in environments with strong magnetic interference, Shielded cable is recommended for signal lines.
- Strictly prohibit unauthorized disassembly, modification, or repair of this product.
- Pay attention to the wiring method of this product to ensure correct Wiring and avoid damaging the product.
- Read this manual carefully before installation and use. If you have any questions, please contact our technical support personnel or refer to relevant technical guidance videos.
- Our company is not responsible for damage to components other than this product during use.
- Please download the latest electronic version of the documentation. The content of this manual is for reference only. We continuously improve the user experience, and technical parameters are subject to change without notice.





II. Product Dimensions

- Product dimensions: **106mm (L) X 84mm (W) X 29mm (H)**
- Industrial-grade flame-retardant plastic shell, standard DIN35 rail mounting.

III. Operating Environment

- Do not expose this product to excessively high or low temperatures.
- The surrounding environment must be free from strong vibration, impact, and electromagnetic interference such as large currents and sparks.
- The operating environment must not contain harmful substances that cause severe corrosion to metal or plastic components. Do not use or store the product in harsh environments, otherwise it will affect the electrical performance of the product.
- Operating Temperature: -40℃～+80℃ Relative Humidity: 10% ～ 90%RH (non-condensing)

IV. After-Sales Service

We are committed to providing you with comprehensive after-sales service and warranty policy. The product warranty period is three years. During the warranty period, if the product fails due to non-human factors, we will provide free repair or replacement service. Damage caused by violation of operating regulations and requirements will require payment of parts cost and repair fee. After the warranty period expires, we continue to provide technical support and assistance. During this period, replacement parts are provided at cost price.

V. Application Fields


Automation Equipment


Medical Electronics


Remote Monitoring


Process Control

· Product Introduction

The SPT temperature data acquisition module is meticulously designed based on a new generation of embedded systems. Equipped with an isolated communication interface, it can communicate independently with a PC or PLC or be networked with multiple communication modules. It also features a transient suppression circuit that effectively suppresses various surges, ensuring reliable operation in harsh environments.

The SPT1□□□-MC series thermocouple data acquisition module collects 2/4/6 thermocouple signals and is equipped with an RS485 communication interface. It utilizes an advanced 24-bit delta-sigma high-precision digital-to-analog converter, achieving measurement accuracy better than 0.1% and a temperature display resolution of 0.1° C. The power supply, input, and communication output are isolated, making it suitable for collecting a variety of temperature signals in industrial settings. It meets the high measurement requirements of industrial sites, medical electronics, security monitoring, smart buildings, smart homes, power monitoring, and process control applications.

This product requires an independent power supply and is mounted on a standard 35mm DIN rail, offering simple on-site installation and flexible use, adapting to a variety of field applications.

· Technical Parameters

Basic Parameters	
Power Supply	DC12～36V(DC24V recommended)
Power Consumption	<1.5W
Measurement Accuracy	±0.1%F.S (+25° C)
Temperature Drift	≤200ppm/° C
Sampling Frequency	≤8Hz
ESD Protection	±15kV
Isolation Voltage	3000VDC
Power Supply Protection	Reverse Power Voltage <-40V
Dielectric Strength	1500VAC/1 minute (power, input, output)
Insulation Resistance	≥100MΩ (power, input, output)
Electromagnetic Compatibility	Complies with GB/T18268.1 (IEC61326-1)
Applicable Field Devices	Configuration software, PLCs, touch screens, computers, and other devices supporting the MODBUS-RTU protocol
Input Terminal	
Channels	4/6 Channels
Input Range	As shown in the sensor range table
Sampling Resolution	24-bit ADC, TI dedicated chip
Line Resistance Compensation Range	<50Ω
Output Terminal	
Output Signal	RS485/ Ethernet
Communication Protocol	Standard MODBUS-RTU protocol
Communication Distance	1200m (RS485 typical)
Temperature Type	
Thermocouple	Type B, Type E, Type J, Type K, Type N, Type R, Type S, Type T
Environmental Conditions	
Operating Temperature	-40℃～+80℃
Storage Temperature	-40℃～+85℃
Relative Humidity	10%～90%RH (non-condensing)
Atmospheric Pressure	80kPa～106kPa

· Analog Output

Analog Output	
Output Signal	0-5V/0-10V/0-20mA/4-20mA
Load Capacity	Voltage Output RL ≥ 2kΩ
	Current Output: RL ≤ 500Ω
Output Ripple	≤ 10mV (250Ω load)
Output Resolution	16-bit DAC

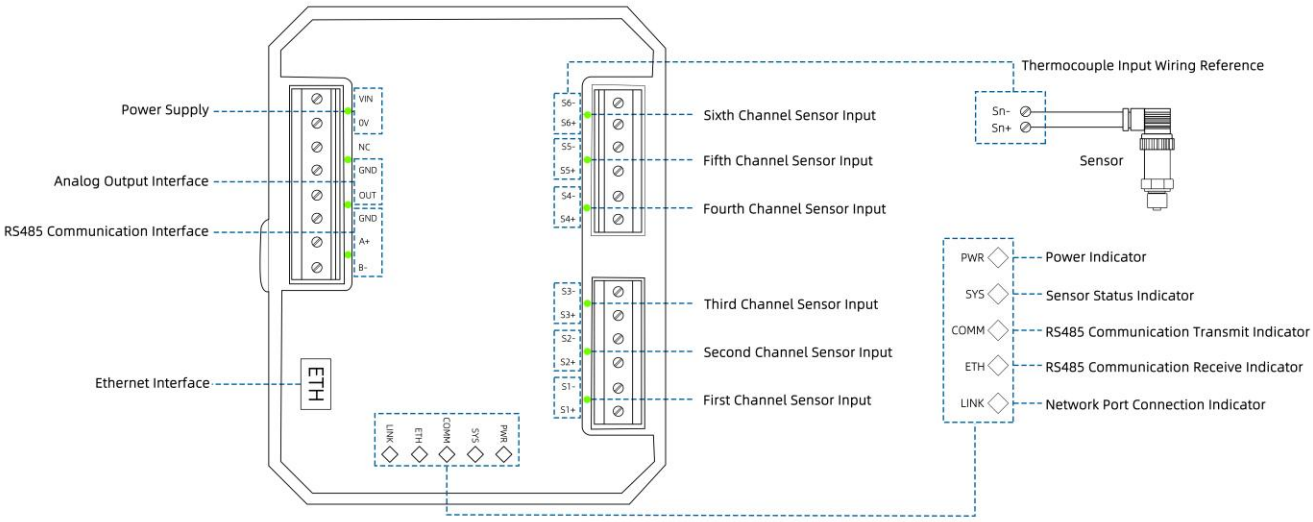
· Terminal Description

Terminal Mark	Function Description
VIN	Power Supply Positive Terminal (DC12-36V Input)
0V	Power Supply Negative Terminal
NC	No Connection
GND	Analog Output Ground
OUT	Analog Output Positive Terminal
GND	RS-485 Communication Signal Ground
A+	RS-485 Communication Signal Positive Terminal
B-	RS-485 Communication Signal Negative Terminal
S1+	Sensor Channel 1 Positive Input
S1-	Sensor Channel 1 Negative Input
S2+	Sensor Channel 2 Positive Input
S2-	Sensor Channel 2 Negative Input
S3+	Sensor Channel 3 Positive Input
S3-	Sensor Channel 3 Negative Input
S4+	Sensor Channel 4 Positive Input
S4-	Sensor Channel 4 Negative Input
S5+	Sensor Channel 5 Positive Input
S5-	Sensor Channel 5 Input negative terminal
S6+	Sensor channel 6 input positive terminal
S6-	Sensor channel 6 input positive terminal
ETH	Ethernet port（optional）

· Indicator Description

Indicator Mark	Function Description
PWR	Power Indicator
SYS	Sensor Status LED - Flashes when open
COMM	RS485 Communication LED - Flashes during data transmission
ETH	Ethernet Link LED
LINK	Host Connection LED

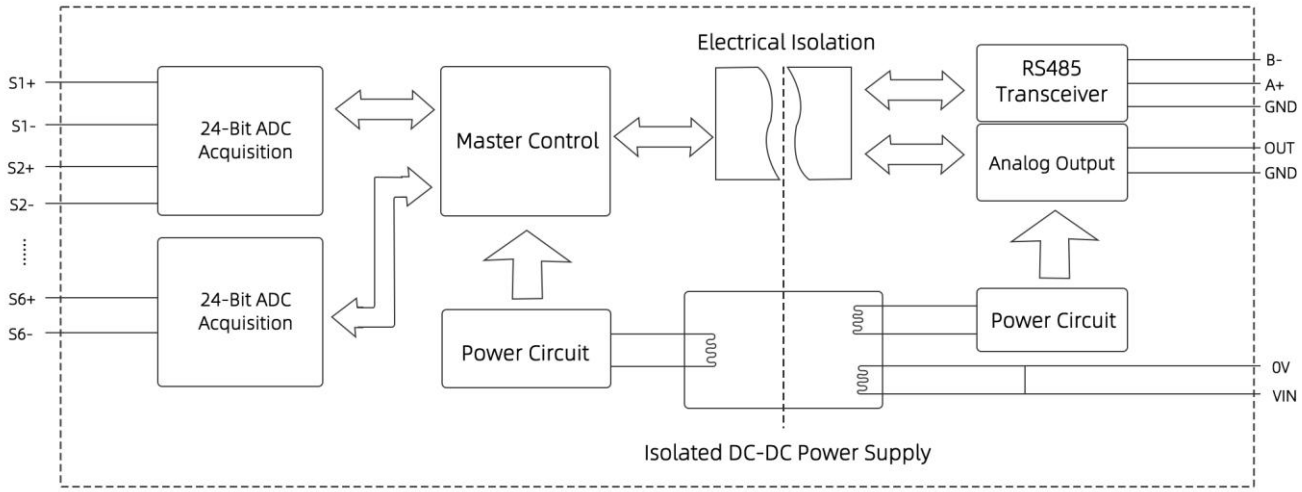
·Wiring and Indication



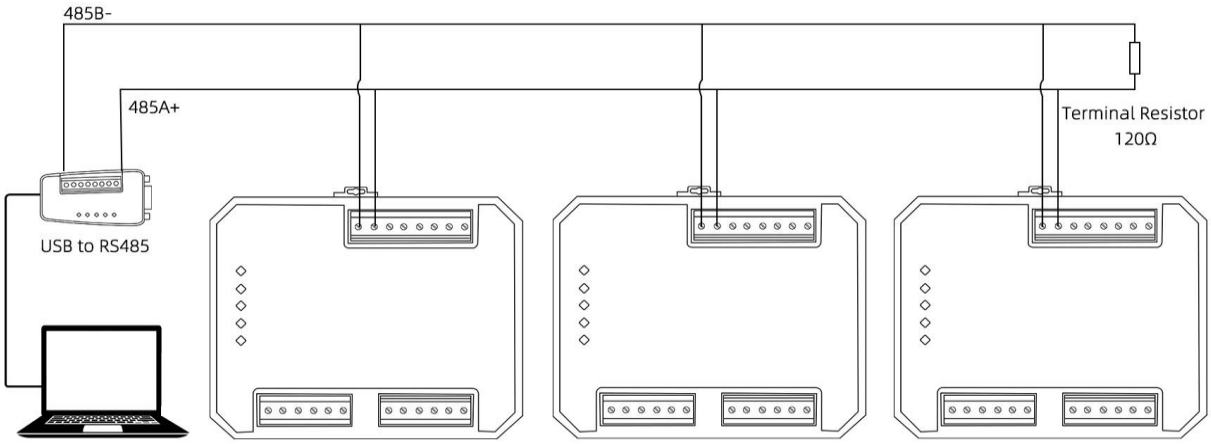
Note: In the analog output version, the analog output value corresponds to the signal value input by the first sensor.

- This module is available in three communication versions: RS485, Ethernet (ETH), and RS485 + Ethernet.
- The Ethernet port is active only in versions equipped with Ethernet functionality.
- For specific Ethernet features and operation, please refer to the Serial Server Manual.

· Module Working Principle



· Module expansion application

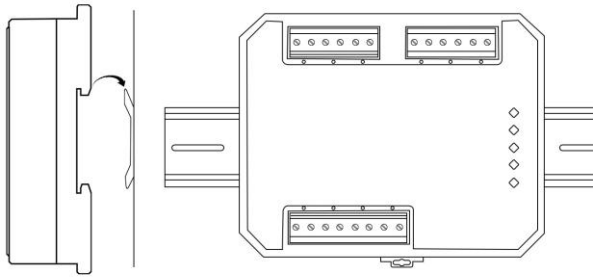


· Sensor Range Chart

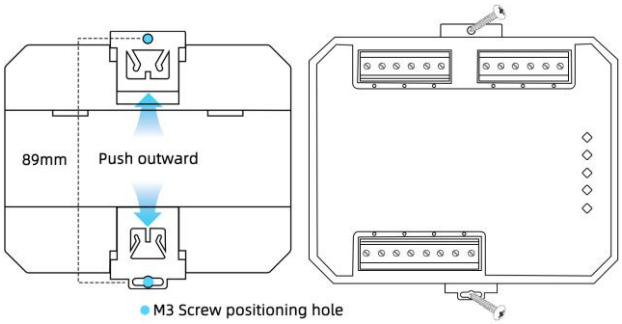
Graduation number	Temperature range	Graduation number	Temperature range	Graduation number	Temperature range	Graduation number	Temperature range
Type B	300℃～1800℃	Type N	-200℃～1300℃	PT100	-200℃～850℃	Cu100	-50℃～150℃
Type E	-200℃～950℃	Type R	-20℃～1750℃	PT500	-200℃～250℃	Ni100	-60℃～180℃
Type J	-200℃～1200℃	Type S	-20℃～1750℃	PT1000	-200℃～250℃	Ni500	-60℃～180℃
Type K	-200℃～1370℃	Type T	-200℃～400℃	Cu50	-50℃～150℃	Ni1000	-60℃～150℃

· Installation Instructions

This module uses the DIN35mm rail mounting method. The rail should comply with the installation dimension specifications for the TH35-7.5 type rail according to the national standard GB/T19334-2003. Users can easily install or remove the module on the rail. Installation must be stable and secure. This module also supports screw mounting without a rail.



– Installation method of guide rail –



– Screw installation method –

· Product Naming Rules

Take the SPT1040-MC01L as an example: a four-channel thermocouple acquisition module with 24-bit acquisition resolution, no analog output, RS485 communication, and a DC12-36V power supply. The housing is M.

SPT	1	04	0	M	C	0	1	L
Product Type	Sensor Type	Number of Channels	Type Code	Product Form Factor	Acquisition Resolution	Analog Output	Comm Method	Power Supply
Temperature Acquisition Module	1 Thermocouple 2 RTD 3 NTC 4 Other	1-32	0 Type B 1 Type E 2 Type J 3 Type K 4 Type N 5 Type R 6 Type S 7 Type T	N Form Factor K Form Factor M Form Factor W Form Factor F Form Factor R Form Factor Y Form Factor Q Form Factor	A 12-bit ADC B 16-bit ADC C 24-bit ADC D 32-bit ADC	0 No Output 1 0-5V 2 0-10V 3 4-20mA 4 0-20mA	0 No Comm 1 RS485 2 ETH 3 RS485+ETH 4 CAN 9 Other Comm	L DC12-36V H AC220V C +12V D +24V

· Product Model Selection Guide

SPT1040-MC01L-BLE: Module with built-in Bluetooth function for terminal connection (default version)

SPT1040-MC01L-4G: Module with 4G function for terminal connection

SPT1040-MC01L-WIFI: Module with Wi-Fi function for terminal connection

SPT1040-MC01L: Basic version, without terminal connection function

· MODBUS-RTU Communication Protocol

The MODBUS-RTU protocol specifies various function codes to implement different functions. This manual explains the messages for commonly used function codes. This module only supports some of these function codes, including 0X03, 0X04, 0X06, and 0X10.

Function Code	Register add	Function Description
0X01	0XXXX	Read Coil Status (bit operation), e.g., read relay or digital output current state (ON/OFF)
0X02	0XXXX	Read Input Status (bit operation), e.g., read one or more groups of digital input states (ON/OFF)
0X05	0XXXX	Write Single Coil (bit operation), e.g., force a relay or digital output ON/OFF
0X03	4XXXX	Read Holding Registers data.
0X04	4XXXX	Read Input Registers (can be replaced by 0X03)
0X06	4XXXX	Write Single Holding Register data.
0X10	4XXXX	Write Multiple Holding Registers data.

· Communication Parameter Settings

Parameter	Setting Range	Default Value
Address	1～247	1
Baud Rate	1200、2400、4800、9600、14400、19200、38400、56000、57600、115200	9600
Parity	None, Even, Odd	None
Stop Bits	1, 2, 0.5, 1.5	1

· Communication Protocol Description

This communication board complies with the MODBUS RTU bus protocol, RS485 interface. The communication format is 11 bits:

1 start bit

8 data bits

1 parity bit (if used)

1 stop bit (with parity), 2 stop bits (without parity)

Data type: Unsigned int

With Parity

Start Bit	1	2	3	4	5	6	7	8	Parity Bit	Stop Bit

Without Parity

Start Bit	1	2	3	4	5	6	7	8	Stop Bit	Stop Bit

The message frame starts with a silence interval of more than 3.5 character times. The first field transmitted is the module add, followed by the function code, then the register add then the data, followed by the CRC16 check. It ends with a silence interval of more than 3.5 character times. The frame format is as follows:

Start Bit	Module add	Function Code	Register add High Byte	Register add Low Byte	Register Data High Byte	Register Data Low Byte	CRC16 calibration	End
>3.5 Chars	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte	>3.5 Chars
	1–247	0X03 0X06	0X00	0X01	0X00	0X01	CRC	

Function Code: 0X01

1.Host Request Frame:

1 Byte	2 Byte	3 Byte	4 Byte	5 Byte	6 Byte	7 Byte	8 Byte
ADR	0X01	Start address Hi	Start address Lo	Qty Hi	Qty Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	coil start address to be read		number of coils to be read		CRC16 checksum from bytes1 to 6	

2.Slave Response Frame (Correct) : Coil status 0 = OFF and 1 = ON

1	2	3	4、5	6、7	……	N-1、N	N+1	N+2
ADR	0X01	Coil status Byte Count	Coil Status 1 Data	Coil Status 1 Data	……	Coil Status N Data	CRC16 Lo	CRC16 Hi
Module address (1~247)	Function code	Returns the number of bytes in coil status	Returns the wire net status data (one coil status is two bytes)				CRC16 checksum from bytes 1 to N	

Function Code: 0X02

1.Host Request Frame:

1	2	3	4	5	6	7	8
ADR	0X02	Start address Hi	Start address Lo	Qty Hi	Qty Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	The coil input start address to be read		number of coils to be read		CRC16 checksum from bytes1 to 6	

2.Slave Response Frame (Correct) : Coil status 0 = OFF and 1 = ON

1	2	3	4、5	6、7	……	N-1、N	N+1	N+2
ADR	0X02	Coil status Byte Count	Coil Status 1 Data	Coil Status 1 Data	……	Coil Status N Data	CRC16 Lo	CRC16 Hi
Module address (1~247)	Function code	Returns the number of bytes in coil status	Returns multiple coil input status data				CRC16 checksum from bytes1 to N	

Function Code: 0X05

1.Host Request Frame: Coil status 0 = OFF and 1 = ON

1	2	3	4	5	6	7	8
ADR	0X05	Coil address Hi	Coil address Lo	Force Data Hi	Force Data Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Written coil address		Number of coils written		CRC16 checksum from bytes1 to 6	

2.Slave Response Frame (Correct) :

1	2	3	4	5	6	7	8
ADR	0X05	Coil address Hi	Coil address Lo	Force Data Hi	Force Data Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Written coil address		Returns coil status data		CRC16 checksum from bytes1 to 6	

Function Code: 0X03

1.Host Request Frame:

1 Byte	2 Byte	3 Byte	4 Byte	5 Byte	6 Byte	7 Byte	8 Byte
ADR	0X03	Start address Hi	Start address Lo	Reg Qty Hi	Reg Qty Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	The register starting address to read is		Number of registers read		CRC16 checksum of bytes 1 to 6	

2.Slave Response Frame (Correct) :

1	2	3	4、5	6、7	……	N-1、N	N+1	N+2
ADR	0X03	Byte Count	Reg 1 Data Hi	Reg 1 Data Lo	……	Reg N Data Hi, Reg N Data Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Returns the effect of reading register bytes	Returns multiple register data (one register data is two bytes)				CRC16 checksum of bytes 1 to N	

Function Code: 0X06

1.Host Request Frame:

1	2	3	4	5	6	7	8
ADR	0X06	Reg address Hi	Reg address Lo	Reg Data Hi	Reg Data Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Register address to be written		Register data to be written		CRC16 checksum of bytes 1 to 6	

2.Slave Response Frame (Correct) :

1	2	3	4	5	6	7	8
ADR	0X06	Reg address Hi	Reg address Lo	Reg Data Hi	Reg Data Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Returns the register address written		Returns the written register data		CRC16 checksum of bytes 1 to 6	

Function Code: 0X10

1.Host Request Frame:

1	2	3、4	5、6	7	8、9	10、11	……	N-1、N	N+1	N+2
ADR	0X10	Start Add	Reg Qty	Byte Count	Reg 1 Data	Reg 2 Data	……	Reg N Data	CRC Check	CRC Check
Module address (1~247)	Function code	The starting address of the register to be written	Validity of register written	Number of register data bytes written	Multiple register data written (One register data is two bytes)				CRC16 checksum of bytes 1 to N	

2.Slave Response Frame (Correct) :

1	2	3	4	5	6	7	8
ADR	0X10	Start Add Hi	Start Add Lo	Reg Qty Hi	Reg Qty Lo	CRC Lo	CRC Hi
Module address (1~247)	Function code	Returns the starting address of the register written		Returns the number of registers written		CRC16 checksum of bytes 1 to 6	

· Register Definition Table

PLC add	Register add (HEX)	Function Definition	R/W Attribute	Value Range and Description
40002	1	Sensor channel 1 temperature value	Read only	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40003	2	Sensor channel 2 temperature value	Read only	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40004	3	Sensor channel 3 temperature value	Read only	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40005	4	Sensor channel 4 temperature value	Read only	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40006	5	Sensor channel 1 status	Read only	0: Normal status 1: Sensor disconnected 2: Sensor connected incorrectly
40007	6	Sixth Relay Output Control	Read only	0: Normal status 1: Sensor disconnected 2: Sensor connected incorrectly
40008	7	Seventh Relay Output Control	Read only	0: Normal status 1: Sensor disconnected 2: Sensor connected incorrectly
40009	8	Eighth Relay Output Control	Read only	0: Normal status 1: Sensor disconnected 2: Sensor connected incorrectly
40010	9	Cold junction temperature	Read only	Module internal temperature sensor value, unit 0.1℃
40051	32	Sensor channel 1 temperature lower limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40052	33	Sensor channel 1 temperature upper limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40053	34	Sensor channel 2 temperature lower limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40054	35	Sensor channel 2 temperature upper limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40055	36	Sensor channel 3 temperature lower limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40056	37	Sensor channel 3 temperature upper limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40057	38	Sensor channel 4 temperature lower limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40058	39	Sensor channel 4 temperature upper limit	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40059	3A	Sensor channel 1 calibration number	Read/Write	0: Type B thermocouple 1: Type E thermocouple 2: Type J thermocouple 3: Type K thermocouple 4: Type N thermocouple 5: Type R thermocouple 6: Type S thermocouple 7: Type T thermocouple 8: PT100 9: PT500 10: PT1000 11: Cu50 12: Cu100 13: Ni100 14: Ni500 15: Ni1000
40060	3B	Sensor channel 2 scale	Read/Write	parameters are the same as sensor channel 1 scale
40061	3C	Sensor channel 3 scale	Read/Write	parameters are the same as sensor channel 1 scale
40062	3D	Sensor channel 4 scale	Read/Write	parameters are the same as sensor channel 1 scale
40063	3E	Sensor Channel 1 Wiring System	Read/Write	0: Two-wire sensor 1: Three-wire sensor 2: Four-wire sensor Wiring system is valid for RTDs with calibration numbers 8-15.

40064	3F	Sensor channel 2 wiring system	Read/Write	parameters are the same as those of sensor channel 1 wiring system
40065	40	Sensor channel 3 wiring system	Read/Write	parameters are the same as those of sensor channel 1 wiring system
40066	41	Sensor channel 4 wiring system	Read/Write	parameters are the same as those of sensor channel 1 wiring system
40067	42	Sensor channel 1 cold junction offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40068	43	Sensor channel 2 cold junction offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40069	44	Sensor channel 3 cold junction offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40070	45	Sensor channel 4 cold junction offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40071	46	Sensor channel 1 reading offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40072	47	Sensor channel 2 reading offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40073	48	Sensor channel 3 reading offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40074	49	Sensor channel 4 reading offset	Read/Write	-32768～32768, 10 times the temperature value, 100 is 10.0℃
40075	4A	Sensor channel 1 damping coefficient	Read/Write	0～65536 Unit: 0.1 second
40076	4B	Sensor channel 2 damping coefficient	Read/Write	0～65536 Unit: 0.1 second
40077	4C	Sensor channel 3 damping coefficient	Read/Write	0～65536 Unit: 0.1 second
40078	4D	Sensor channel 4 damping coefficient	Read/Write	0～65536 Unit: 0.1 second
40079	4E	Sensor channel 1 damping coefficient	Read/Write	0～65536 Unit: 0.1 second
40080	4F	Functionality retained	Read/Write	0～65536
40081	50	Functionality retained	Read/Write	0～65536
40082	51	Functionality retained	Read/Write	0～65536
40083	52	Communication address	Read/Write	1～247
40084	53	Baud Rate	Read/Write	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 14400bps 5: 19200bps 6: 38400bps 7: 56000bps 8: 57600bps 9: 115200bps
40085	54	Parity Bit	Read/Write	0: No parity 1: Even parity 2: Odd parity
40086	55	Stop Bit	Read/Write	0: 1 stop bit 1: 0.5 stop bits 2: 2 stop bits
40087	56	Device Number 1	Read-only	0～65536
40088	57	Device Number 2	Read-only	0～65536
40089	58	Firmware version	Read-only	0～65536
40090	59	Equipment Category	Read-only	0～65536