

JSY-MK-1039 Single-phase AC Energy Meter Module

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1. Product Introduction

1.1. Introduction

JSY-MK-1039 energy meter module is a highly integrated measurement, digital communication, etc., which can complete the measurement, collection and transmission of electric energy, single-phase AC parameter measurement application products, accurately measure single-phase AC voltage, current, power, forward and reverse power and other electrical parameters, built-in 2-channel RS-485 communication interface, one channel for uplink communication, the other can read the electrical data of other products of Jiansiyan Company (up to 16 products can be read), with excellent cost performance.

JSY-MK-1039 energy meter module can be widely used in energy-saving transformation, electricity, communications, railways, transportation, environmental protection, petrochemicals, steel and other industries to remotely monitor the current and

power consumption of AC equipment.

1.2. Features

- 1.2.1. Collect single-phase AC power parameters, including voltage, current, power, electric energy and other electrical parameters.
- 1.2.2. Adopting special measurement chip and effective value measurement method, the measurement accuracy is high.
- 1.2.3. With 2-channel RS-485 communication interface.
- 1.2.4. The communication protocol adopts standard Modbus-RTU, which has good compatibility and is convenient for programming.
- 1.2.5. RS-485 communication interface with ESD protection circuit.
- 1.2.6. Wide working voltage AC80 ~ 265V, with anti-reverse connection protection function, the module will not be damaged if the power supply is reversed.
- 1.2.7. High isolation voltage, withstand voltage up to DC2000V.

1.3. Technical Parameters

1.3.1 Single-phase AC input

- 1) Voltage range: 100V, 220V, etc. optional.
- 2) Current range: 80A, 100A optional, external open current transformer model optional.
- 3) Signal processing: using dedicated measurement chip, 24-bit AD sampling.
- 4) Overload capacity: 1.2 times the range is sustainable. instantaneous (<20mS) current is 5 times, voltage is 1.2 times the range without damage.
- 5) Input impedance: voltage channel >1 kΩ / V. current channel ≤ 100mΩ.

1.3.2 Communication interface

- 1) Communication standard RS-485.
- 2) Interface type: 2-channel RS-485 interface.
- 3) Communication protocol: MODBUS-RTU protocol.
- 4) Data format: "n,8,1".
- 5) The baud rate of RS-485 communication interface can be set to 1200, 2400, 4800, 9600 Bps, the baud rate is 9600 Bps by default.

1.3.3 Measurement output data

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

1.3.4 Measurement accuracy

Voltage , current: $\pm 1.0\%$. Active energy level 1

1.3.5 isolation

RS-485 interface, isolated from power supply, voltage input, and current input. isolation withstand voltage 2000VDC.

1.3.6 Power supply

- 1) Optional 100V, 220V, voltage line 100V~220V
- 2) When powered by AC220V, the peak voltage shall not exceed 265V. Typical power consumption: $\leq 2W$.

1.3.7 Work Environment

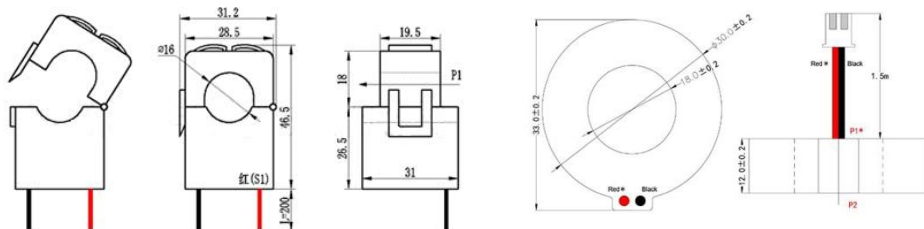
- 1) Working temperature: $-20\sim+70^{\circ}C$. Storage temperature: $-40\sim+85^{\circ}C$.
- 2) Relative humidity: 5-95%, no condensation (at $40^{\circ}C$) .
- 3) Altitude: 0-3000m.
- 4) Environment: A place without explosive, corrosive gas and conductive dust, and without significant shaking, vibration and impact.

1.3.8 Temperature drift: $\leq 100ppm/^{\circ}C$.

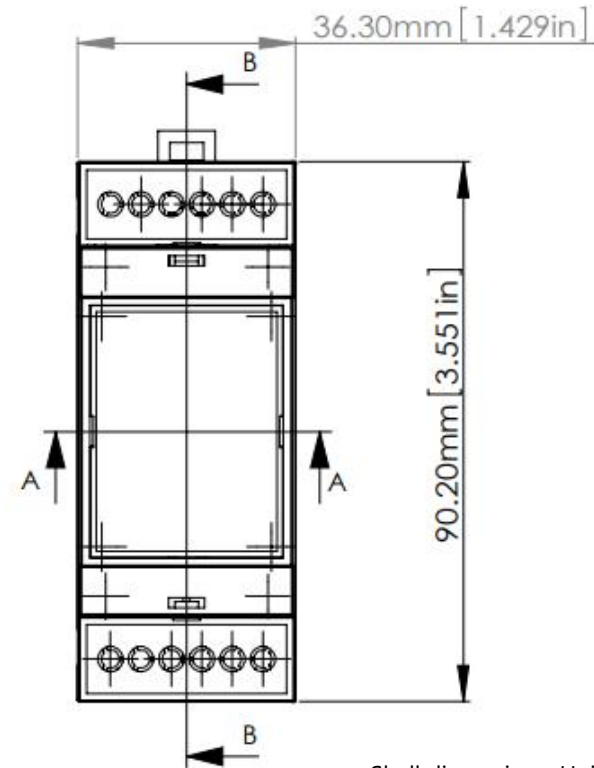
1.3.9 Module size : 35mm DIN rail installation

2. Application

2.1、 Dimensions



CT appearance and dimensions: Dimensions (unit: mm)



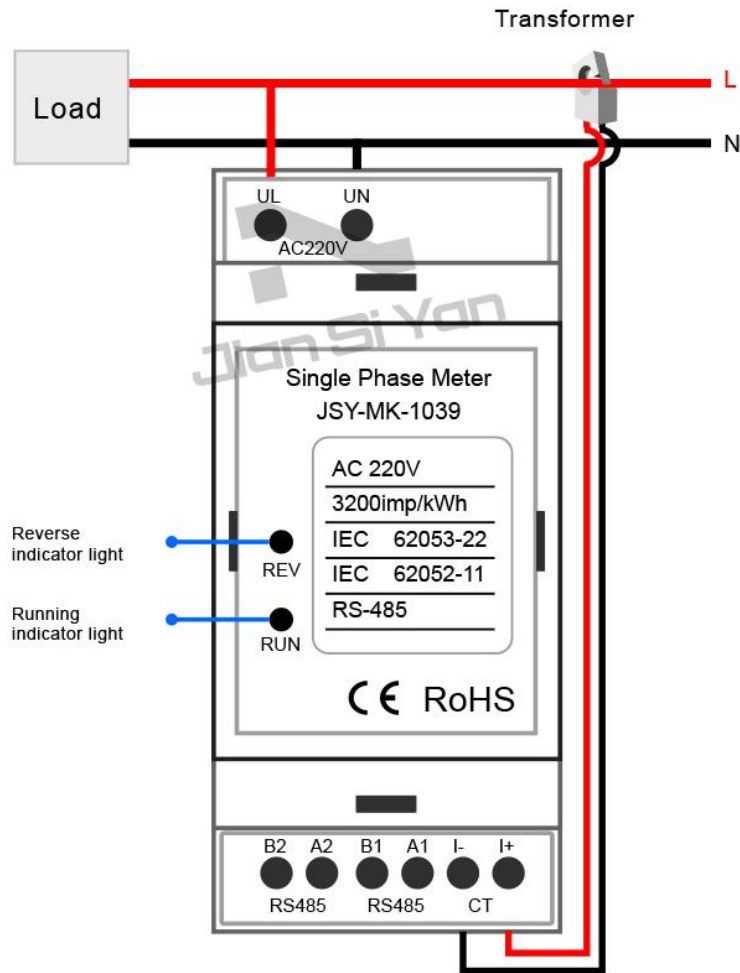
Shell dimensions: Unit (mm)

2.2、 Interface Definition

2.2.1 L (live wire) and N (neutral wire) are the voltage connection ports to be measured.

2.2.2 The current line to be measured (according to the current direction at the bottom of the transformer) passes through the external transformer.

2.2.3 The RS-485 communication interface is a 2P wiring socket, A (RS485 communication positive pole), B (RS485 communication negative pole).



Wiring Diagram

2.3、 Application Notes

Please connect correctly according to the product specifications and models and refer to the above diagrams. 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 supply for testing.

The panel has three indicator lights, namely "Run", and "Reverse".

Operation indicator light: The light is always on after power-on and flashes during communication.

Reverse indicator light: The indicator light is always on when the current is reversed.

When the product leaves the factory, it is set to the default configuration: address 1, baud rate 9600bps, data format "n,8,1", data update rate 1000ms.

1039 series product test software we provide can be used to change and set product parameters and perform general product tests.

2.4、 RS-485 communication connection

The host usually only has an RS - 232 interface. In this case, it can be connected to the 485 network through an RS - 232/ RS- 485 converter. It is recommended to use an isolated 485 converter to improve the reliability of the system.

The A+ and B- terminals of all devices on a bus are connected in parallel, and they cannot be connected in reverse. Up to 255 network instruments can be connected to one line at the same time. Each network instrument can set its communication address. The communication connection should use shielded twisted pair cables with a wire diameter of not less than 0.5mm². When wiring, keep the communication line away from strong electric cables or other strong electric field environments .

RS - 485 communication line should use shielded twisted pair cable. the communication distance of 485 can reach 1200 meters. When there are many RS485 devices connected to a bus , or a higher baud rate is used, the communication distance will be shortened accordingly. At this time, a 485 repeater can be used for expansion.

RS - 485 networking has a variety of topological structures, generally using linear connection, that is, starting from the upper host, multiple devices are connected to the

network one by one from near to far. At the farthest end, a 120 ~ 300 Ω / 0.25 watt terminal matching resistor can be connected (depending on the specific communication quality, that is, it does not need to be installed when the communication is very good).

2.5、 Energy metering function

It can provide single-phase voltage, current, power, power factor, frequency, active energy and other parameters.

The data of electricity is a 4-byte unsigned number, which will not overflow if accumulated for 10 consecutive years and will be saved when the power is off.

3.JSY-MK-1039 Modbus communication protocol

Communication Format:

- (1) The default communication format is 8, N, 1, and the default baud rate is 9600bps
- (2) The protocol is MODBUS-RTU, and the list of valid data registers is as follows:

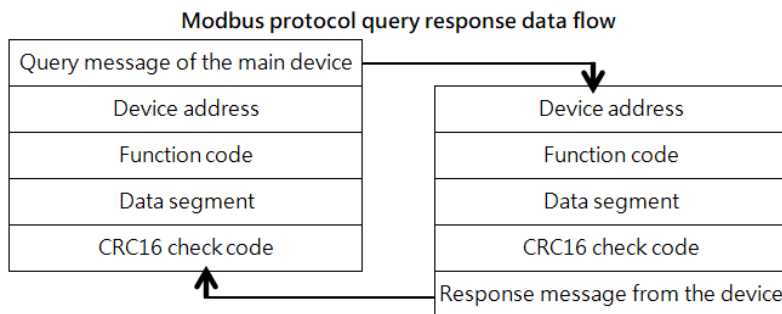
	Register Address	Number of bytes	Read/Write	Function	illustrate
0	0x0000	2	read	model	Model, value is 0x1039
1	0x0001	2	read	Hardware version	0x1001
2	0x0002	2	read	Software Version	0x1001
3	0x0003	2	read	Protocol Version	0x1001
4	0x0004	2	Read/Write	RS485 address and baud rate	The high byte is the address, the default is 0x01. the value is 0106H. the default address is 01H, the default communication format is 8, N, 1, 9600bps Description:

					The high byte 8 bits are the address, 1~255. 0 is the broadcast address. the low byte is the baud rate, 5-4800bps, 6-9600bps, 7-19200bps
5	0x000C 0x000D	4	Write	Energy Clear	Writing 0x00000000 will clear all energy registers, and writing other values will be invalid.
6	0x0048	2	read	Voltage	Unsigned number, value = DATA/100. unit V
7	0x0049	2	read	Current	Signed number, value = DATA/100. unit A, high bit is the sign bit, set to 1 for negative, complement code.
8	0x004A	2	read	power	Signed number, value = DATA/100. unit kW
9	0x004B	4	read	Positive active energy	Unsigned number, value = DATA/100. unit kWh
10	0x004D	4	read	Negative active energy	Unsigned number, value = DATA/100. unit kWh
11	0x004F	2	read	Power Factor	Unsigned number, value = DATA/1000.
12	0x0050	2	read	frequency	Unsigned number, value = DATA/100. unit Hz

4. MODBUS communication protocol

This instrument provides a serial asynchronous half-duplex RS485 communication interface, using 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. Each network instrument can set its communication address. The communication connection should use a shielded twisted pair with a copper mesh, and the wire diameter should not be less than 0.5mm². When wiring, communication lines should be kept away from strong current cables or other strong electric field environments.

The MODBUS protocol adopts the master-slave response communication connection method on one communication line. First, the signal from the host computer is addressed to a terminal device (slave) with a unique address. Then, the response signal from the terminal device is transmitted to the host in the opposite direction, that is, the signal is transmitted along a separate communication line. All communication data streams are transmitted in opposite directions (half-duplex operating mode). The MODBUS protocol only allows communication between the host (PC, PLC, etc.) and terminal devices, but does not allow data exchange between independent terminal devices. In this way, each terminal device will not occupy the communication line when they are initialized, but is limited to responding. Query signal arriving at this machine.



Host query: The query message frame includes device address, function code, data information code, and check code. The address code indicates the slave device to be selected.

the function code tells the selected slave device what function to perform. For example, function code 03 or 04 requires the slave device to read registers and return their contents. the data segment contains the slave device requirements. Any additional information that performs functions. The check code is used to verify the correctness of a frame of information. The slave device provides a method to verify whether the message content is correct. It uses the calibration rule of CRC16.

Slave response: If the slave device generates a normal response, the response message contains the slave address code, function code, data 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 machine will not respond.

We specify the communication data format used in this instrument: bits per byte (1 start bit, 8 data bits, odd or even parity 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: 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 instruments 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 relay 1
05H	Write the output status of relay 1

Data segment: Contains the data required by the terminal to perform specific functions or the data collected when the terminal responds to queries. The content of these data may be numerical values, reference addresses or setting values.

Check code: CRC16 occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and then appended 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. mistake.

The process of generating a CRC16 is:

- (1) Preset a 16-bit register to 0FFFFH (all 1s), called CRC register.
- (2) Perform XOR operation on the 8 bits of the first byte in the data frame and the low byte in the CRC register, and store the result back into the CRC register.
- (3) Shift the CRC register one bit to the right, fill the highest bit with 0, shift out the lowest bit and detect it.
- (4) If the lowest bit is 0: repeat the third step (next shift). if the lowest bit is 1: perform an XOR operation on the CRC register and a preset fixed value (0A001H).
- (5) Repeat steps 3 and 4 until 8 shifts. In this way, a complete eight bits are processed.
- (6) Repeat steps 2 to 5 to process the next eight bits until all bytes are processed.
- (7) The final value of the CRC register is the value of CRC16.

MODBUS-RTU communication protocol example:

4.1. Function code 0x03: Read multiple registers

Example: The host wants to read 2 slave register data with address 01 and start address 0048H.

Host sends: 01 03 00 48 00 02 CRC

Address function code starting address data length CRC code

Slave response: 01 03 04 12 45 56 68 CRC

Address function code returns the number of bytes Register data 1 Register data 2 CRC code

4.2. Function code 0x10: Write multiple registers

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

Host sends: 01 10 00 0C 00 02 04 00 00 00 00 F3 FA

Address function code starting address number of write registers byte count saved data 1 2 CRC code

Slave response: 01 10 00 0C 00 02 81 CB

Address function code starting address write register number CRC code

4.3. Function code 00x01: Read the status of 1 switch output

Example: The host wants to read the output status of the A-phase relay (the slave address code is 0x01)

Host sends: 01 01 00 00 00 01 CRC

The starting bit of the address function code reads the switch quantity CRC code

Slave response: 01 01 01 01 CRC

Address function code data length status data CRC code

4.4. Function code 0x05: Write 1 relay

The control command is: "FF00" means the output switch value is "1", that is, the control relay is "closed". "0000" means the output switch value is "0", that is, the control relay is "open".

Example: The host wants to control the phase A relay to "close" (slave address is 0x01)

Host sends: 01 05 00 00 FF 00 8C 3A

Address function code output bit control command CRC code

Slave response: exactly the same as the message and data content sent by the host

4.5. Description

The register in the MODBUS-RTU communication protocol refers to 16 bits (ie 2 bytes), and the high-order bit is 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 code:

81: Illegal function code, that is, the received function code module does not support it.

82: Reading or writing illegal data address, 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 module received by the host exceeds the data range of the corresponding address.

Examples of communication messages

4.6.1 Read data register (function code 03H): Read the three register values of phase A.

The result is: voltage 231.5V, current 10.123A, power 2343W, instrument address is 1.

Host reads data frame:

address	Order	Starting address (high bit first)	Number of registers (high end first)	Check code (low digit first)
01H	03H	00H,48H	00H,03H	85H,DDH

The instrument responds with a data frame:

address	Order	Data length	Data segment (6 bytes)	Check code
01H	03H	06H	5AH,6EH,27H,8BH,09H,27H	F8H,92H

4.6.2 Write data register (function code 10H): Set the upper limit of phase A voltage to 260V, the upper limit of phase A current to 50A, and the instrument address to 1.

Host writes data frame:

addr ess	Order	starting address	Number of registers	Number of bytes	data segment	Check code
01H	10H	00H,20H	00H,02H	04H	01H,04H, 01H,F4H	B1H,9DH

The instrument responds with a data frame:

address	Order	starting address	Number of registers	Check code
01H	10H	00H,20H	00H,02H	40H,02H

5. Notes

- 1) Pay attention to the auxiliary power information on the product label. The auxiliary power level and polarity of the product must not be connected incorrectly, otherwise the product may be damaged.
- 2) Please connect correctly according to the product specifications and models and refer to the diagram. Before connecting, make sure to disconnect all signal sources and power to avoid danger and damage to the equipment. After checking and confirming that the wiring is correct, turn on the power for testing.
- 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 connect wires or unplug terminals when there is current on the primary side of the CT.
- 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) When installing in a centralized manner, the minimum installation interval should not be less than 10mm.
- 7) This series of products does not have a lightning protection circuit inside. When the input and output feeder lines of the module are exposed to harsh outdoor weather environments, lightning protection measures should be taken.
- 8) Please do not damage or modify the product labels or logos, and do not disassemble or modify the product. Otherwise, our company will no longer provide the "Three Guarantees" (exchange, refund, and repair) service for this product.

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