

JSY1009 Single Inductive Metering Module

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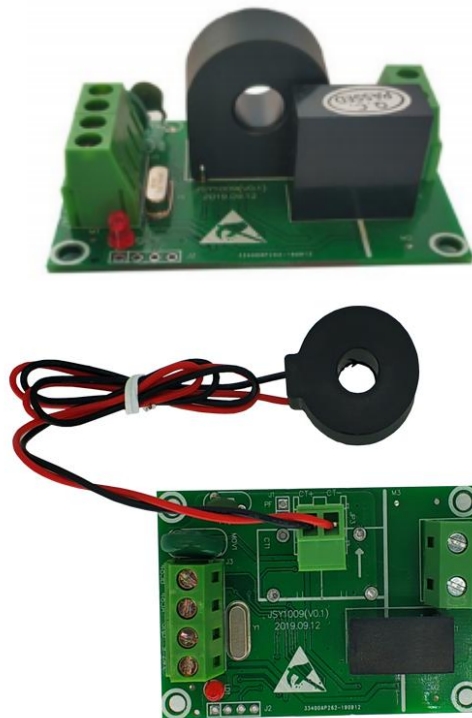
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I. Products

1.1、brief

JSY1009 single-phase mutual inductive power quality tester is highly integrated measurement, digital communication, etc., can complete the power measurement, acquisition and transmission, single-phase AC power parameter measurement application products, accurate measurement of single-phase AC voltage, current, power, power and total power and other electrical parameters, DC9-24V power supply, 1 RS-485 communication interface, MODBUS-RTU statute, has an excellent It has excellent cost performance.

JSY1009 single mutual inductive power quality tester can be widely used in energy-saving renovation, electric power, communication, railway, transport, environmental protection, petrochemical, iron and steel and other industries, for monitoring the current and power consumption of AC equipment.

1.2、Functional features

- 1.2.1. Collects single-phase AC parameters, including voltage, current, power, electrical energy and many other electrical parameters;
- 1.2.2. Adopting special measurement chip, RMS measurement method, high measurement accuracy;
- 1.2.3. With 1 RS-485 communication interface;
- 1.2.4. The communication protocol adopts standard Modbus-RTU, good compatibility and convenient programming;
- 1.2.5. RS-485 communication interface with ESD protection circuit;
- 1.2.6. Wide operating voltage DC9-24V;
- 1.2.7. High isolation voltage, withstanding voltage up to DC2000V;
- 1.2.8. Different sizes of single-turn through-centre PCB fixed or open-ended transformers are available for convenience and ease of use;

1.3、Technical parameters

1.3.1 Single-phase AC input

- 1) Voltage range: 100V, 220V, etc. optional;
- 2) Current range: 5A, 50A, 100A, etc. Optional; external open-ended current transformer models can be selected;
- 3) Signal processing: Adopt special measurement chip, 24-bit AD sampling;
- 4) Overload capacity: 1.2 times the range can be sustained; instantaneous (<20ms) current 5 times, voltage 1.5 times the range without damage;
- 5) Input impedance: voltage channel > 1 kΩ/V; current channel ≤ 100mΩ;

1.3.2 communication interface

- 1) Interface type: 1 RS-485 interface;
- 2) Communication protocol: MODBUS-RTU protocol;

- 3) Data format: software settable, "n,8,1", "e,8,1", "o,8,1", "n,8,2";
- 4) Communication rate: RS-485 communication interface baud rate can be set 1200, 2400, 4800, 9600Bps; baud rate default is 9600bps;

1.3.3 Measured output data

Several electrical parameters such as voltage, current, power, electrical energy, power factor, frequency, etc. are listed in the MdoBus data register list;

1.3.4 Measurement accuracy

Voltage, current, power: $\pm 1.0\%$; active power level 1

1.3.5 incommunicado

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

1.3.6 power supply

- 1) Typical power consumption when powered by DC9V supply: $\leq 1W$;

1.3.7 working environment

- 1) Working temperature: $-20 \sim +70^{\circ}C$; Storage temperature: $-40 \sim +85^{\circ}C$;
- 2) Relative humidity: 5 to 95% without condensation (at $40^{\circ}C$);
- 3) Altitude: 0 to 3000 metres;
- 4) Environment: no explosion, corrosive gas and conductive dust, no significant shaking, vibration and shock of the place;

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

1.3.9 Mounting: screw-fixed mounting

1.3.10 Module size: $62 \times 42 \times 23mm$

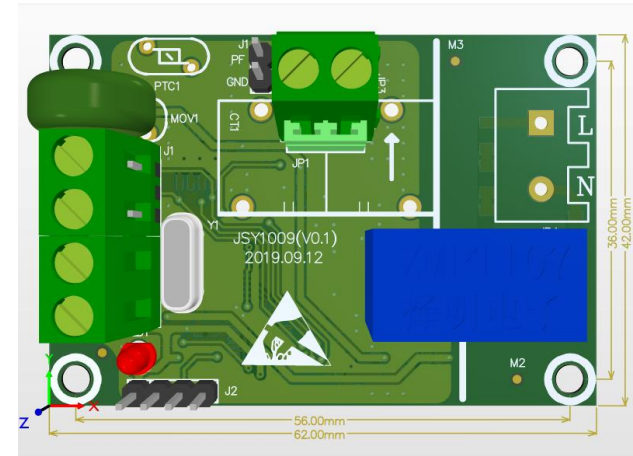
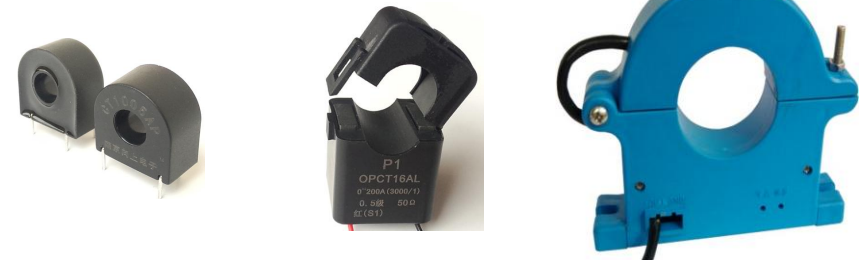
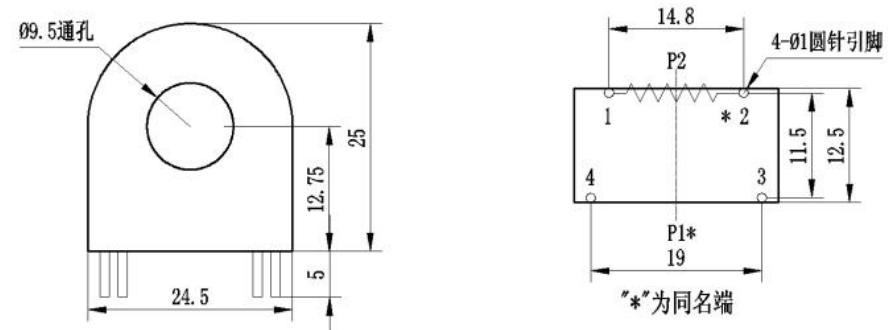


Figure 2.1 External Dimensions (Unit: mm)

Current Transformer Outline Drawing



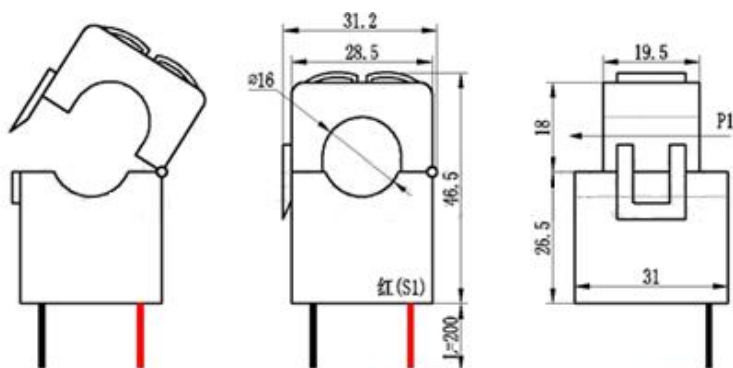
Current transformer external shape and dimension drawing:



II. Applications

2.1、 Shape and Installation

50A Through-core Current Transformer Dimensions



2.2、 Application Notes

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

When the power is switched on, the "indicator light" is always on, and when communicating, the "indicator light" blinks synchronously during communication data transmission.

The products are shipped from the factory with the default configuration: address 1, baud rate 9600bps, data format "n,8,1", data update rate 1000ms, and variable ratio 1;

The JSY-MK-109 series test software can be used to change and set the product parameters and the general test of the product.

2.3、 RS-485 communication connection

The host generally only has RS-232 interface, at this time can be connected to the 485 network after the RS-232/RS-485 converter; it is recommended to use the 485 converter with isolation type to improve the reliability of the system;

The A+ end of all devices on a bus is connected in parallel, the B- end is connected in parallel and cannot be connected in reverse, up to 255 network instruments can be

connected to a line at the same time, and each network instrument can be set to its communication address, the communication connection should be made using shielded twisted-pair wires with a diameter of not less than 0.5mm^2 . The wiring should be made so that the communication lines are far away from the strong electric cables or other strong electric field environments.

RS-485 communication line should use shielded twisted pair; 485 communication distance up to 1200 metres, when a bus connected to a lot of RS485 devices, or use a higher baud rate when the communication distance will be shortened accordingly, at this time you can use the 485 repeater for expansion.

RS-485 network has a variety of topologies, generally using a line connection, that is, from the host host from near and far will be more than one device connected to the network one by one. In the farthest end can be connected to $120 \sim 300\Omega / 0.25$ watt terminal matching resistor (depending on the specific quality of communication to determine, that is, communication is very good when you do not have to install).

2.4、 Electricity metering function

Parameters such as single-phase voltage, current, power, power factor, frequency, active energy and carbon emissions can be provided;

The data of electricity degree is 4-byte unsigned number, which will not overflow for 10 years of continuous accumulation, and the data is saved by power down.

III.JSY1009 Modbus Register List

The registers are used for the MODBUS-RTU communication protocol. The valid registers are listed below:

Note: There are functions in the protocol that this module may not have, please refer to the specific instructions;

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

serial number	define	register address	Read/Write	explicit explanation
1	address and baud rate	0004H	Read/Write	Default value is 0105H; default address is 01H, default communication format is 8,N,1,9600bps Description: The high byte 8 bits are the address, 1 to 127; 0 is the broadcast address; The high 2 bits of the low byte are data format bits. The value "00" means 10 bits without parity, i.e. "8, N, 1"; "01" means 11 bits, even parity, i.e. "8, E, 1"; A "10" means 11 bits, odd-checked, i.e. "8, O, 1"; "11" means 11 bits, no parity, 2 stop bits, i.e. "8, N, 2"; The lower four bits of the low byte are the baud rate, 3-1200bps, 4-2400bps, 5-4800bps, 6-9600bps, the

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

serial number	define	register address	Read/Write	Explicit explanation
1	Model 1	0000H	phrase marked by pause	The value is 9000
2	Model 2	0001H	phrase marked by pause	Value B131H
3	voltage range	0002H	phrase marked by pause	A value of 250 represents 250V
4	Current range	0003H	phrase marked by pause	A value of 160 represents 16A

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

serial number	define	register address	Read/Write	Explicit explanation
1	Total active electrical energy	000CH	Read/Write	Total active electrical energy (high level)
2	Total active electrical energy	000DH	Read/Write	Total active electrical energy (low)
3	Active electrical energy (clear power)	000CH 000DH	Read/Write	Use function 10H to write data as 00000000

Table 4: Measured electrical parameter registers and communication data table (function code 03H, read-only)

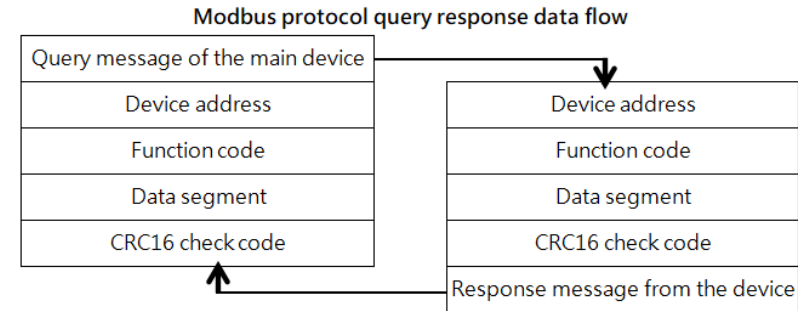
serial number	define	register address	Read/Write	Data types and calculations Description
1	input voltage	0048H	phrase marked by pause	Unsigned number, value = DATA/100, unit V
2	amps	0049H	phrase marked by pause	Unsigned number, value = DATA/1000, unit A
3	active power	004AH	phrase marked by pause	Unsigned number, value = DATA, unit W
4	Total active electrical energy	004BH	phrase marked by pause	Unsigned number, value = DATA/3200 in kWh, same value as 000CH, 000DH registers
		004CH	phrase marked by pause	
5	power factor	004DH	phrase marked by pause	Unsigned number, value =

				DATA/1000
6	Carbon dioxide emissions	004EH	phrase marked by pause	High CO2 emissions.
		004FH	phrase marked by pause	Low CO2 emissions, value = DATA/1000 in Kg
7	temp	0050H	phrase marked by pause	Reserved (this function is listed in this module)
8	frequency	0051H	phrase marked by pause	Value = DATA/100 in Hz
9	Device Serial Number	0052H	Read/Write	High 2 bytes, 0EXX, 0E for fixed address
		0053H	Read/Write	Low 2 bytes, XXXX

IV. MODBUS communication protocol

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

The MODBUS protocol uses a master-slave answer method on a single communication line. First, the signals from the master computer are addressed to a uniquely addressed terminal device (slave), and then the answer signals from the terminal device are transmitted to the host computer in the opposite direction, i.e. the signals are transmitted in the opposite directions on a single communication line for all communication data streams (half-duplex mode of operation). The MODBUS protocol allows communication only between the host (PC, PLC, etc.) and the end devices, but not the exchange of data between independent end devices, so that the end devices do not occupy the communication line during their initialisation but only respond to the query signals arriving at the machine.



Host Query: The query message frame includes the device address, function code, data message code, and checksum. The address code indicates the slave device to be selected; the function code tells what function the selected slave device is to perform, e.g., function code 03 or 04 requires the slave device to read the registers and return their contents; the data segment contains any additional information about the function the slave device is to perform, and the check code is used to verify the correctness of a frame, and the slave device provides a method of verifying that the contents of the message are correct by using the CRC16 calibration rule.

Slave Response: If the slave device generates a normal response, there is a slave address code, a function code, a data message code and a CRC16 checksum in the response message. The data information code includes the data collected from the device, such as register values or status. If an error occurs, we agree that the slave does not respond.

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

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

device address	function code	data segment	CRC16 check digit
1 byte	1 byte	N bytes	2 bytes (low byte first)

Device address: consists of one byte, the address of each terminal device must be unique, and terminals that are merely addressed will respond to the corresponding query.

Function Code: Tells what function is performed by the terminal being addressed. The following table lists the function codes supported by this series of instruments and what they do.

function code	functionality
03H	Read the value of one or more registers
10H	Write the value of one or more registers
01H	Read the output status of 1 relay
05H	Write the output state of 1 relay

Data Segment: Contains data required by the terminal to perform a specific function or data collected by the terminal in response to a query. The content of this data may be numerical values, reference addresses, or setting values.

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

The process to generate a CRC16 is:

- (1) A 16-bit register is preset to 0FFFFH (all 1's) and is called the CRC register.
- (2) The 8 bits of the first byte in the data frame are differentiated from the low byte in the CRC register, and the result is stored back in the CRC register.
- (3) Shift the CRC register one bit to the right, fill in the highest bit with a 0, and shift out and detect the lowest bit.
- (4) If the lowest bit is 0: repeat the third step (next shift); if the lowest bit is 1: perform a different-or operation of the CRC register with a preset fixed value (0A001H).
- (5) Repeat steps 3 and 4 until 8 shifts have been made. This completes the processing of a full eight bits.
- (6) Repeat steps 2 through 5 for the next octet until all bytes are processed.
- (7) The final CRC register value is the CRC16 value.

Example of MODBUS-RTU communication protocol.

4.1, Function code 0x03: Read multiplexed registers

Example: The master wants to read the data of 2 slave registers 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 Number of bytes returned Register data 1 Register data 2
CRC code

4.2. Function code 0x10: Write multiplexed registers

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

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

Address Function code Starting address Number of write registers Byte count Save data1 2 CRC code

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

Address Function code Starting address Number of write registers CRC code

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

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

Host sends: 01 01 00 00 00 01 CRC

Address Function code Starting bit Number of switches read 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 commands are: "FF00" is the output switch quantity "1", i.e. control relay "close"; "0000" "FF00" is the output switch quantity "1", i.e. control relay "close"; "0000" is the output switch quantity "0", i.e. control relay "split".

Example: The master wants to control the A-phase relay "close" (slave address 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 message and data content as sent by the master

4.5. Description

Registers in the MODBUS-RTU communication protocol refer to 16 bits (i.e. 2 bytes) and are preceded by the high bit.

When setting parameters, be careful not to write illegal data (i.e., data values that exceed the data range limit);

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

Address code: 1 byte

Function code: 1 byte (highest bit is 1)

Error code: 1 byte

CRC: 2 bytes

The response returns the following error code:

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

82: An illegal data address is read or written, i.e. the data location is outside the readable or writable address range of the module.

83: Illegal data value, i.e. the module receives a data value from the host that is outside the data range of the corresponding address.

4.6 Examples of communication messages

4.6.1 Read data register (function code 03H): read the 3 register values of phase A. The result is: voltage 231.5V, current 10.123A, power 2343W, and the instrument address is 1.

The host reads the data frame:

address	command	starting address (high first)	Number of registers (high first)	Check digit (low bit first)
01H	03H	00H, 48H	00H, 03H	85H, DDH

The meter responds to the data frame:

address	command	data length	Data segment (6 bytes)	check digit
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 A-phase voltage to 260V, the upper limit of A-phase current to 50A, and the instrument address to 1.

The host writes the data frame:

address	command	starting address	register count	byte count	data segment	check digit

	d					
01H	10H	00H, 20H	00H,02H	04H	01h, 04h, 01h, f4h	B1H,9DH

The meter responds to the data frame:

address	command	starting address	register count	check digit
01H	10H	00H, 20H	00H,02H	40H,02H

4.7. Example of instruction parsing:

Read electrical parameter command (using module address 0x01 as an example):

Send data: 01 03 00 48 00 06 45 DE (reads 6 registers starting at 0048)

Received data: 01 03 0C 57 E4 09 D9 02 2D 00 00 03 40 03 D6 3F 17

The red parts are the relevant electrical parameters, and the decomposition results are shown below:



The red data 57 E4 corresponds to register 0048, which is the voltage: $0x57E4 = 22500$, divided by 100 for 225V, each register is 2 bytes of data, and the rest of the data is derived in the same way according to the calculation formula.

V. Precautions

- 1) Pay attention to the auxiliary power supply information on the product label, the auxiliary power supply level and polarity of the product must not be connected incorrectly, otherwise the product may be damaged.
- 2) Please refer to the diagram for correct wiring according to the product specifications. Before wiring, make sure to disconnect all signal sources and power supply to avoid danger and damage to the equipment. After checking that the wiring is correct, then turn on the power to test.
- 3) The secondary circuit of the voltage circuit or PT must not be short-circuited.
- 4) When there is current on the primary side of the CT, the secondary circuit of the CT is strictly prohibited to be open; it is strictly prohibited to wire or unplug the terminal with electricity;
- 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) For centralised installation, the minimum installation interval should not be less than 10mm.
- 7) This series of products are not equipped with internal lightning protection circuits, when the module's input and output feeders are exposed to harsh outdoor climatic environments, attention should be paid to taking lightning protection measures.
- 8) Please do not damage or modify the product's labels, signs, do not disassemble or modify the product, otherwise the company will no longer provide "three packages" (package replacement, package return, package repair) service for the product.

Contact Information:

Shenzhen Jiansiyan Technologies Co., Ltd.

Address: 901, Building 1, Taijiale Technology Industrial Park, Tongguan Road, Tianliao Community, Yutang Street, Guangming District, Shenzhen, Guangdong, 518100, China.

Tel.: (+86) 0755 86524536 Fax: (+86) 0755 26628850

Web: www.jsypowermeter.com , E-mail: jsykj@outlook.com