

JSY-MK-194T single-phase two-way electric energy metering module

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1. product introduction

1.1, introduction

JSY-MK-194T single-phase two-way electric energy metering module is a single-phase AC parameter measurement product that can complete electric energy measurement, collection and transmission with highly integrated measurement and digital communication technology, and can accurately measure two single-phase AC voltage, current, power, power factor, Frequency, power and other electrical parameters, 1 channel TTL level interface, completely isolated circuit, small size, simple interface, can be easily embedded in various equipment that needs to measure power consumption, it has excellent cost performance.

JSY-MK-194T single-phase two-way electric energy metering module can be widely used in energy-saving transformation, new energy charging pile, electric power, communication, railway, transportation, environmental protection, petrochemical, steel and other industries to monitor the current and power consumption of AC equipment.

1.2.2. Use special measuring chip, effective value measurement method, high measurement accuracy;

1.2.3. With 1 TTL communication interface, compatible with 5V/3.3V interface;

1.2.4. The communication protocol is Modbus-RTU, with good compatibility and convenient programming;

1.2.5. High isolation voltage, withstand voltage up to DC3000V;

1.2, functional characteristics

1.2.1. Collect single-phase two-way AC electrical parameters, including voltage, current, power, factor, frequency, electrical energy and other electrical parameters;

1.3, technical parameters

1.3.1 Single-phase AC input

1) Voltage range: 1~400V (customizable);

2) Current range: 10mA ~ 80A (customizable);

3) Signal processing: using a special measuring chip, 24-bit AD sampling;

4) Overload capacity: 1.2 times the current range is sustainable, and 1.5 times the voltage range is not damaged;

5) input impedance: voltage channel > 1 kΩ/V;

1.3.2 Communication Interface

1) Interface type: 1 TTL communication interface, compatible with 5V/3.3V;

2) Communication Statute: MODBUS-RTU Statute;

3) Data format: default to "n, 8, 1", "e, 8, 1", "o, 8, 1", "n, 8, 2" can be set;

4) Communication rate: the default is 4800bps, 9600bps, 19200bps can be set;

1.3.3 Measurement output data

Voltage, current, power, electric energy, power factor, frequency and other electrical parameters, see Modbus data register list;

1.3.4 Measurement accuracy

Voltage, current, power and electricity: less than 1.0%;

1.3.5 Isolation

The tested power supply and the power supply are isolated from each other; the isolation withstand voltage is 3000VDC;

1.3.6 Power Supply

1) DC single power supply 3.3~5V power supply, power consumption 10mA.

1.3.7 Working environment

- 1) Operating temperature: $-40 \sim +80 \text{ }^{\circ}\text{C}$;
- 2) Relative humidity: $5 \sim 95\%$, no condensation (at $40 \text{ }^{\circ}\text{C}$);
- 3) altitude: $0 \sim 3000$ meters;
- 4) Environment: no explosion, corrosive gas and conductive dust, no significant shaking, vibration and impact;

Temperature drift of

1.3.8: $\leq 100\text{ppm}/^{\circ}\text{C}$;

1.3.9 Installation method: PCB welding;

1.3.10 Module size: $60.48 \times 36.81 \text{mm} \times 28 \text{mm}$ (length * width * height)

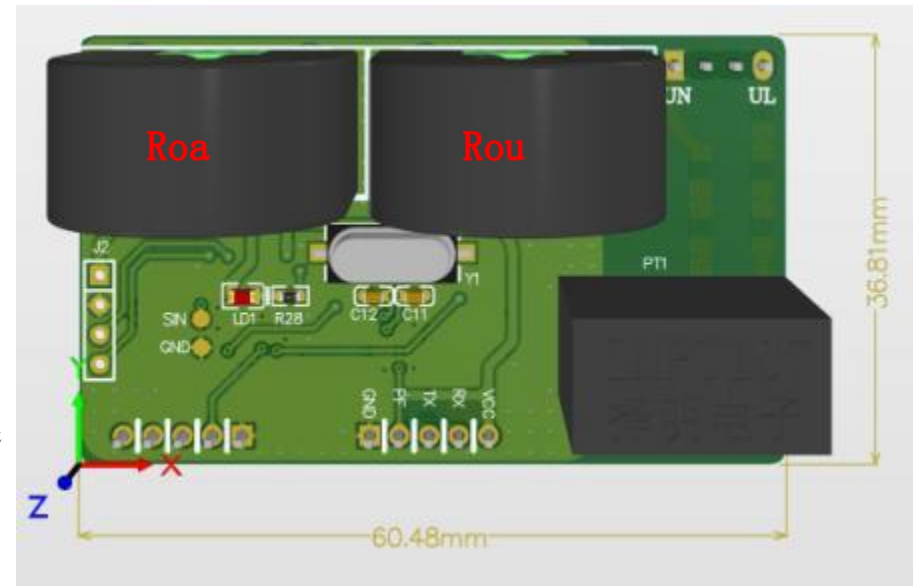


Fig. 2.1 outline and dimension diagram (unit: mm)

2. application

2.1, Shape and Installation

2.3, application instructions

Please refer to the above diagram for correct wiring according to product specifications and models. Make sure to disconnect all signal sources before wiring to avoid danger and damage to the equipment. After checking and confirming that the wiring is correct, turn on the power test again.

After the power is turned on, the "indicator light" is always on, and the "indicator light" flashes synchronously during communication data transmission.

When the products leave the factory, they are all set to the default configuration: address 1, baud rate 4800bps, data format "n,8,1", data update rate of 330ms once, and change ratio of 1;

We can change the setting of product parameters and general testing of products through the JSY-MK-194T series product testing software we provide.

2.4, electric energy metering function

Can provide single-phase voltage, current, power, power factor, frequency, active energy and other parameters;

The data of electricity is an unsigned number of 4 bytes, which will not overflow for 10 consecutive years, and the data will be saved after power failure.

3. JSY-MK-194T Modbus register list

Table 1: System Configuration Read Parameter Register Address and Data Communication Table (Function Code 03H Read, 10H Write)

Serial number	Definition	Register address	Read/Write	Specific description
1	Address and baud rate	0004H	Read/Write	<p>The default value is 0105H; The default address is 01H, and the default communication format is 8, N, 1, 4800bps</p> <p>Description:</p> <p>High byte 8 bits are addresses, 1~255; 0 is the broadcast address;</p> <p>The upper 2 bits of the low byte are the data format bits, For "00" is expressed as 10 bits, there is no check, that is, "8,N,1"; For "01" is expressed as 11 bits, even check, that is, "8,E,1"; For "10" is expressed as 11 bits, odd check, that is, "8,0,1"; For "11" is expressed as 11 bits, no check, 2 stop bits, that is, "8,N, 2";</p> <p>The low 4 bits of low byte are baud rate, 3-1200bps, 4-2400bps, 5-4800bps, 6-9600bps, 7-19200bps, 8-38400bps</p>

Table 2: System Read-Only Parameter Register Address and Communication Data Sheet (Function Code 03H, Read-Only)

Serial number	Definition	Register address	Read/Write	Specific description
1	Model 1	0000H	Read	The value is 0194H
2	Model 2	0001H	Read	Reserved
3	Voltage range	0002H	Read	The value is 250, representing 250V
4	Current range	0003H	Read	The value is 800, representing 80A

Table 3: Measurement Electrical Parameter Register and Communication Data Sheet (Function Code 03H Read, 10H Write)

Serial number	Definition	Register address	Read/Write	Word length	Specific description
1	1 voltage	0048H	Read	4	Unsigned number, value = DATA/10000 unit v

2	1 current	0049H	Read	4	Unsigned number, value = DATA/10000 unit a
3	1 active power	004AH	Read	4	Unsigned number, value = DATA/10000 unit w
4	1 road active total power	004BH	Read/Write	4	Unsigned number, value = DATA/10000 unit kWh
5	1-way power factor	004CH	Read	4	Unsigned number, value = DATA/1000
6	1 carbon dioxide emissions	004DH	Read	4	Unsigned number, value = DATA/10000 unit kg
7	Reservatio n	004EH	Read	4	Reservation
8	Frequency	004FH	Read	4	Unsigned number, value = DATA/100 unit Hz
9	2-way voltage	0050H	Read	4	Unsigned number, value = DATA/10000 unit v
10	2 current	0051H	Read	4	Unsigned number, value = DATA/10000 unit a
11	2 channels of active power	0052H	Read	4	Unsigned number, value = DATA/10000 unit w
12	Total active power of 2 channels	0053H	Read	4	Unsigned number, value = DATA/10000 unit kWh
13	2-way power factor	0054H	Read	4	Unsigned number, value = DATA/1000
14	2-way CO2 emissions	0055H	Read	4	Unsigned number, value = DATA/10000 unit kg

4. MODBUS communication protocol

This instrument provides serial asynchronous half-duplex RS485 communication interface and adopts standard MODBUS-RTU protocol. All kinds of data information can be transmitted on communication lines. Up to 255 network instruments can be connected on a line at the same time, and each network instrument can set its communication address. Shielded twisted pair with copper net shall be used for communication connection, and the wire diameter shall not be less than 0.5mm². The wiring should keep the communication line away from the strong electric cable or other strong electric field environment.

The MODBUS protocol uses a master-slave response communication connection on 1 communication line. First, the signal of the host computer is addressed to a terminal device (slave) with a unique address, and then the response signal sent by the terminal device is transmitted to the host in the opposite direction, that is, the signal on a separate communication line transmits all communication data streams in two opposite directions (half duplex

working mode). The MODBUS protocol only allows communication between the host (PC, PLC, etc.) and the terminal equipment, and does not allow data exchange between independent terminal equipment, so that each terminal equipment will not occupy the communication line when they are initialized, but is limited to responding to the query signal reaching the machine.

Modbus协议查询应答数据流



Host query: The query message frame includes the device address, function code, data information code, and check code. The address code indicates the slave device to be selected; the function code tells what functions the selected slave device wants to perform, for example, the function code 03 or 04 requires the slave device to read registers and return their contents; the data segment contains any additional information to be performed by the slave device. The check code is used to verify the correctness of 1 frame of information. The slave device provides 1 method to verify whether the message content is correct, it adopts the calibration rules of CRC16.

Slave response: If the slave device generates a normal response, there are slave address code, function code, data information code and CRC16 check code in the response message. The data information code includes the data collected from the device: like register value or status. If there is an error, we agree that the slave will not respond.

We specify the communication data format to be used in this instrument: bits per byte (1 start bit, 8 data bits, odd or even or no check, 1 or 2 stop bits).

The structure of the data frame, I .e. the message format:

Device address	Function code	Data segment	CRC16 check code
1 byte	1 byte	N bytes	2 bytes (low bytes before)

Device address: It consists of one byte. The address of each terminal device must be unique. Only the addressed terminal will respond to the corresponding query.

Function code: tells the addressed terminal what function to perform. The following table lists the function codes supported by this series of meters and their functions.

Function code	Function
03H	Read the value of one or more registers
10H	Write the value of one or more registers
01H	Read the output status of the 1-way relay
05H	Write the output status of the 1-way relay

Data segment: contains the data required by the terminal to perform specific functions or the data collected by the terminal when responding to the query. The contents of these data may be values, reference addresses, or set values.

Check code: CRC16 takes up two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmission device and then attached to the data frame. The receiving device recalculates the CRC value when receiving the data and then compares it with the value in the received CRC field. If the two values are not equal, an error occurs.

The process for generating a CRC16 is:

- (1) Preset a 16-bit register as 0FFFFH (all 1), which is called CRC register.
- (2) The 8 bits of the first byte in the data frame are XOR with the low byte in the CRC register, and the result is saved back to the CRC register.
- (3) Move the CRC register 1 bit to the right, fill the highest bit with 0, and move the lowest bit out and detect.
- (4) If the lowest bit is 0: repeat the third step (next shift); if the lowest bit is 1: XOR the CRC register with a preset fixed value (0A001H).
- (5) Repeat the third and fourth steps until 8 shifts. This handles a complete eight digits.
- (6) Repeat steps 2 to 5 to process the next eight bits until all byte processing is completed.
- (7) The value of the final CRC register is the value of CRC16.

Examples of MODBUS-RTU communication protocols:

4.1. Function Code 0x03: Read Multiplex Register

Example: The host needs to read the data of 2 slave registers with address 01 and start address 0048H

Host send: 01 03 00 48 00 02 CRC

Address function code start address data length CRC code

Slave response: 01 03 04 12 45 56 68 CRC

Address function code returns byte count register data 1 register data 2 CRC code

4.2. function code 0x10: write multiple registers

Example: The host needs to save the 0000 0000 to the slave register with address 000C,000D (the slave address code is 0x01) and the host sends: 01 10 00 0C 00 02 04 00 00 00 00 00 F3 FA

Address function code start address write register number byte count save data 1 2 CRC code slave response: 01 10 00 0C 00 02 81 CB

Address function code start address write register number CRC code

4.3. description

The register in the MODBUS-RTU communication protocol refers to 16 bits (I. e. 2 bytes), and the high bit is the first. When setting parameters, be careful not to write illegal data (that is, data values that exceed the data range limit);

The error code format returned by the slave is as follows:

Address code: 1 byte

Function code: 1 byte (the highest bit is 1)

Error code: 1 byte

CRC: 2 bytes

The response returns the following error codes:

81: Illegal function code, that is, the received function code module is not supported.

82:

Read or write illegal data addresses, that is, the data location exceeds the readable or writable address range of the module. 83: Illegal data value, that is, the data value sent by the host received by the module exceeds the data range of the corresponding address.

4.4. Example of instruction parsing:

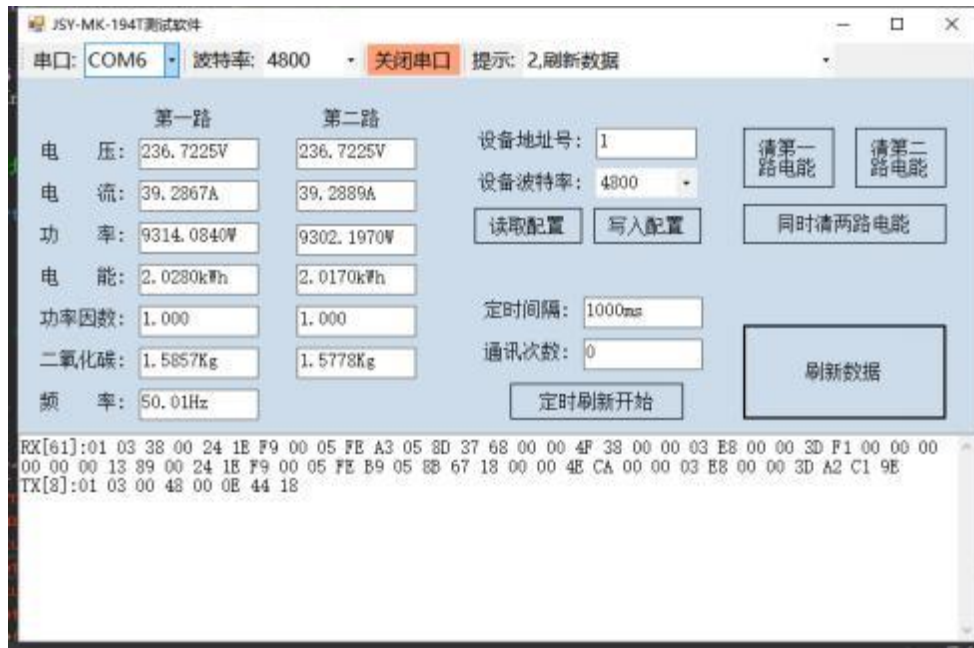
4.4.1 Read electrical parameter instruction (take module address 0x01 as an example):

Send data: 01 03 00 48 00 0E 44 18 (14 registers starting from 0048H)

Received data: 01 03 38 00 24 1E F9 00 05 FE A3 05 8D 37 68 00 00 4F 38 00 03 E8 00 00 3D F1 00 00 00 00 00 00 13 89 00 24 1E F9 00 05 FE B9 05 8B 67 18 00 00 4E CA 00 00

03 E8 00 00 3D A2 C1 9E (the red part is the data corresponding to the 0048H start register),

4.4.2 Quantity cleaning instruction (take module address 0x01 as an example):



Precautions for 5.

- 1) Pay attention to the auxiliary power information on the product label. The auxiliary power level and polarity of the product cannot be connected incorrectly, otherwise the product may be damaged.
- 2) Please wire correctly according to the product specifications and models and refer to the figure. Make sure to disconnect all signal sources and power supplies before wiring to avoid danger and damage to the equipment. After checking and confirming that the wiring is correct, turn on the power test again.
- 3) The voltage circuit or the secondary circuit of PT cannot be short-circuited.
- 4) When there is current on the primary side of the CT, it is strictly forbidden to open the secondary circuit of the CT; it is strictly forbidden to wire or unplug the terminal;
- 5) When the product is used in an environment with strong electromagnetic interference, please pay attention to the shielding of the input and output signal lines.
- 6) During centralized installation, the minimum installation interval should not be less than 10mm.
- 7) There is no lightning protection circuit inside this series of products. When the input and output feeders of the module are exposed to the harsh outdoor climate environment, lightning protection measures should be taken.
- 8) Do not damage or modify the label and logo of the product, do not disassemble or modify the product, otherwise the company will no longer mention the product