JSY-MK-194 and JSY-MK-194T

Traduced from Chinese and layout by Jean-Pol Deloyer BELGIUM - Finished on 05/05/2023.

Note: I have added the HEX format 0x00 for 8 bits µC.

Manual content

Product introduction.

**SINGLE PHASE TWO CHANNEL ELECTRIC METER MODULE
Current power data monitoring**

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 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.

Functional characteristics.

Collect single-phase two-way AC parameters, including voltage, current, power, factor, frequency, electric energy and other electrical parameters;
Use special measuring chip, effective value (RMS) measurement method, high measurement accuracy;
With 1 TTL communication interface, compatible with 5V/3.3V interface;
The communication protocol is Modbus-RTU, which good compatibility and convenient programming;
High isolation voltage, withstand voltage up to 3000V;

Technical parameters.

Single-phase AC input:

Voltage range: 1~400V (customizable);
Current range: 10mA~80A (customizable);
Signal processing: using a special measuring chip, 24-bit AD sampling;
Overload capacity: 1.2 times the current range is sustainable, and 1.5 times the voltage range is not be damaged;
Input impedance: voltage channel > 1 kΩ/V;

Communication interface:

Interface type: 1 TTL communication interface, compatible with 5V/3.3V;
Communication protocol: MODBUS-RTU protocol;
Data format: the default is "8, N, 1", "8, E, 1", "8, O, 1", "8, N, 2" can be set;
Communication rate: the default from factory is 4800bps.
, 9600bps, 19200bps, 34800bps can be set;

Measurement output data:

Multiple electrical parameters such as voltage, current, power, electric energy, power factor, frequency, etc., see Modbus data register list.

Measurement accuracy:

Voltage, current, power and energy: less than ±1.0%;

Isolation:

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

Power supply:

DC single power supply 3,3~5V power supply, power consumption 10mA.

Working environment:

1. Operating temperature: -40 ~ +80 ℃;

2. Relative humidity: 5 ~ 95%, no condensation (below 40 ℃);

3. Altitude: 0-3000 meters;

4. Environment: No explosion, corrosive gas and conductive dust, no significant shaking, vibration and shock;

Temperature drift:

≤100ppm/;

Installation method:

 PCB welding, the plane size of the module is 60 * 36 mm.

Module size:
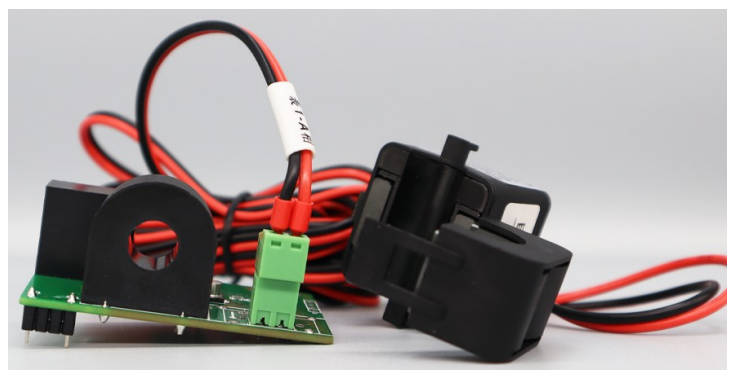
Size of the module: 60,5 * 36,8 * 28mm

There are two models of JSY-MK-194T, one has the second coil deported. If you order the module, you must notify the seller that you want to detect the current in both ways.

Application.

Appearance and installation.
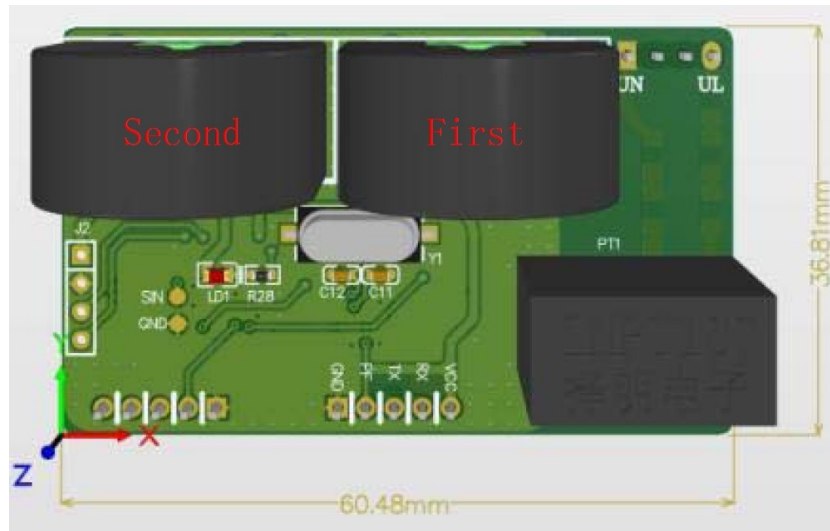
Figure 2.1 Dimensions (unit: mm)
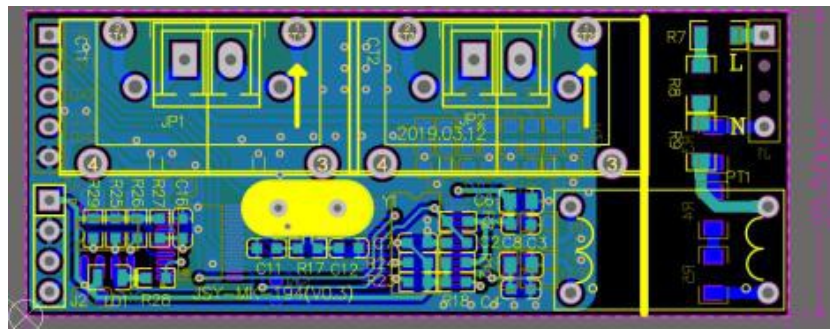
Interface definition.

Pins description:

Identification	Feature	Function description
UL	Live wire	Connect Live wire (230 VAC)
UN	Neutral line	Connect Neutral wire (230 VAC)
PF	Output Pulse Signal	Active power verification pulse output, low level output by default, generally not connected to this pin, but pin position should be reserved
TX	Data Output	TTL level send
RX	Data Input	TTL level receive
VCC	DC+	Power supply: 3,3V ~ 5VDC
GND	DC-	Power supply ground (GND)

Application description.

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 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 product leaves the factory, there are all set to the default configuration: address 1, baud rate 4800bps, data format "8, N, 1", data update rate of 330ms once, and change ratio is 1;

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

Electric energy measurement function.

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

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

Modbus register list.

Table 1: System configuration read parameter register address and data communication table.
(function code 03H or 0x00 0x03 read, 10H or 0x00 0x10 write)

N°	Definition	Register address	Read / Write	Specific instructions
1	ID and baud rate	0004H or 0x00 0x04	Read / Write	The default value is 0105H or 0x01 0x05; the default ID is 01H or 0x01, the default communication format is 8, N, 1, 4800bps. **Explain** : High byte is ID, it can be set as 1 to 255; Low byte is baud rate, 3-1200bps , 4-2400bps, 5-4800bps, 6-9600bps , 7-19200bps , 8-38400bps

00	10	00	04	00	01	02	01	05	6B	D7
0x00	0x10	0x00	0x04	0x00	0x01	0x02	0x01	0x05	0x6B	0xD7
Address	write	start address		write register number		byte count	4800 bps		CRC code	

for communication format 8, N, 1, 4800 bps

There are two ways to modify the communication address and baud rate of the electric energy metering module of Genesis Research Technology:

1. It can be modified through the test host computer software provided by Genesis Research Technology.

2. It can be modified by sending instructions. The specific examples are as follows:

Table 2: System parameter
(function code 03H or 0x03, read-only)

Number	Definition	Register address	Read/Write	Description
1	Model 1	0000H or 0x00 0x00	Read	Value is 0194H or 0x01 0x94
2	Model 2	0001H or 0x00 0x01	Read	Reserved
3	Voltage range	0002H or 0x00 0x02	Read	Value is 250 (V)
4	Current range	0003H or 0x00 0x03	Read	Value is 800 (800/10= 80A)

Table 3: Measuring electrical parameter register
(function code 03H or 0x03 read, 10H or 0x10 write)

N°	Definition	Register address	Read / Write	Byte length	Description
1	First channel Voltage	0048H or 0x00 0x48	Read	4	Unsigned, Value=DATA/10000 (V)
2	First channel current	0049H or 0x00 0x49	Read	4	Unsigned, Value=DATA/10000 (A)
3	First channel active power	004AH or 0x00 0x4A	Read	4	Unsigned, Value=DATA/10000 (W)
4	Positive active energy of first channel	004BH or 0x00 0x4B	Read / Write	4	Unsigned, Value=DATA/10000 (kWh)
5	First channel power factor	004CH or 0x00 0x4C	Read	4	Unsigned, Value=DATA/1000
6	Negative active energy of first channel	004DH or 0x00 0x4D	Read / Write	4	Unsigned, Value=DATA/10000 (kWh)
7	Power direction	004EH or 0x00 0x4E	Read	4	First byte (first channel): 00-positive, 01-negative; Second byte (second channel): 00-positive, 01-negative;
8	Frequency	004FH or 0x00 0x4F	Read	4	Unsigned, Value=DATA/100, (Hz)
9	Second channel Voltage	0050H or 0x00 0x50	Read	4	Unsigned, Value=DATA/10000 (V)
10	Second channel Current	0051H or 0x00 0x51	Read	4	Unsigned, Value=DATA/10000 (A)
11	Second channel active power	0052H or 0x00 0x52	Read	4	Unsigned, Value=DATA/10000 (W)
12	Positive active energy of second channel	0053H or 0x00 0x53	Read / Write	4	Unsigned, Value=DATA/10000 (kWh)
13	Second channel power factor	0054H or 0x00 0x54	Read	4	Unsigned, Value=DATA/1000
14	Negative active energy of second channel	0055H or 0x00 0x55	Read / Write	4	Unsigned, Value=DATA/10000 (kWh)

The power factor refers to the ratio of the active power to the apparent power of the AC circuit.
Under a certain voltage and power of the user's electrical equipment, the higher the value, the better the benefit, and the more fully the power generation equipment can be used. Commonly used as cos Φ.

MODBUS Serial Communication Protocol.

The instrument provides a serial asynchronous half-duplex RS485 communication interface, adopts the standard MODBUS-RTU protocol, and various data information can be transmitted on the communication line.
Up to 255 network instruments can be connected to one line at the same time, and each network instrument can set its communication address.
The communication connection should use a shielded twisted pair with copper mesh, and the wire diameter is not less than 0.5 mm2.
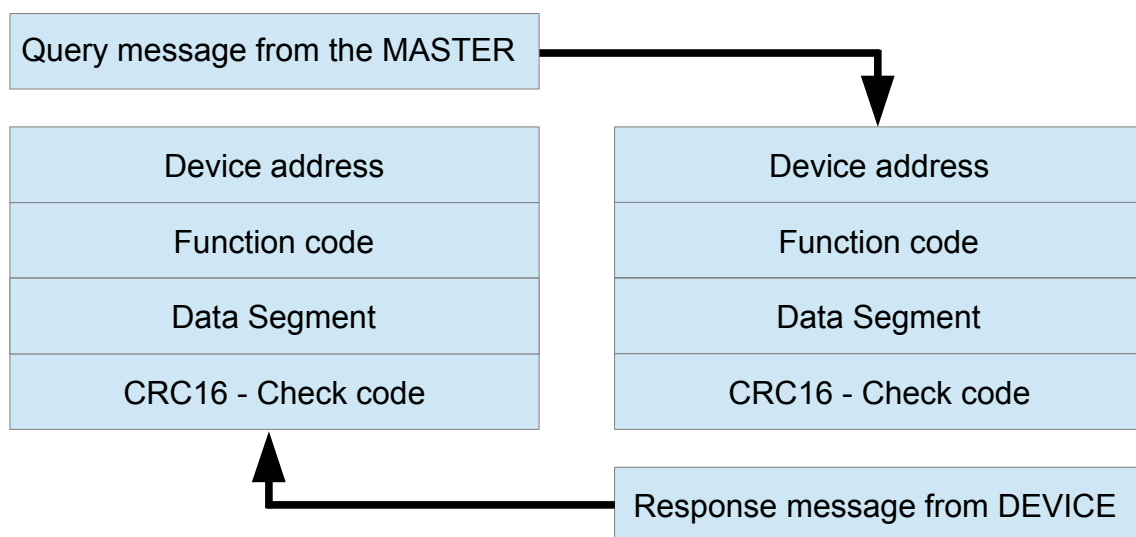When wiring, keep the communication lines away from strong electric cables or other strong electric field environments.

The MODBUS protocol adopts the communication connection mode of master-slave response on a communication line. First, the signal from the host computer addressed to a terminal device (slave) with a unique address, then the response signal sent by the terminal device is transmitted to the master in the opposite direction, that is, the signal is transmitted in two opposite directions on a single communication line.
All communication streams (half-duplex working mode).

The MODBUS protocol only allows communication between the host (PC, PLC, etc.) data exchange between independent terminal devices, so that the terminal devices do not occupy the communication line when they are initialized, but are limited to responds to inquiry signals arriving at the unit.

MODBUS - Protocol Query Response Data Stream

Query message from the MASTER

Device address		Device address
Function code		Function code
Data Segment		Data Segment
CRC16 - Check code		CRC16 - Check code

		Response message from DEVICE

Host query:

The query message frame includes device address, function code, data information code, and check code (CRC16). The address code indicates that you want to choose the slave device in the device; the function code tells the selected slave device what function 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, checksum used to check the correctness of a frame of information, the slave device provides a method to verify whether the content of the message is correct, it uses CRC16 calibration rules.

Slave response:

If the slave device generates a normal response, there are slave address code, function code, data signal in the response message Information code and CRC16 check code. Data information codes include data collected from the device: like register values or status. If an error occurs, we agree that the slave will not respond.

We stipulate the communication data format used in this instrument: the bit of each byte (1 start bit, 8 data bits, odd parity or even or no parity, 1 or 2 stop bits).

The structure of the data frame, that is, the message format:

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

Device address:

Composed of one byte, the address of each terminal device must be unique, only the addressed terminal will respond corresponding query.

Function code:

Tells the addressed terminal what function to perform. The following table lists the function codes supported by this series of instruments, in order and their functions.

Function code	Function
03H or 0x03	Read the value of one or more registers
10H or 0x10	Write the value of one or more registers
01H or 0x01	Read the output status of 1 relay
05H or 0x05	Write the output status of 1 relay

Data segment:

Contains the data required by the terminal to perform specific functions or the data collected when the terminal responds to queries. There the content of the data may be a numerical value, a reference address or a setting value.

Check code:

CRC16 occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device, then attach it to the data frame, the receiving device recalculates the CRC value when receiving the data, and then compares it with the received CRC field if the two values are not equal, an error occurs.

The process of generating a CRC16 is:

(1) Preset a 16-bit register as 0FFFFH (all 1), called CRC register.

(2) XOR the 8 bits of the first byte in the data frame with the low byte in the CRC register, and store the result back CRC register.

(3) Shift the CRC register one bit to the right, fill the highest bit with 0, take out the lowest bit and check it.

(4) If the lowest bit is 0: repeat the third step (the next shift); if the lowest bit is 1: combine the CRC register with one a preset fixed value (0A001H) for XOR operation.

(5) Repeat the third and fourth steps until 8 shifts. This completes a full eight bits.

(6) Repeat steps 2 to 5 to process the next eight bits until all bytes are processed.

(7) The final CRC register value is the CRC16 value.

Here is a "On line CRC calculator": *https://crccalc.com/*

Example of MODBUS - RTU communication protocol:

Function code 0x03:

Read multiple registers.

Example: The host wants to read the data of 2 registers on the slave whose address is 01 or 0x01 and start address is 0048H or 0x00 0x48

Host sends:	01	03	00	48	00	02	44	1D
	0x01	0x03	0x00	0x48	0x00	0x02	0x44	0x1D
	Address	read	start address		data length		CRC code	

Slave response:	01	03	04	12	45	56	68	D0	D0
	0x01	0x03	0x04	0x12	0x45	0x56	0x68	0xD0	0xD0
	Address	read	length	register1		register2		CRC code	

Function code 0x10:

Write multiple registers.

Example: The host wants to save 0000 0000 to the slave register with address
000C or 0x00 0x0C, 000D or 0x00 0x0D (slave address code is 0x01)

Host sends:

01	10	00	0C	00	02	04	00	00	00	00	F3	FA
0x01	0x10	0x00 0x0C		0x00 0x02		0x04	0x00 0x00 0x00 0x00				0xF3 0xFA	
Address	write	start address		write register number		byte count	data				CRC code	

Slave response:

01	10	00	0C	00	02	81	CB
0x01	0x10	0x00 0x0C		0x00 0x02		0x81 0xCB	
Address	write	start address		write register number		CRC code	

Description of the REGISTER:

The register in the MODBUS-RTU communication protocol refers to 16 bits (that is, 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 writeable address range of the module.

83: Illegal data value, that is, the data value sent by the host received by module exceeds the data range of the corresponding address.

Example of command analysis:

Read electrical parameter instruction (take module address 01 or 0x01 as an example):

Send data: (Read 14 (0E or 0x0E) registers starting from 0048H or 0x00 0x48)

01	03	00	48	00	0E	44	18
0x01	0x03	0x00 0x48		0x00 0x0E		0x44 0x18	
Address	read	start address		Number of register		CRC code	

Received data:

  01 03 48 00 24 8E 5F   00 00 94 0B   00 8A C4 AA   00 00 2D B4   00 00 03 E8
00 00 26 16   00 00 00 00   00 00 13 8B   00 24 1E F9   00 05 FE B9
05 8B 67 18   00 00 4E CA   00 00 03 E8   00 00 3D A2 68 59

(the red part is the data corresponding to the 0048H start register followed by 13 registers for a total of 14 registers),

Data = 2395743 37899 9094314 111700 1000 9750 0 5003 2367225 392889 93021976 20170 1000 15778 (14 values data)

The Data will give the following result:

239.5743 V, 3.7899 A, 909.4314 W, 11.1700 kWh, 1.000 PF, 0.9750 kWh, 0 = direction positive for both coils, 50.03 Hz, 236.7225 V, 39.2889 A, 9302.1976 W, 2.0170 kWh, 1.000 PF, 1.5778 kWh.

Energy cleaning instruction:

(take module address 01 or 0x01 as an example):

Send data:

01	10	00	0C	00	02	04	00	00	00	00	F3	FA
0x01	0x10	0x00	0x0C	0x00	0x02	0x04	0x00	0x00	0x00	0x00	0xF3	0xFA
Address	write	start address		write register number		byte count	data				CRC code	

Received data:

01	10	00	0C	00	02	81	CB
0x01	0x10	0x00	0x0C	0x00	0x02	0x81	0xCB
Address	write	start address		write register number		CRC code	

Caution:

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 the 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 labels and logo of the product, do not disassemble or modify the product, otherwise the company will no longer mention the product.

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