

Pt100 to RS-485, thermal resistance temperature Modbus data acquisition module

WJ125

Product features:

- Pt100/Pt1000 thermal resistance isolation conversion RS-485 output
- Standard 3-wire measurement method with automatic long line compensation
- Using a 12 bit AD converter, the measurement accuracy is better than 0.1%
- The accuracy of the calibration module can be programmed through the RS-485 interface
- Isolation withstand voltage between signal input/output 1000VDC
- Wide power supply range: 8~32VDC
- High reliability, easy programming, and easy application
- Standard DIN35 rail installation, convenient for centralized wiring
- Users can program module addresses, baud rates, etc
- Supports Modbus RTU communication protocol and automatic recognition protocol
- Industrial flame retardant shell, RS485 port surge protection
- The AD conversion rate can be programmed and set

Typical applications:

- Pt100 temperature signal measurement
- RS-485 remote I/O, data acquisition
- Intelligent building control, security engineering and other application systems
- RS485 bus industrial automation control system
- Industrial site signal isolation and long-distance transmission
- Equipment operation monitoring
- Measurement of sensor signals
- Acquisition and recording of industrial field data
- Development of medical and industrial control products



diagram 1 WJ125 module appearance diagram

Product Overview:

The WJ125 product implements multi-channel signal acquisition between sensors and hosts to detect temperature signals. The WJ125 series products can be applied in RS-485 bus industrial automation control systems, temperature signal measurement, monitoring, and control, etc.

The product includes power isolation, signal isolation, linearization, A/D conversion, and RS-485 serial communication. Each serial port can connect up to 255 WJ125 series modules, and the communication method adopts ASCII code communication protocol or MODBUS RTU communication protocol. The address and baud rate can be set by code, and can be hung on the same RS-485 bus with control modules from other manufacturers for easy computer programming.

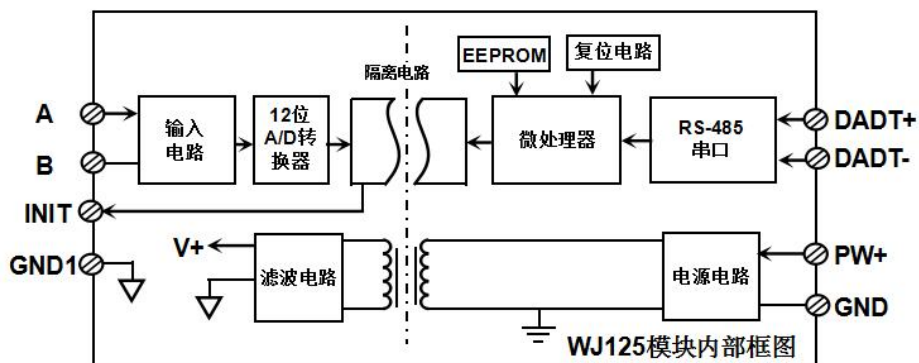


Figure 2 Internal Block Diagram of WJ125 Module

The WJ125 series products are intelligent monitoring and control systems based on microcontrollers. All user set calibration values, addresses, baud rates, data formats, parity checks, and other configuration information are stored in non-volatile memory EEPROM.

The WJ125 series products are designed and manufactured according to industrial standards, with isolation between signal inputs/outputs, capable of withstanding 1000VDC isolation voltage, strong anti-interference ability, and high reliability. The working temperature range is -45 °C to +85 °C.

Function Introduction:

The WJ125 signal isolation acquisition module can be used to measure one temperature signal.

1、 Temperature signal input

12 bit acquisition accuracy, 1 temperature signal input. All signal input ranges have been calibrated before the product leaves the factory. During use, users can also easily program and calibrate themselves.

2、 Communication Protocol

Communication interface: 1 standard RS-485 communication interface.

Communication Protocol: Supports two protocols, the character protocol defined by the command set and the MODBUS RTU communication protocol. The module automatically recognizes communication protocols and can achieve network communication with various brands of PLCs, RTUs, or computer monitoring systems.

Data format: 10 digits. 1 start bit, 8 data bits, 1 stop bit, no checksum.

The communication address (0-255) and baud rate (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be set;

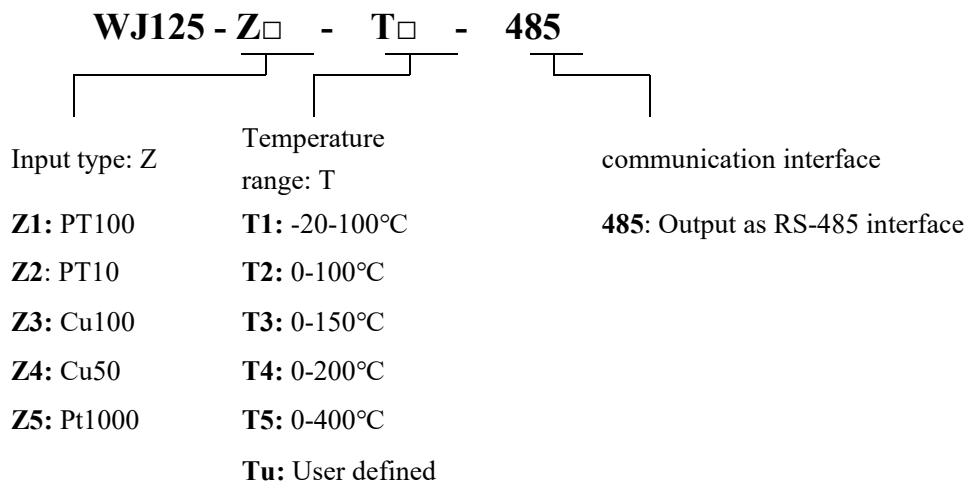
The communication network can reach a maximum distance of 1200 meters and is connected through twisted pair shielded cables.

High anti-interference design of communication interface, ± 15KV ESD protection, communication response time less than 100mS.

3、 anti-interference

Parity check can be set as needed. There is a transient suppression diode inside the module, which can effectively suppress various surge pulses, protect the module, and the internal digital filter can also effectively suppress power frequency interference from the power grid.

Product selection:



Selection example 1: Model: **WJ125 Z1-T1-485** indicates input: Pt100, temperature range: -20~100 °C, output is RS-485 interface

Selection example 2: Model: **WJ125- Z5-T4-485** indicates input: Pt1000, temperature range: 0~200 °C, output is RS-485 interface

Selection Example 3: Model: **WJ125 Z1-Tu-485** Input: Pt100, Temperature Range: 0~50 °C, Output: RS-485 Interface

WJ125 General Parameters:

(Typical @+25 °C, Vs is 24VDC)

Input type: Pt100 input/Pt1000 input

Accuracy: 0.1%

Temperature drift: ± 50 ppm/°C (± 100 ppm/°C, maximum)

Bandwidth: -3 dB 10 Hz

Conversion rate: 10 Sps (factory default value, users can modify the conversion rate by issuing commands.)

You can set the AD conversion rate to 2.5 SPS, 5 SPS, 10 SPS, and 20 SPS by sending commands. (Channel conversion rate=AD conversion rate/number of open channels)

Note: Please recalibrate the module after modifying the conversion rate, otherwise the measured data may have deviations. You can also specify the conversion rate when placing an order, and we will recalibrate the product according to the conversion rate you require when it leaves the factory.

Common mode rejection (CMR): 120 dB (1k Ω Source Imbalance @ 50/60 Hz)

Normal mode suppression (NMR): 60 dB (1k Ω Source Imbalance @ 50/60 Hz)

Input protection: overvoltage protection, overcurrent protection

Communication: RS-485 standard character protocol and MODBUS RTU communication protocol

Baud rates (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be selected by software

The address (0-255) can be selected by software

Communication response time: 100 ms maximum

Working power supply: +8~32VDC wide power supply range, with internal anti reverse and overvoltage protection circuits

Power consumption: less than 1W

Working temperature: -45~+80 °C

Working humidity: 10~90% (no condensation)

Storage temperature: -45~+80 °C

Storage humidity: 10~95% (no condensation)

Isolation withstand voltage: 1KVDC between input/output, 1 minute, leakage current 1mA

The RS-485 output and power supply are grounded together.

Surge resistant voltage: 1KVAC, 1.2/50us (peak value)

Dimensions: 106 mm x 59mm x 24mm

Pin definition:

Pin	name	Description	Pin	name	Description
one	PW+	Positive end of power supply	five	INIT	Initial state setting
two	GND	Negative end of power supply	six	GND1	Digital signal ground, thermistor input B2 terminal
three	DATA+	RS-485 signal positive terminal	seven	B	Thermal resistor input B1 terminal
four	DATA-	RS-485 signal negative terminal	eight	A	Thermal resistor input A terminal

Table 1 Pin Definition

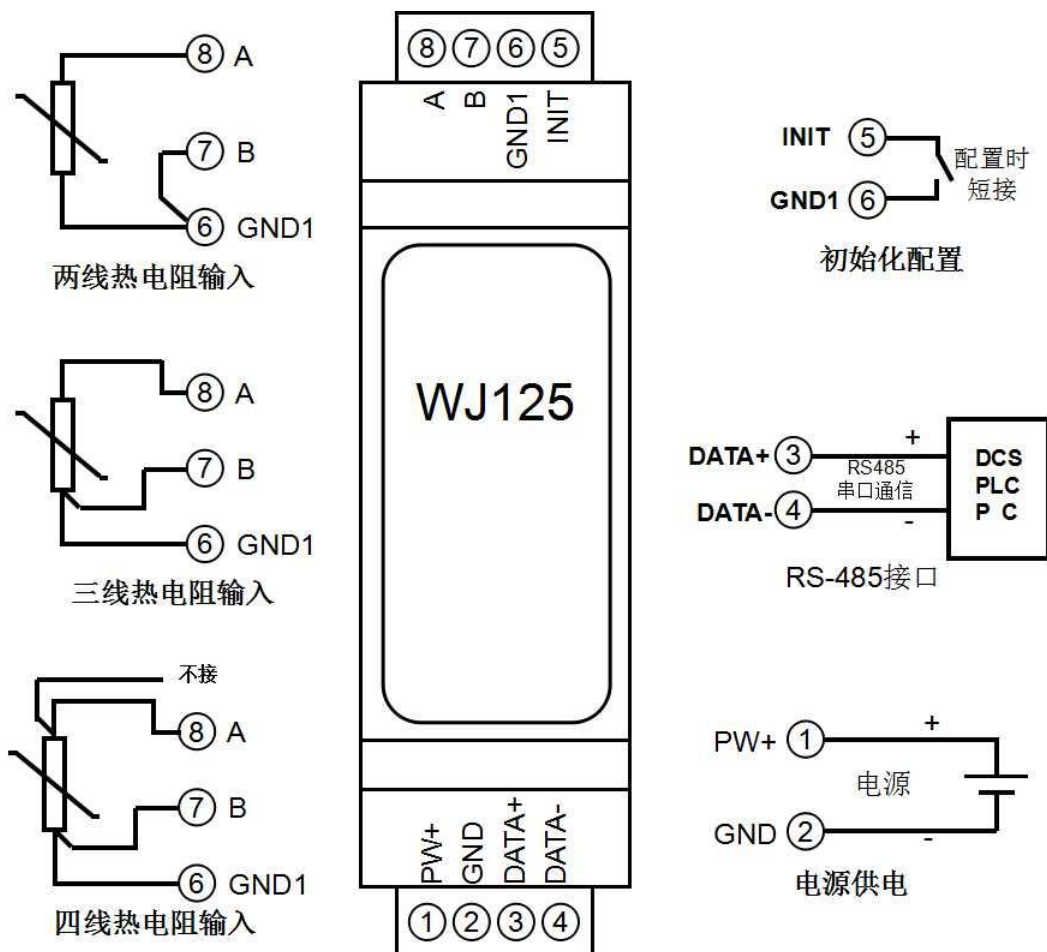


Figure 3 Wiring diagram of WJ125 module

WJ125 Character Protocol Command Set:

The factory initial settings of the module are as follows:

The address code is 01

Baud rate 9600 bps

No verification

If using an RS-485 network, a unique address code must be assigned, with a hexadecimal value between 00 and FF.

Since the address codes of new modules are the same, their addresses will conflict with those of other modules. Therefore, when building the system, you must reconfigure the addresses of each WJ125 module. After connecting the power line and RS485 communication line of the WJ125 module, the address of the WJ125 module can be modified through configuration commands. The baud rate and parity check also need to be adjusted according to the user's requirements.

Method to put the module into default state:

The WJ125 module has a special pin labeled as Initiat. Short circuit the Initiat pin to the GND pin, then turn on the power, and the module will enter the default state. In this state, the configuration of the module is as follows:

The address code is 00

Baud rate 9600 bps

No verification

When unsure of the specific configuration of a module, the Initiat pin can also be short circuited to the GND pin, and then the power can be turned on to put the module into default state, and then the module can be reconfigured.

The character protocol command consists of a series of characters, such as the prefix, address ID, and variables.

Note: In some cases, many commands use the same command format. To ensure that the address you are using is correct in a command, if you use the wrong address that represents another module, the command will take effect in that module, resulting in an error.

2. Commands must be entered in uppercase letters.

1. Read analog input module data command

Explanation: Read back the temperature data of the thermistor from the module, which is the actual temperature value.

If the data is -888.88, it indicates a short circuit in the thermal resistance,

If the data is 888.88, it indicates a thermoelectric blocking line.

Command format: **# 01**

Parameter description: # delimiter.

01 module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

Response format: The **>(data) (cr)** command is valid.

? The **AA (cr)** command is invalid or an illegal operation or channel is closed.

Parameter description: >delimiter.

(data) represents the retrieved data. The data format is temperature values.

(cr) End symbol, enter key on the upper computer (ODH).

Other instructions: If there is a syntax error, communication error, or if the address does not exist, the module will not respond.

Application example: User command (character format) **# 01**

(Hexadecimal format) **233031**

Module response (character format) **>+018.00 (cr)**

(Hexadecimal format): **3E2B3031382E30300D**

Explanation: The input on address 01H module is: +018.00 °C

2. Configure WJ125 module command

Explanation: Set the address, input range, baud rate, and parity for a WJ125 module. The configuration information is stored in non-volatile memory EEPROM.

Command format: **% AANNTTCCFF**

Parameter description: **%** delimiter.

AA module address, with a value range of 00 to FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

NN represents the new module hexadecimal address, with values ranging from 00 to FF. Convert to hexadecimal to ASCII code for each character. If address 18 is replaced with hexadecimal as 31H and 38H.

TT uses hexadecimal to represent type encoding. The WJ125 product must be set to 00.

CC uses hexadecimal to represent baud rate encoding.

Baud rate code	Baud rate
04	2400 baud
05	4800 baud
06	9600 baud
07	19200 baud
08	38400 baud
09	57600 baud

Table 2 Baud rate codes

FF uses 8 bits in hexadecimal to represent parity check.

00: No verification

10: Odd verification

20: Even verification

Response format: **!** The **AA (cr)** command is valid.

? The **AA (cr)** command is invalid or an illegal operation.

Parameter description: **!** The delimiter indicates that the command is valid.

? The delimiter indicates that the command is invalid.

AA represents the input module address

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Other instructions: If you are configuring the module for the first time, AA=01H, NN equals the new address.

If the format is incorrect, the communication is incorrect, or the address does not exist, the module will not respond.

Application example: User command **% 0111000600**

Module response: **! 11(cr)**

Explanation: **%** delimiter.

01 means that the original address of the WJ125 module you want to configure is 01H.

11 indicates that the new module's hexadecimal address is 11H.

00 type code, WJ125 product must be set to 00.

06 represents a baud rate of 9600 baud.

00 indicates no verification.

3. Read configuration status command

Explanation: Read configuration for a designated WJ125 module.

Command format: **\$012**

Parameter description: \$delimiter.

01 module address, with a value range of 00 to FF (hexadecimal).

2 represents the command to read the configuration status

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Response format:!
 ? The **AA (cr)** command is invalid or an illegal operation.

Parameter description:!
AA represents the input module address.

TT stands for type code.

CC stands for baud rate encoding. See Table 2

FF is shown in Table 3

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Other instructions: If the format is incorrect, the communication is incorrect, or the address does not exist, the module will not respond.

Application example: User command **\$012**

Module response! **300F0600(cr)**

Explanation:!
301 indicates that the WJ125 module address is 01H.

00 represents the input type code.

06 represents a baud rate of 9600 baud.

00 indicates no verification.

4. Set module AD conversion rate

Description: Set the AD conversion rate of the module. Among them, channel conversion rate=AD conversion rate/number of opened channels. The slower the sampling rate, the more accurate the data collected. Users can adjust it according to their needs. The default conversion rate at the factory is 10SPS.

Note: Please recalibrate the module after modifying the conversion rate, otherwise the measured data may have deviations. You can also specify the conversion rate when placing an order, and we will recalibrate the product according to the conversion rate you require when it leaves the factory.

Command format: **\$AA3R**

Parameter description: \$delimiter.

AA module address, with a value range of 00 to FF (hexadecimal).

3 represents the command to set conversion rate

R conversion rate code, which can range from 0 to 3

Code R	0	one	two	three						
Conversion rate	2.5 SPS	5 SPS	10 SPS	20 SPS						

Response format:!
 ? Invalid or illegal operation of **AA (cr)** command

Parameter description:!
 ? The delimiter indicates that the command is invalid.

The delimiter indicates that the command is invalid.

AA represents the input module address.

(cr) End symbol, upper computer enter key, hexadecimal is 0DH.

Other instructions: If the format is incorrect, the communication is incorrect, or the address does not exist, the module will not respond.

Application example 1: User command **\$0032**

Module response! **00 (cr)**

Explanation: Set the AD conversion rate to 10SPS.

Application example 2: User command **\$0033**

Module response! **00 (cr)**

Explanation: Set the AD conversion rate to 20SPS.

5. Read module AD conversion rate

Explanation: Read the AD conversion rate of the module. Among them, channel conversion rate=AD conversion rate/number of opened channels. The slower the sampling rate, the more accurate the data collected.

Command format: **\$AA4**

Parameter description: \$delimiter.

AA module address, with a value range of 00 to FF (hexadecimal).

4 represents the read conversion rate command

Response syntax:! The **AAR (cr)** command is valid.

? Invalid or illegal operation of **AA (cr)** command

Parameter description:! The delimiter indicates that the command is valid.

? The delimiter indicates that the command is invalid.

AA represents the input module address.

R conversion rate code, which can range from 0 to 3

Code R	0	one	two	three						
Conversion rate	2.5 SPS	5 SPS	10 SPS	20 SPS						

(cr) End symbol, enter key on the upper computer (ODH).

Other instructions: If there is a syntax error, communication error, or if the address does not exist, the module will not respond.

Application example 1: User command **\$004**

Module response! **002 (cr)**

Explanation: The current AD conversion rate is 10SPS.

Application Example 2: User Command **\$004**

Module response! **003 (cr)**

Explanation: The current AD conversion rate is 20SPS.

6. Reset all parameters set by the above character command to factory settings.

Explanation: The parameters set by the module using the above character commands are restored to factory settings.

Command format: **\$AA900** Set parameters to factory settings.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted to hexadecimal as the ASCII code for each character. If address 01 is replaced with hexadecimal, it will be 30H and 31H.

Response format:! **AA (cr)** indicates successful setup, and the module will automatically restart.

Application example: User command (character format) **\$01900**

Module response (character format)! **01(cr)**

Explanation: Parameters are reset to factory settings.

Modbus RTU communication protocol:

The factory initial settings of the module are as follows:

The Modbus address is 01

Baud rate 9600 bps

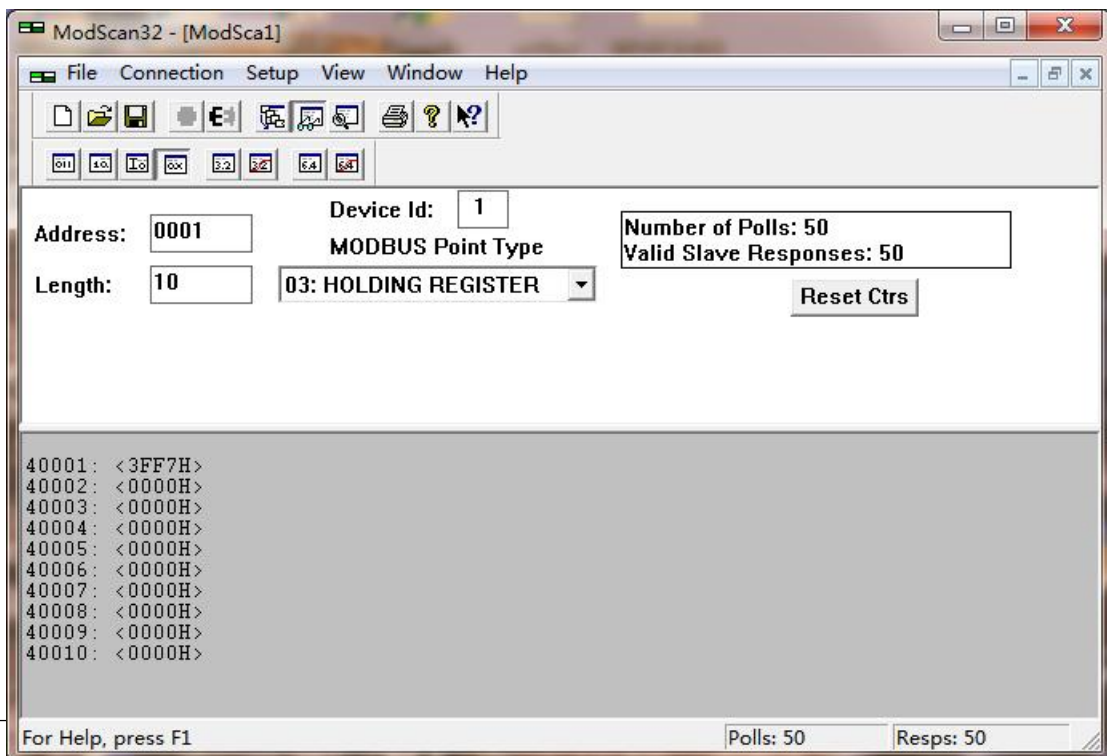
Data format: 10 digits. 1 start bit, 8 data bits, and 1 stop bit. No verification.

Method to put the module into default state:

The WJ150 module has a special pin labeled as Initiat. Short circuit the Initiat pin to the GND pin, then turn on the power, and the module will enter the default state. In this state, the module temporarily returns to its default state: address 01, baud rate 9600. When unsure of the specific configuration of a module, users can query the address and baud rate registers 40201-40202 to obtain the actual address and baud rate of the module, or modify the address and baud rate as needed.

Supports Modbus RTU communication protocol **function code 03** (read hold register) and **function code 06** (write single register), with command format following the standard Modbus RTU communication protocol.

Modbus software testing example:



The registers supporting function codes 03 and 06 are as follows:

Address 4X (PLC)	Address (PC, DCS)	Data content	attribute	Data Explanation
forty thousand and eleven	0010	Integer temperature value	read-only	The measured temperature data, signed integer, divided by 10 equals the actual temperature. If the data is -8888, it indicates a short circuit in the thermal resistance, If the data is 8888, it indicates a thermoelectric blocking line.
40031~40032	0030~0031	Floating point temperature value	read-only	Measured temperature data, 32-bit floating-point number, The lower 16 bits are in register 40031, The high 16 bits are in register 40032 If the data is -888.88, it indicates a short circuit in the thermal resistance, If the data is 888.88, it indicates a thermoelectric blocking line.
forty thousand two hundred and one	0200	Module address	Read/Write	Integer, effective after restart, range 0x0000-0x00FF
forty thousand two hundred and two	0201	Baud rate	Read/Write	Integer, effective after restart, range 0x0004-0x000A 0x0004 = 2400 bps, 0x0005 = 4800 bps 0x0006 = 9600 bps, 0x0007 = 19200 bps 0x0008 = 38400 bps, 0x0009 = 57600 bps 0x000A = 115200bps
forty thousand two hundred and three	two hundred and two	Parity check	Read/Write	Integer, takes effect after restart 0: No verification 1: Odd verification 2: Even verification
forty thousand two hundred and four	0203	Conversion rate	Read/Write	Integer, range 0x0000-0x0003, The factory default is 2. Please recalibrate the module after modification. 0x0000 = 2.5 SPS, 0x0001 = 5 SPS, 0x0002 = 10 SPS, 0x0003 = 20 SPS

Communication example: If the module address is 01, send in hexadecimal: **0103000A0001A408** to retrieve the data

from register 40011.

01	03	00	0A	00	01	A4	08
Module address	Read and hold register	Register Address High Bit	Low bit register address	Register quantity high	Low register quantity	CRC check low bit	CRC check high bit

If the module replies: **0103020BB8BF06**, the read data is 0x0BB8, converted to decimal 3000, and then divided by 10, it indicates that the current input temperature is 300.0 °C.

01	03	02	nineteen	ninety-nine	BF	06
Module address	Read and hold register	The number of bytes in the data	data-high	data-low	CRC check low bit	CRC check high bit

Calibration module:

The product has been calibrated before leaving the factory, and users can use it directly without calibration.

During use, you can also use the product's calibration function to recalibrate the module. When in school, the module needs to input appropriate signals, and different input ranges require different input signals.

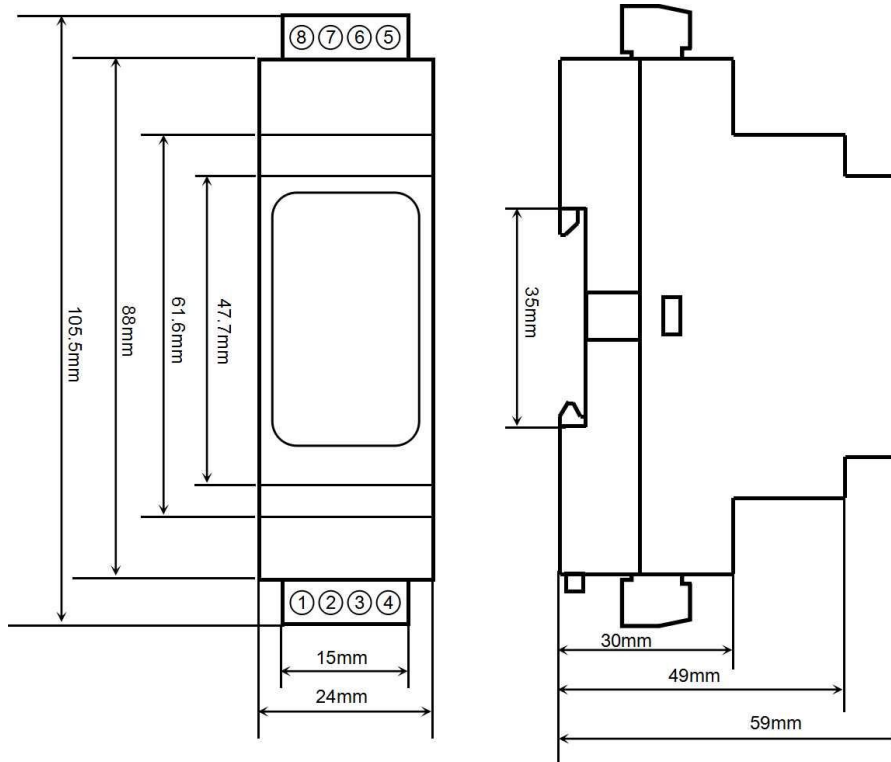
To improve calibration accuracy, it is recommended to use the following equipment for calibration:

1. A high-precision resistor box that can be precise to 0.01 ohms

Calibration process

- 8 1. Connect the corresponding input signal to the channel that needs to be calibrated according to the input range of the module.
- 9 2. Input the resistance signal corresponding to the zero point to the WJ125 module.
- 10 3. For example, for Pt100, if the zero point is 0 degrees, adjust the resistance of the resistance box to 100 ohms
- 11 4. After the signal stabilizes, send the offset calibration \$01C0 command to the WJ25 module.
- 12 5. Input the resistance signal corresponding to 100% full load to the WJ125 module.
- 13 6. For example, with Pt100 and a full range of 400 degrees, adjust the resistance of the resistance box to 247.092 ohms
- 14 7. For example, with Pt100 and a full range of 600 degrees, adjust the resistance of the resistance box to 313.708 ohms
- 15 8. After the signal stabilizes, send the gain calibration \$01C1 command to the WJ125 module.
6. Calibration completed

Dimensions: (Unit: mm)



guarantee:

Within two years from the date of sale, if the user complies with the storage, transportation, and usage requirements and the product quality is lower than the technical specifications, it can be returned to the factory for free repair. If damage is caused due to violation of operating regulations and requirements, device fees and maintenance fees shall be paid.

Copyright:

Copyright © 2023 Shenzhen Weijunrui Technology Co., Ltd.

Without permission, no part of this manual may be copied, distributed, translated, or transmitted. This manual is subject to modification and update without prior notice.

Trademark:

The other trademarks and copyrights mentioned in this manual belong to their respective owners.

Version number: V1.1

Date: March 2023