RS232/RS485/WiFi signal to 4-channel analog signal isolated D/A converter

Product features:

WJ32 module appearance diagram

●RS-485/232 interface, isolated and converted into 4-channel standard analog signal output
● Optional output of 4-20mA or 0-10V to control other devices
●The accuracy of analog signal output is better than 0.2%
● Supports WiFi network control or MQTT control
● Can be set as MODBUS master station to read data from other devices
● Programmable calibration module output accuracy
●Isolation and voltage resistance between signal output/communication interfaces 3000VDC
●Wide power supply range: 8~32VDC
●High reliability, easy programming, easy installation and wiring
● Users can program module addresses, baud rates, etc
● Supports Modbus RTU communication protocol and automatic recognition protocol
●Low cost, small volume modular design

Typical applications:

●0-10V standard analog signal output
●Intelligent building control, security engineering and other application systems
●RS-232/485 bus industrial automation control system
● Light control, LED intelligent dimming control
●Equipment operation debugging and control
●Remote transmission and signal restoration of sensor signals
● Industrial field actuator data given
●Development of medical and industrial control products
●4-20mA signal output

Product Overview:

The WJ32 series products achieve the isolation and conversion of host RS-485/232 interface signals into standard analog signals for controlling remote devices. The WJ32 series products can be applied in industrial automation control systems based on RS-232/RS-485 bus, with standard signal outputs such as 4-20mA, 0-5V, 0-10V, etc., used to control execution equipment, control equipment, display instruments, etc. in industrial sites.

The product includes power isolation, signal isolation, linearization, D/A conversion, and RS-485 serial communication. Each serial port can connect up to 255 WJ32 series modules, using ASCII code communication protocol and MODBUS RTU communication protocol for communication. The communication protocol is automatically recognized and replied to, and the baud rate can be set by code. It can be connected to other manufacturers' control modules on the same RS-485 bus for easy computer programming.

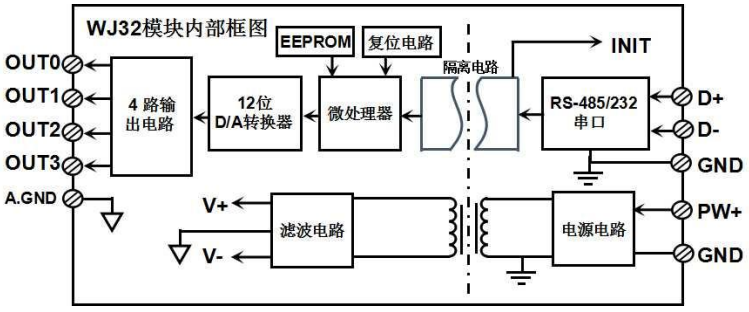


Figure 2 Schematic diagram of WJ32 product

The WJ32 series products are intelligent monitoring and control systems based on microcontrollers. All user set calibration values, addresses, baud rates, data formats, checksum statuses, and other configuration information are stored in non-volatile memory EEPROM.

The WJ32 series products are designed and manufactured according to industrial standards, with isolation between signal output/communication interfaces. They can withstand an isolation voltage of 3000VDC, have strong anti-interference ability, and high reliability. The working temperature range is -45 ℃ to+80 ℃.

WJ32 Function Introduction:

The WJ32 signal isolation D/A conversion module can be used to output 4-channel common ground current or voltage signals.

1、 Analog signal output

12 bit output accuracy, all signal output ranges have been calibrated before the product leaves the factory. During use, users can also easily program and calibrate themselves.

Please refer to the product selection for the specific current or voltage output range. The selection of the 4-channel output must be the same.

2、 Communication Protocol

Communication interface: 1 standard RS-485 communication interface or 1 standard RS-232 communication interface, please specify when ordering and selecting.

Additionally, there is a WiFi network that supports multiple communication methods such as TCP/UDP/MQTT.

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, and 1 stop bit.

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

Checksums 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:

WJ32 - □ - U(A)□

Communication interface — output voltage or current signal value

485: Input is RS-485 interface

232: Input is RS-232 interface

U1： 0-5V	**A1：** 0-1mA
U2： 0-10V	**A2：** 0-10mA
U3： 0-75mV	**A3：** 0-20mA
U4： 0-2.5V	**A4：** 4-20mA
U5： 0-±5V	**A5：** 0-±1mA
U6： 0-±10V	**A6：** 0-±10mA

Selection example 1: Model: **WJ32-485-A4** represents RS-485 interface, 4-20mA signal output
Selection Example 2: Model: **WJ32-232-U2** indicates RS-232 interface, 0-10V signal output
Selection Example 3: Model: **WJ32-232-A7** for RS-232 interface, 0- ± 20mA signal output

WJ32 General Parameters:

(Typical @+25 ℃, Vs is 24VDC)

Output type: current output/voltage output
Accuracy: 0.2%
Output imbalance: current output ± 0.5 uA/℃, voltage output ± 0.1 mV/℃
Temperature drift: ± 20 ppm/℃ (± 30 ppm/℃, maximum)
Output load capacity: Current output 350 Ω (4-20mA/0-20mA/0- ± 20mA current output)
Voltage output 10mA (0-5V/0-10V/0- ± 5V voltage output)
Communication: RS-485 or RS-232 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 2W
Working temperature: -45~+80 ℃
Working humidity: 10~90% (no condensation)
Storage temperature: -45~+80 ℃
Storage humidity: 10~95% (no condensation)
Isolation voltage withstand: Communication interface/output: 3KVDC, 1 minute, leakage current 1mA
The communication interface and power supply are grounded together. 4-channel analog output shared by ground.
Surge resistant voltage: 3KVAC, 1.2/50us (peak)
Dimensions: 106.7 mm x 79 mm x 25mm

Pin definition:

Table 1 Pin Definition

Pin	name	Description	Pin	name	Description
one	A.GND	Analog signal output common ground terminal	**six**	A.GND	Analog signal output common ground terminal
two	Out0	Analog signal 0 output positive terminal	**seven**	DATA+	Positive end of RS-485/232 signal
three	Out1	Analog signal 1 output positive terminal	**eight**	DATA-	Negative terminal of RS-485/232 signal
four	Out2	Analog signal 2 output positive terminal	**nine**	PW+	Positive end of power supply
five	Out3	Analog signal 3 output positive terminal	**ten**	GND	Negative terminal of power supply, digital signal output ground

Note: **The** pins **with the** same name are internally connected

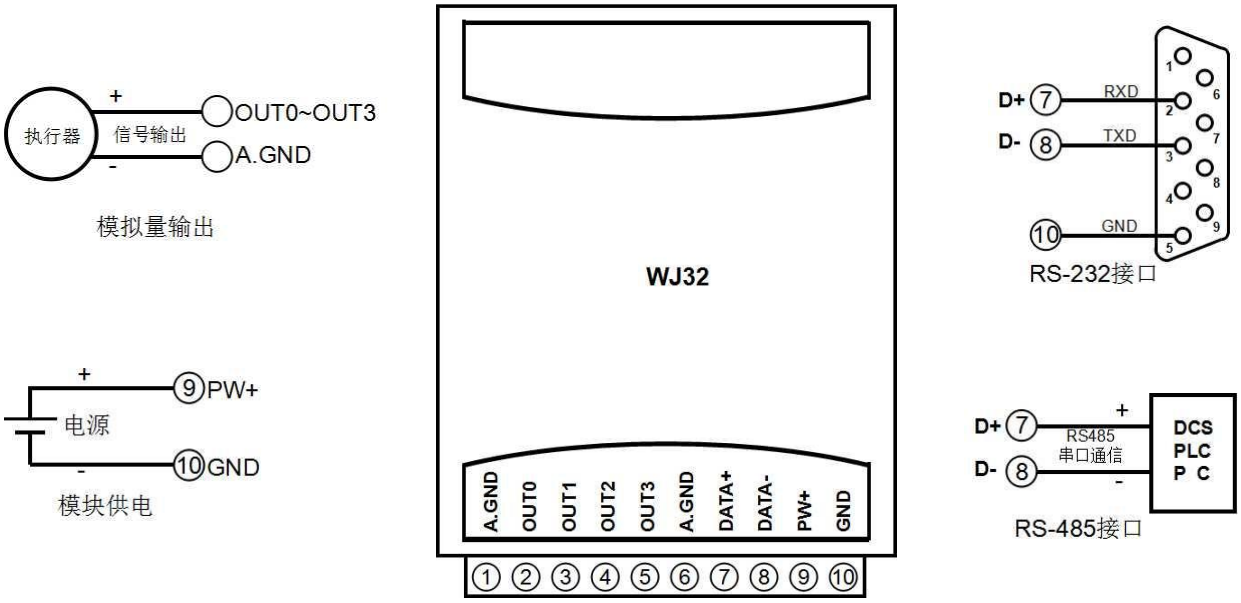


Figure 3 Wiring diagram of WJ32 module

WJ32 Character Protocol Command Set:

The initial factory settings of the module are as follows, with the side switch of the module in the NORMAL position

Address 01, baud rate 9600 bps

Users can use this address, baud rate, and module to communicate or modify parameters.

When unsure of the specific configuration of a module, the side switch of the module can also be turned to the Initialize position to enter the default state, and then the module can be reconfigured. In this state, the configuration of the module is as follows:

The address code is 00 and the baud rate is 9600 bps

At this point, the address, baud rate, parity, and other parameters of the WJ32 module can be modified through configuration commands. You can also query or set parameters such as address, baud rate, parity check, etc. through the WiFi of the mobile phone connection module. Please refer to the WiFi configuration section later for details.

WiFi communication can also use this communication protocol, where the address is fixed at 01. Supports TCP Server, TCP Client, UDP, and Websocket.

1. Set the analog output value command for channel N

Explanation: Set the analog output value for channel N of the analog output module in the current configured data format.

Command format: **# AAN (data)**

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.

N channel code 0~3. Convert to hexadecimal as 30H~33H. If all channels need to be set simultaneously, replace the

channel number with A.

(data) represents the analog data output of channel N to be set. The data format can be engineering units, percentage of FSR, hexadecimal complement. For detailed instructions, please refer to Article 3 of the command set

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

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

Parameter description:>delimiter.

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

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) **# 010+16.000**

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

Explanation: Set the output value of channel 0 on address 01H module to+16.000mA (data format in engineering units).

2. Command to set the analog output value of channel N after power on or reset

Explanation: Set the analog output value for channel N of the analog output module in the current configured data format.

Command format: **# AASN (data)**

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.

S means to set the analog output value after power on or reset.

N channel code 0~3. Convert to hexadecimal as 30H~33H. If all channels need to be set simultaneously, replace the channel number with A.

(data) represents the analog data output after the channel N to be set is powered on. The data format can be engineering units, percentage of FSR, hexadecimal complement. For detailed instructions, please refer to Article 3 of the command set.

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

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

Parameter description:>delimiter.

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

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 **# 01S0+04.000**

Module response**>(cr)**

Explanation: Set the power on output value of channel 0 on address 01H module to+04.000mA (data format in engineering units).

3. Configure analog output module command

Explanation: Set the address, output range, baud rate, data format, and parity check for an analog output 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.

TT uses hexadecimal to represent type encoding. The WJ32 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-bit hexadecimal to represent data format, parity check. Note that unused bits must be set to zero.

Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit2	Bit 1	Bit 0

Table 3 Data format, checksum code

Bit7-Bit6: Must be set to zero

Bit5-Bit4: Parity check.

00: No verification

01: Odd verification

10: Even verification

Bit3 Bit2: Must be set to zero

Bit1-Bit0: Data format bits.

00: Engineering Units

01: Percentage of Full Scale (% of FSR)

10: Two complement in hexadecimal

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

? The **AA (cr)** command is invalid or an illegal operation, or a configuration jumper is not installed before changing the baud rate or checksum.

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

? The delimiter indicates that the command is invalid.

AA represents module address

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

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**% 0011000600**

Module response**! 11(cr)**

Explanation:**%** delimiter.

00 means that the original address of the analog output module you want to configure is 00H.

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

00 type code, WJ32 product must be set to 00.

06 represents a baud rate of 9600 baud.

00 indicates no verification, and the data format is in engineering units.

4. Read configuration status command

Explanation: Read configuration for a specified analog output module.

Command format: **$AA2**

Parameter description: **$**delimiter.

AA 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 **AATTCCFF (cr)** command is valid.

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

Parameter description:**!** Boundary symbol.

AA represents the module address.

TT stands for type code.

CC stands for baud rate encoding. See Table 3

FF is shown in Table 4

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

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 **$302**

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

Explanation:**!** Boundary symbol.

30 indicates that the address of the analog output module is 30H.

00 represents the output type code.

06 represents a baud rate of 9600 baud.

00 indicates no verification, and the data format is in engineering units.

5. Read back command for analog output value of channel N

Explanation: The analog output module reads back the analog output value of channel N and the power on output value. If no setting command has been entered, reply with an error.

Command format: **$AADN**

Parameter description: **$**delimiter.

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

D represents the command to read back the analog output value.

N channel code 0~3

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

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

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

Parameter description:**!** Boundary symbol.

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

(data) represents the analog data output from channel N that is read back. The data format can be engineering units, percentage of FSR, hexadecimal complement. For detailed instructions, please refer to Article 3 of the command set.

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

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 **$01D0**

Module response**! 01+12.000 (cr)**

Explanation: The current output value of channel 0 on module 01H is+12.000mA (data format is in engineering units).

Calibration module:

The product has been calibrated before leaving the factory, and users can use it directly without calibration. Non professionals are not allowed to calibrate randomly.

During use, users can use the product's calibration function to recalibrate the module. When in school, the module needs to use a high-precision multimeter to monitor its output.

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

1. A voltage/current measuring instrument with a precision of 5 and a half bits or higher monitors the accuracy of the output signal

Calibration process

1. Select the output channel to be calibrated and connect the corresponding voltage or current measuring instrument according to the output range of the module.
2. Set the channel output zero signal that needs to be calibrated for the analog output module, usually 0mA or 0V. Set the analog output using the command **$01QN (data)** (01 is the module address; N represents the channel code currently being calibrated, 0~3; The value range of (data) is 0-65535, adjust it to the zero point value displayed in the measuring instrument. Command format example: **$01Q005000**
3. After the signal stabilizes, send the offset calibration **$011N** command to the analog output module (01 is the module address; N represents the channel code currently being calibrated, 0-3).
4. Set the analog output module to calibrate the channel output full-scale signal, usually 20mA or 10V. Set the analog output using the command **$01QN (data)** (01 is the module address; N represents the channel code currently being calibrated, 0~3; The value range of (data) is 0-65535, adjust it to the output signal displayed in the measuring instrument as the full degree value. Command format example: **$01Q060000**
5. After the signal stabilizes, send the gain calibration **$010N** command to the analog output module (01 is the module address; N represents the channel code currently being calibrated, 0-3).
6. Calibration completed

Modbus RTU communication protocol:

Initial settings for WJ32 module at factory: **Address 01, baud rate 9600 bps**

When unsure of the specific configuration of a module, the side switch of the module can also be turned to the Initialize position to enter the default state, and then the module can be reconfigured. In this state, the configuration of the module is as follows:

Address code 01, baud rate 9600 bps

At this point, the address, baud rate, parity, and other parameters of the WJ32 module can be modified by adjusting the values of registers 40201 to 40203. You can also query or set parameters such as address, baud rate, parity check, etc. through the WiFi of the mobile phone connection module. Please refer to the WiFi configuration section later for details.

WiFi communication also supports Modbus TCP communication, with register addresses consistent with the table below.

The Modbus function codes supported by the module are 03, 06, and 16.

Register Description:

Address 4X (PLC)	Address (PC, DCS)	Data content	attribute	Data Explanation

forty thousand and one	0	Out0(0x0000-0x0FFF)	Read/ Write	Please refer to Table 6 for the correspondence between the analog output values of channels 0-3 and the actual measurement range
forty thousand and two	one	Out1(0x0000-0x0FFF)	Read/ Write	
forty thousand and three	two	Out2(0x0000-0x0FFF)	Read/ Write	
forty thousand and four	three	Out3(0x0000-0x0FFF)	Read/ Write	
forty thousand and eleven	ten	Sout0 (0x0000-0x0FFF)	Read/ Write	Please refer to Table 6 for the correspondence between the analog output values of channels 0-3 and the actual measurement range
forty thousand and twelve	eleven	Sout1 (0x0000-0x0FFF)	Read/ Write	
forty thousand and thirteen	twelve	Sout2 (0x0000-0x0FFF)	Read/ Write	
forty thousand and fourteen	thirteen	Sout3 (0x0000-0x0FFF)	Read/ Write	
forty thousand and thirty-one	thirty	Out0~Out3(0x0000-0x0FFF)	Read/ Write	Simultaneously set analog output values for channels 0 to 3
forty thousand and thirty-two	thirty-one	Sout0~Sout3(0x0000-0x0FFF)	Read/ Write	Simultaneously set the power on output values for channels 0-3
forty thousand two hundred and one	two hundred	Module address	Read/ Write	Integer, effective after restart, range 0x0000-0x00FF
forty thousand two hundred and two	two hundred and one	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 eleven	two hundred and ten	Module Name	read-only	High bit: 0x00 Low bit: 0x32

Table 5 Modbus Rtu Register Description

Output range	maximum	minimum
A4：4-20mA	0x0FFF=20mA	0x0333=4mA
A3：0-20mA	0x0FFF=20mA	0x0000=0mA

U1：0-5V	0x0FFF=5V	0x0000=0V
U2：0-10V	0x0FFF=10V	0x0000=0V
U5：0-±5V	0x0FFF=5V	0x0000=-5V
U8/A8: User defined	0x0FFF	0x0000
A7：0-±20mA	0x0FFF=20mA	0x0000=-20mA
U6：0-±10V	0x0FFF=10V	0x0000=-10V

Table 6 Corresponding relationship between Modbus register data content and output.

Example of Modbus RTU communication protocol application:

1. Supports Modbus RTU communication protocol function code 03 (read hold register), with command format following the standard Modbus RTU communication protocol.

Communication example: If the module address is 01, send in hexadecimal: **010300000001840A** to retrieve the data from the register.

01	03	00	00	00	01	eighty-four	0A
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: **0103020FFFFDF4**, the read data is 0x0FFF, which means the current output is the maximum value.

01	03	02	0F	FF	FD	F4
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

2. Supports Modbus RTU communication protocol function code 06 (write to a single register), with command format following the standard Modbus RTU communication protocol.

A communication example: If the module address is 01, send in hexadecimal: **010600000FFFCC7A**, which means set the output data to 0x0FFF.

01	06	00	00	0F	FF	CC	7A
Module address	Write a single register	Register Address High Bit	Low bit register address	data-high	data-low	CRC check low bit	CRC check high bit

If the module replies: **010600000FFFCC7A**, the setting is successful

01	06	00	00	0F	FF	CC	7A
Module address	Write a single register	Register Address High Bit	Low bit register address	data-high	data-low	CRC check low bit	CRC check high bit

WiFi configuration module parameters

Turn the side switch of the module to the Initialize position to enter the default state. The module will enter AP mode and generate a WiFi in the following format:

WiFi8_XX: XX: XX: XX: XX: XX: XX: XX, connect this WiFi with your phone, enter the password: 12345678, wait a few seconds and you will enter the configuration interface. If it is in normal mode, the module has already been connected to the local area network through WiFi. You can also enter the module's IP address in the same local area network computer or mobile browser to enter the configuration interface.

The homepage will display the following link:

Configure module parameters

Online testing output

Json Batch Configuration

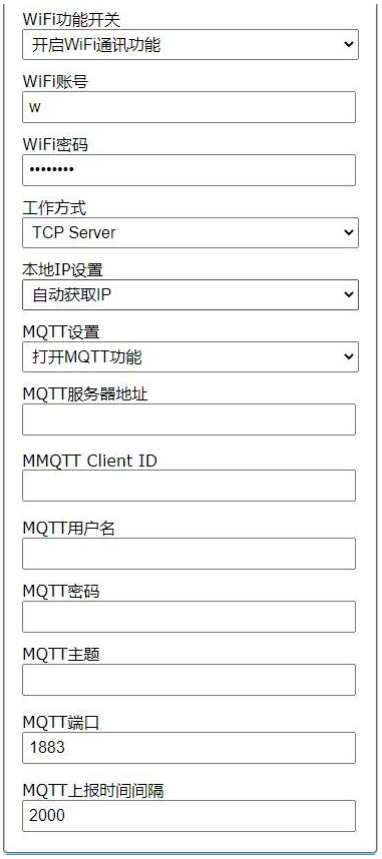
Configure module parameters:

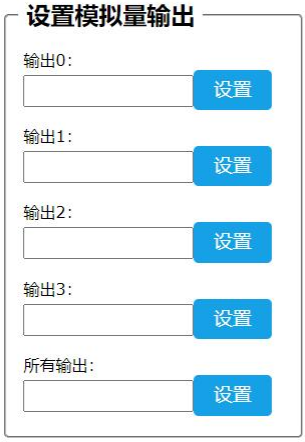
When the module is used as a slave, its address and baud rate parameters can be set through the webpage.

When the module serves as the master station, it can set the relevant parameters of the slave stations that need to be read. Supports Modbus master and character master. It can be connected to devices such as flow meters or weighing instruments.

As a Modbus master, you can set the address and baud rate of the slave station that needs to be read, the register address to be read, the range between the slave station data and 4-20mA, so that flow or weight data can be converted into standard 4-20mA signals and sent to DCS systems or other devices.

As a character master, you can set the address and baud rate of the slave station that needs to be read, select the starting and ending positions of the data in the string, and convert this data into 4-20mA output.





Online testing output

In the Initiat mode, the output value can be directly set on the phone,

Easy to debug products and can also be used as a simple signal source

To debug other devices. In normal mode, it can also be achieved through

Enter the IP address of the module, open the module's webpage, and access it t...

Use web pages to set output and test products.

The webpage interface is shown in the figure on the right.

Json Batch Configuration

Used for setting parameters in batch production or batch setting MQTT parameters. Partial or all parameters can be set in JSON format, which ordinary users do not need.

WiFi communication

Supports communication protocols such as TCP Server, TCP Client, UDP, Websocket, MQTT, etc.

TCP Server, TCP Client, UDP, and Websocket can communicate using the above character protocol or MODBUS TCP format. The Websocket web interface is located in the/w directory on the homepage.

The registers used for Modbus TCP communication are the same as those used for Modbus RTU. Please refer to the register table in the Modbus RTU chapter.

The MQTT communication format is as follows:

The module reports the current output value, with channels 0 to 3 arranged in sequence: {"Output": [20,0,0,0]}

The output of the module can be set in the same theme by sending the following code:

{"setOutput0": 20} Set channel 0 to output 20mA

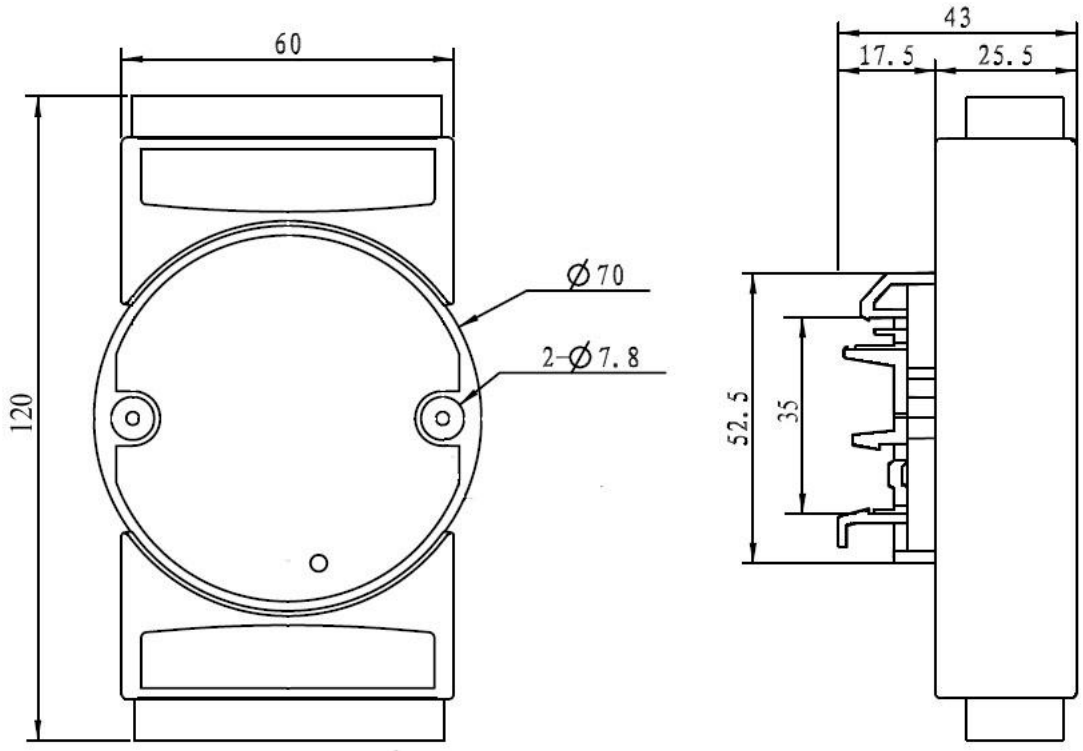
{"setOutput1": 4} Set channel 1 to output 4mA

{"setOutput2": 5.016} Set channel 2 to output 5.016mA

{"setOutput3": 9.999} Set channel 3 to output 9.999mA

{"setOutputAll": 12} Set all channels to output 12mA

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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