Resistance potentiometer electronic ruler conversion network Modbus TCP and MQTT network data acquisition module WJ183

Two wire resistor, three wire resistor

Figure 1 Appearance of WJ183 module

Product features:

- Signal acquisition and conversion of resistance potentiometer electronic ruler to standard Modbus TCP protocol
- Supports communication protocols such as TCP Server, UDP, MQTT, etc
- Built in web page function, data can be queried through web pages
- Wide power supply range: 8~32VDC
- High reliability, easy programming, and easy application
- Standard DIN35 rail installation, convenient for centralized wiring
- Users can set module IP addresses and other parameters on the webpage
- Low cost, small size, modular design
- Dimensions: 106 mm x 59mm x 37mm

Typical applications:

- Signal measurement, monitoring, and MQTT reporting
- TCP network, data collection
- Intelligent building control, security engineering and other application systems
- Industrial automation control system based on TCP network
- Industrial site signal isolation and long-distance transmission
- Equipment operation monitoring, MES system
- Potentiometer, displacement signal measurement
- Acquisition and recording of industrial field data
- Development of medical and industrial control products

Signal acquisition of resistance potentiometer electronic ruler

Product Overview:

The WJ183 product is an IoT and industrial Ethernet acquisition module that enables transparent data exchange between sensors and networks. The analog data from sensors can be forwarded to the network.

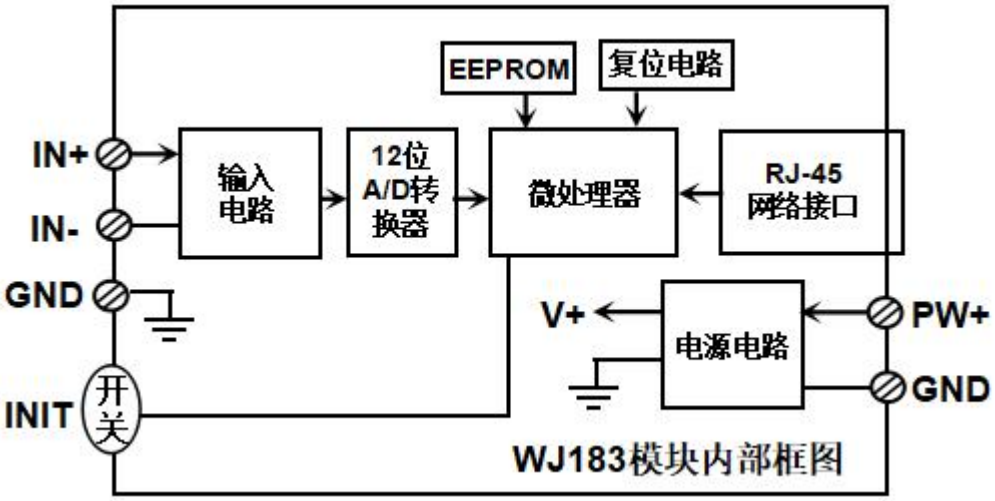


Figure 2 Internal Block Diagram of WJ183 Module

The WJ183 series products include power conditioning, analog acquisition, and RJ-45 network interface communication. The communication method adopts MODBUS TCP protocol. TCP is a transport layer based protocol that is widely used and a reliable connection oriented protocol. Users can directly set module IP addresses, subnet masks, etc. on the webpage. Can be used for monitoring and controlling the operation of sensor devices.

The WJ183 series products are intelligent monitoring and control systems based on microcontrollers, where user set module IP addresses, subnet masks, and other configuration information are stored in non-volatile memory EEPROM.

The WJ183 series products are designed and manufactured according to industrial standards, with strong anti-interference ability and high reliability. The working temperature range is -45 ℃ to+80 ℃.

Function Introduction:

The WJ183 remote I/O module can be used to measure potentiometer resistance signals.

1. Potentiometer signal input

12 bit acquisition accuracy, potentiometer resistance signal input. The product has been fully calibrated before leaving the factory. Users do not need to calibrate.

2. Communication Protocol

Communication interface: RJ-45 network interface. The two indicator lights at the network port position, the Link light (green light) stays on and the Data light (yellow light) stays on after the network cable is plugged in.

Communication protocol: MODBUS TCP protocol is adopted to achieve industrial Ethernet data exchange. It can also communicate with modules through TCP sockets.

Network cache: 2K bytes (for both sending and receiving)

Communication response time: less than 10mS.

3. Anti interference

There is a transient suppression diode inside the module, which can effectively suppress various surge pulses and protect the module.

Product model:

WJ183 - □R□ - RJ45

Input type: □ **R** □		**Communication interface: RJ45**	
code	explain	code	explain
3Ru	Three wire resistor: universal in the range of 100 Ω~500K Ω	**RJ45**	Output as RJ-45 network interface
2R1	Two wire resistor: 0-50 Ω		
2R2	Two wire resistor: 0-100 Ω		
2R3	Two wire resistor: 0-200 Ω		
2R4	Two wire resistor: 0-500 Ω		
2R5	Two wire resistor: 0-1K Ω		
2R6	Two wire resistor: 0-2K Ω		
2R7	Two wire resistor: 0-5K Ω		
2R8	Two wire resistor: 0-10K Ω		
2Ru	Two wire resistor: user-defined		

Selection Example 1:
Model: **WJ183-3Ru-RJ45** represents the potentiometer signal input within the range of 100 Ω~500K Ω for a three wire resistor resistance, and the output is an RJ-45 network interface

Selection Example 2:
Model: **WJ183-2R8-RJ45** represents a two-wire resistor with a resistance input in the range of 0-10K Ω and an RJ-45 network interface output

WJ183 General Parameters:

(Typical @+25 ℃, Vs is 24VDC)
Input type: Three wire potentiometer resistor input
Accuracy: 0.1%
Temperature drift: ± 50 ppm/℃ (± 100 ppm/℃, maximum)
Input resistance: greater than 1M Ω
Bandwidth: -3 dB 10 Hz
Conversion rate: 16FPS (factory default value, users can modify the conversion rate on the webpage.)
You can set the AD conversion rate to 2SPS, 4SPS, 8SPS, 16SPS, 32SPS, 50SPS, 80SPS, 100SPS by sending commands
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: MODBUS TCP communication protocol or TCP socket character protocol or MQTT protocol
Web page: Supports web access module and web page setting module parameters.
Interface: RJ-45 network interface.
Communication response time: 10 ms maximum
Working power supply:+8~32VDC wide power supply range, with internal anti reverse and overvoltage protection circuits

Power consumption: less than 3W
Working temperature: -45~+80 ℃
Working humidity: 10~90% (no condensation)
Storage temperature: -45~+80 ℃
Storage humidity: 10~95% (no condensation)
Dimensions: 106 mm x 59mm x 37mm

Pin definition and wiring:

Table 1: Definition of Two Wire Resistance Pin

Pin	name	Description	Pin	name	Description
one (Switch)	INIT	Enter AP configuration mode switch	**three**	GND	Negative terminal of power supply, signal common ground
			four	PW+	Positive end of power supply
two (Internet port)	RJ-45	RJ-45 network interface	**five**	GND	**Signal public area**
			six	IN-	**Two wire resistor input negative terminal**
			seven	IN+	**Two wire resistor input positive terminal**

Note: The pins with the same name are internally connected

Table 2: Definition of three wire resistor pins

Pin	name	Description	Pin	name	Description
one (Switch)	INIT	Enter AP configuration mode switch	**three**	GND	Negative terminal of power supply, signal common ground
			four	PW+	Positive end of power supply
two (Internet port)	RJ-45	RJ-45 network interface	**five**	GND	**Digital signal output ground, potentiometer ground wire**
			six	IN-	**Potentiometer center tap**
			seven	IN+	**Potentiometer reference power cord**

Note: The pins with the same name are internally connected

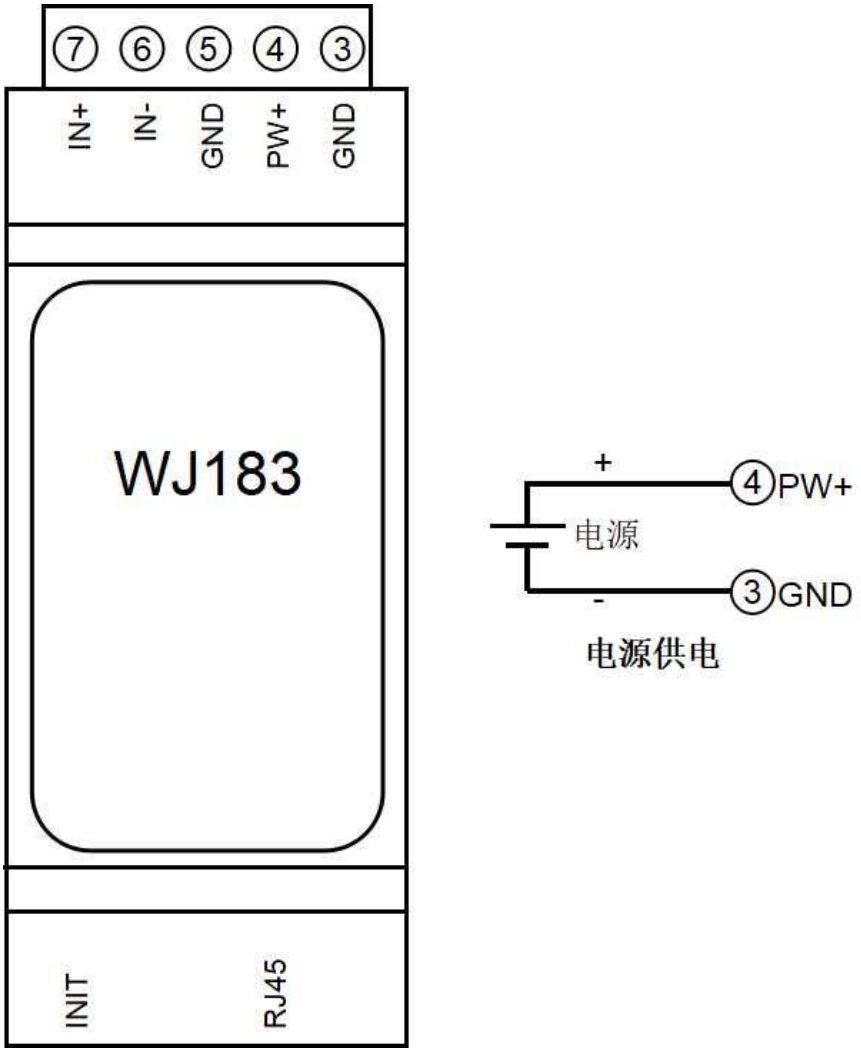
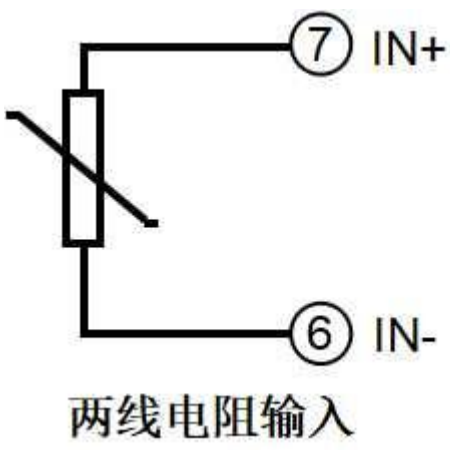
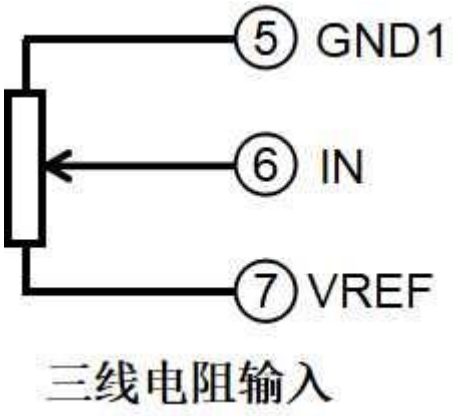
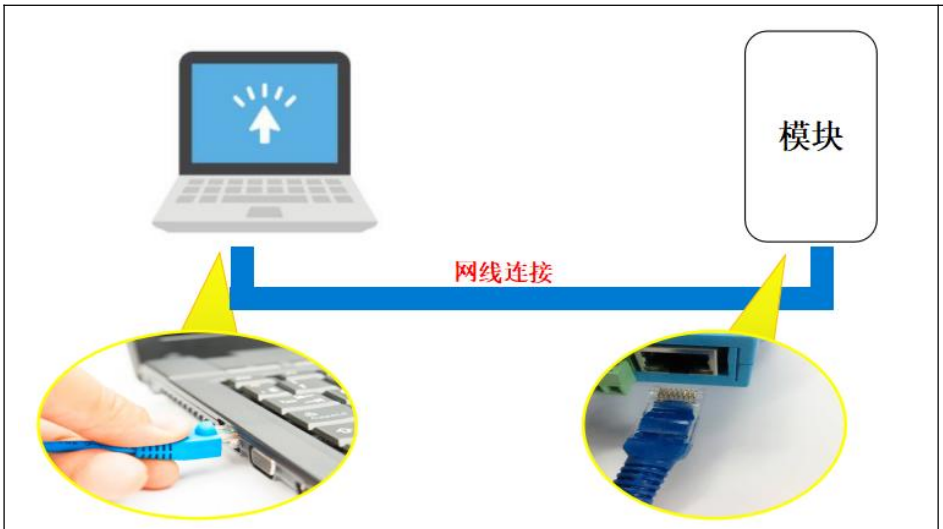


Figure 3 Wiring diagram of WJ183 module

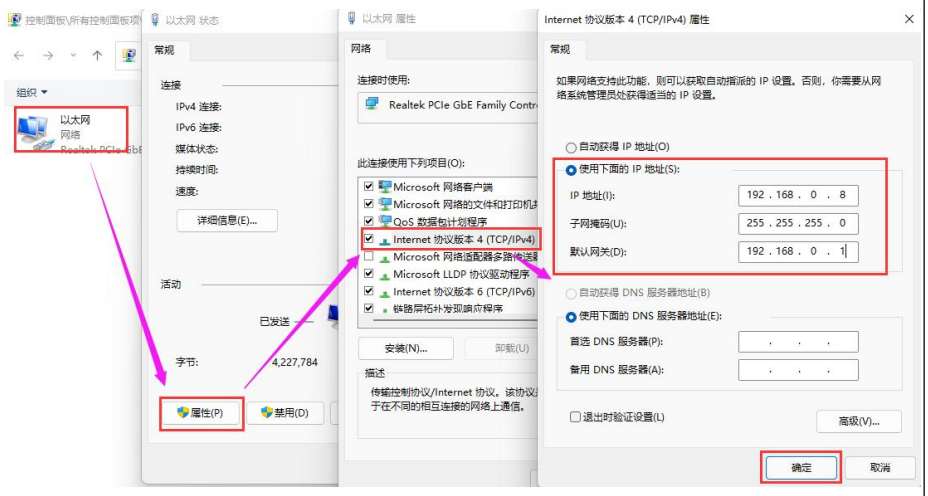
Resistance input wiring diagram

Two-wire resistor	Three wire resistor
	

Configure WJ183 module through computer



1、 Connect the module directly to the computer via Ethernet cable and provide power to the module.



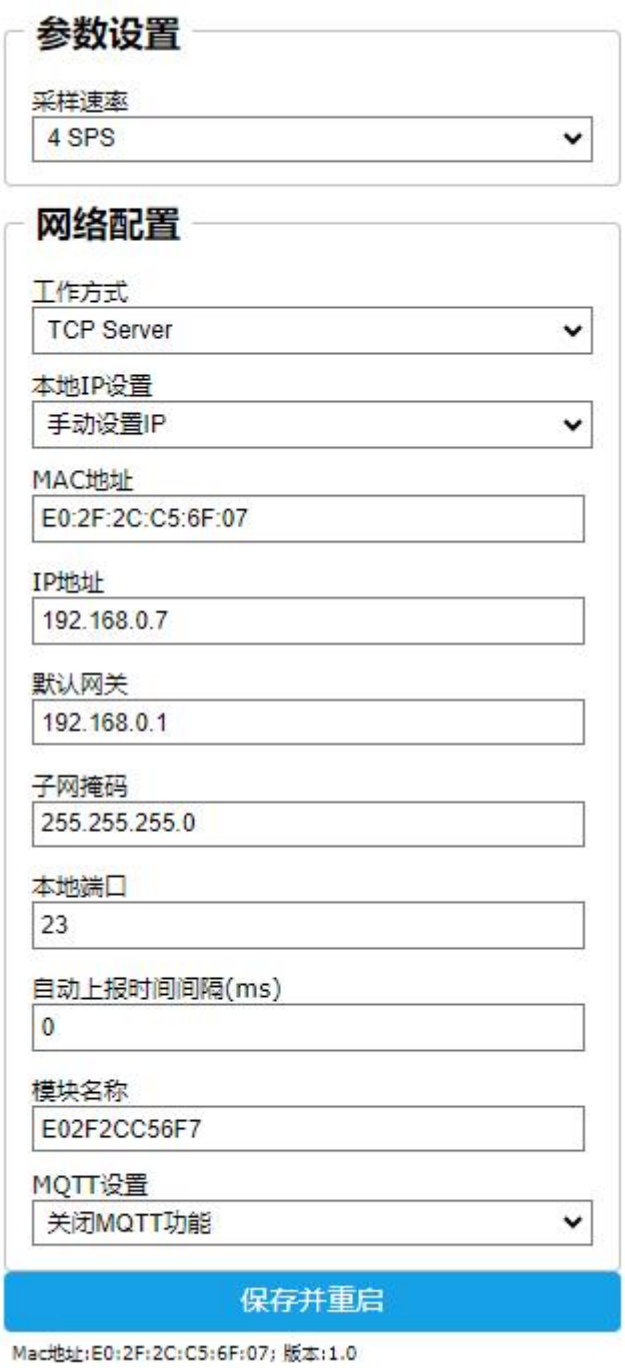
2、 Open the computer "Ethernet" - "Properties" - "Internet Protocol Version 4 (TCP/IPv4)" - Set the computer IP and other information as follows:

“

IP address: 192 168 . 0 eight
Subnet mask: 255 255 . 255 . 0
Default gateway: 192 168 . 0 one

”

3. Open a browser to access: "192.168.0.7"



Click on 'Configure Module Parameters' to set module parameters, as shown in the figure

2-wire system page display

Click on 'View Data Online' to view module data, as shown in the figure

 3-wire system page display	

Character Communication Protocol:

MQTT protocol: After a successful connection, a command is sent to the MQTT subscription topic of the module, and the replied data is displayed on the MQTT publication topic of the module.

Under working modes such as **TCP Server, TCP Client, UDP Mode, Web Socket**, **etc.:** After a successful connection, commands can be sent and data can be received.

1. Read data command (2-wire resistor)

Send: # 01 (If timed automatic reporting is set, there is no need to send commands, the module will report data at regular intervals)

Reply: {"devName": "F4132FA0B8AB", "time": 313670, "resistance": [499.773895]}

Format Description:

The module name 'devName' can be modified on the webpage as needed

The internal time of the 'time' module, measured in mS.

The resistance data inputted as' resistance '.

You can also read a single set of data:

#01>ADC **reply:** {"ADC": [32767]}

#01>actual data **reply:** {"actual data": [20000]}

#01>Resistance **reply:** {"resistance": [499.773895]}

2. Read data command (3-wire resistor)

Send: # 01 (If timed automatic reporting is set, there is no need to send commands, the module will report data at regular intervals)

Reply: {"devName": "468240BA5B99", "time": 78883, "percentage": [0.999500]}

Format Description:

The module name 'devName' can be modified on the webpage as needed

The internal time of the 'time' module, measured in mS.

The 3-wire resistance percentage data input for 'percentage'.

You can also read a single set of data:

#01>ADC **reply:** {"ADC": [32767]}

#01>actual data **reply:** {"actual data": [20000]}

#01>Percentage **reply:** {"percentage": [0.999250]}

3. Read configuration commands

The configuration parameters of the reading module can also be viewed directly on the webpage.

Send:% 01ReadConfig

Reply: {"version": "V1.0", "dataRate": 1, "setIP": 1, "mac": "F4:13:2F: A0: B8: AB", "ipAddress": "192.168.0.7", "gateway": "192.168.0.1", "netmask": "255.255.255.0", "work mode": 0, "localPort": 23, "remoteServerIP": "192.168.0.160", "remotePort": 23, "sendTime": 0, "devName": "F4132FA0BAB", "setMQTT": 0, "mqttHostURL": broker. emqx. io "," contentId ":" F4132FA0B8AB "," username ":" "," passwd ":" "," topic ":"/wayjun/sub "," port ": 1883," pubTime ": 1000," subtopic ":"/wayjun/sub "}

4. Set configuration commands

The configuration parameters of the module can also be set directly on the webpage. You can set all or some parameters, and the module will automatically restart after setting.

send out:

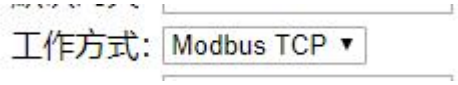
%01WriteConfig{"version":"V1.0","dataRate":1,"setIP":1,"mac":"F4:13:2F:A0:B8:AB","ipAddress":"192.168.0.7","gateway":"192.168.0.1","netmask":"255.255.255.0","workmode":0,"localPort":23,"remoteServerIp":"192.168.0.160","remotePort":23,"sendTime":0,"devName":"F4132FA0B8AB","setMQTT":0,"mqttHostUrl":"broker.emqx.io","clientId":"F4132FA0B8AB","username":"","passwd":"","topic":"/wayjun/pub","port":1883,"pubTime":1000,"subtopic":"/wayjun/sub"}

You can also set only a single parameter, such as modifying IP:% 01WriteConfig {"ipAddress": "192.168.0.7"}

Reply:! 01 (cr) indicates successful setting? 01 (cr) indicates a command error

Modbus TCP protocol

The module defaults to one Modbus TCP Server at the factory, no need to set it up, just communicate according to the Modbus TCP protocol. If more Modbus TCP servers are needed, please change the module's working mode to Modbus TCP in the configuration parameters. Supports up to 6 Modbus TCP servers.



(1) Modbus TCP data frames:

Transmission over TCP/IP Ethernet, supporting Ethernet II and 802.3 frame formats. As shown in Figure 3, the Modbus TCP data frame consists of three parts: packet header, function code, and data.

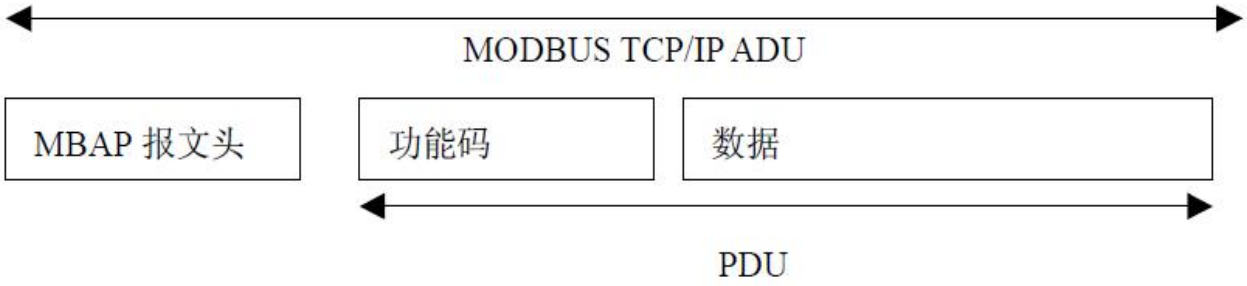


Figure 6: Request/Response of MODBUS on TCP/IP

(2) MBAP message header description:

The MBAP header (MBAP, Modbus Application Protocol, Modbus Application Protocol) is divided into 4 fields, totaling 7 bytes, as shown in Table 1.

Table 1: MBAP Message Header

Domain	Length (B)	Description
Transmission identification	2 bytes	Indicate the transmission of a MODBUS query/response

Protocol Logo	2 bytes	0=MODBUS protocol
Length	2 bytes	Subsequent byte count
Unit identifier	1 byte	Identification code of remote slave station connected on serial link or other bus

(3) Modbus function code:

Modbus function codes are divided into three types, namely:

(1) Public Function Code: Defined function codes that ensure their uniqueness and are recognized by Modbus.org;

(2) There are two sets of user-defined function codes, namely 65-72 and 100-110, which do not require approval but do not guarantee the uniqueness of code usage. If it becomes public code, it needs to be approved by RFC;

(3) The reserved functional code, which is used by certain companies on certain traditional devices, cannot be used for public purposes.

In commonly used public function codes, some of the supported function codes are as follows:

Function code		**name**	**explain**
03	Read Holding Register	Read and hold register	1 represents high level, 0 represents low level.

(4) Description of supported function codes

03 (0x03) Read hold register

In a remote device, use this function code to read the contents of consecutive blocks in the hold register. The request PDU specifies the starting register address and the number of registers. Address registers from scratch. Therefore, addressing registers 1-16 are 0-15. In the response message, each register has two bytes, with the first byte being the data high bit and the second byte being the data low bit.

Example of function code 03, read input analog quantity, register address 40001:

request			**response**		
Field Name		**hexadecimal**	**Field Name**		**hexadecimal**
MBAP message header	Transmission identification	01	MBAP message header	Transmission identification	01
		00			00
	Protocol Logo	00		Protocol Logo	00
		00			00
	length	00		length	00
		06			05
	Unit identifier	01		Unit identifier	01
Function code		03	Function code		03
Starting address Hi		00	Byte count		02
Starting address Lo		00	Register value Hi		00
Register number Hi		00	Register value Lo		00
Register number Lo		01			

Register address description for WJ183 (note: addresses are all decimal numbers)

Supports registers with function code 03.

Address 4X (PLC)	**Address (PC, DCS)**	**Data content**	**attribute**	**Data Explanation**
forty thousand and one (2-wire resistor)	0	Input analog quantity	read-only	Signed integer, AD converted value. 0x0000=zero point of resistance value; 0x7FFF=full resistance value For example, if the input is a 10K Ω two-wire resistor: 0x0000=0Ω; 0x7FFF=10KΩ;
forty thousand and one (3-wire resistor)	0	Input analog quantity	read-only	Signed integer, AD converted value. 0x0000=Zero point percentage of resistance value; 0x7FFF=full percentage of resistance value For example, if the input is a 3-wire 10K Ω resistor: 0x0000=0%; The resistance value is 10K Ω * 0%=0 Ω 0x7FFF=100%; The resistance value is 10K Ω * 100%=10K Ω
forty thousand two hundred and eleven	two hundred and ten	Module Name	read-only	High bit: 0x01 Low bit: 0x83

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 DC voltage/current signal source with stable output and low noise
2. A voltage/current measuring instrument with a precision of 5 and a half bits or higher is used to monitor the accuracy of input signals

Calibration process

（1） 1. Connect the corresponding input signal to the channel that needs to be calibrated according to the input range of the module.

（2） The zero point of the WJ183 module is calibrated when the zero point signal is input, and the full degree is calibrated when the full degree signal is input. For example, when inputting 0-1000 Ω, input 0 Ω for zero calibration and 1000 Ω for full-scale calibration.

（3） 2. Input zero signal to WJ183 module, usually 0 Ω.

（4） After the signal stabilizes, send $01 {"calibrationCH0": 0}, and the module will perform zero point calibration.

（5） 4. Connect the full resistance value to the WJ183 module.

（6） After the signal stabilizes, send $01 {"calibrationCH0": 1}, and the module will perform full-scale calibration.

（7） 6. Calibration completed

Common problems with WJ183

1. Cross network segment issues

If the IP of the device and the communicating PC are not in the same network segment and are directly connected via Ethernet or under the same sub router, then the two cannot communicate at all.

give an example:

Device IP: 192.168.0.7

Subnet mask: 255.255.255.0

PC's IP: 192.168.1.100

Subnet mask: 255.255.255.0

Due to the device's IP being 192.168.0.7, it is unable to log in to the device's webpage or ping it on the PC.

If you want the two to communicate, you need to set the subnet mask of the device and PC, as well as the subnet mask on the router, to 255.255.0.0, so that you can log in to the module webpage.

2. The device can ping, but the webpage cannot be opened

There may be several reasons for this:

1) The device has set a static IP address that conflicts with the IP addresses of existing devices in the network

2) The HTTP server port has been modified (default should be 80)

3) Other reasons

Solution: Reset the device to an unused IP address; Restore factory settings or enter the correct port when opening the browser.

3. Every once in a while, there is a disconnection and reconnection

Every once in a while, there will be a phenomenon of disconnection and reconnection

Reason: There is an issue of IP address conflict between the serial server and other devices

4. Communication is **abnormal, network connection cannot** be established**, or search cannot** be **found**

The firewall of the current computer needs to be turned off (in the Windows firewall settings)

Three local ports must not conflict, meaning they must be set to different values. Default values are 23, 26, and 29

Having illegal MAC addresses, such as full FF MAC addresses, may result in inability to connect to the target IP address or duplicate MAC addresses.

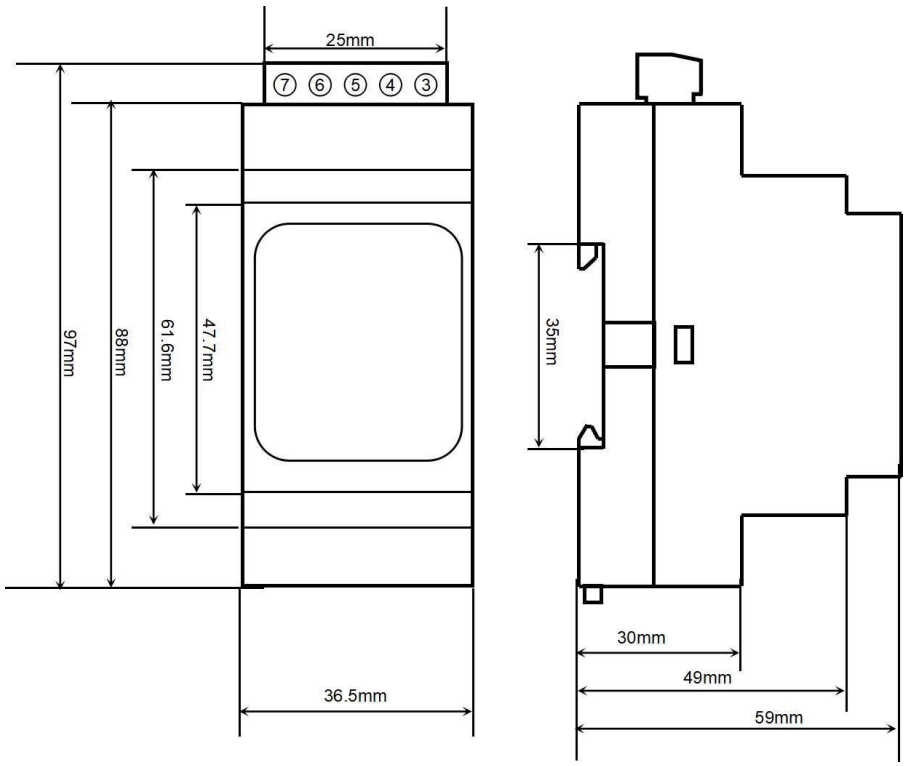
Illegal IP addresses, such as network segments that are not in the same network segment as the router, may not be able to access the external network.

5. Hardware problem search

Poor power supply from the power adapter or poor contact of the plug

If the power light and network port light are not on, it means there is no power supply or the hardware is broken

Dimensions: (Unit: mm)



Can be installed on standard DIN35 rails

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.

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