JSY1003F Single phase Bi-directional induction metering module

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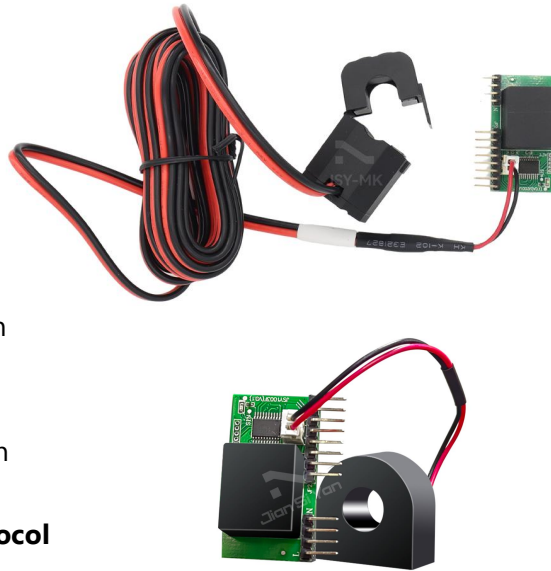
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1. Product Introduction

1.1、 Introduction

JSY1050 is a single-phase AC power parameter measurement product with highly integrated measurement and digital communication technology, which can complete electric energy measurement, collection and transmission . It can accurately measure single-phase AC voltage, current , power, power factor, frequency, power and other electrical parameters . It has 1 TTL level interface, completely isolated circuit, small size, simple interface, and can be easily embedded in various devices that need to measure power consumption. It has excellent cost performance.

JSY1050 single-phase inductive energy metering module can be widely used in energy-saving transformation , power, communication, railway, transportation, environmental protection, petrochemical, steel and other industries to 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, factor, frequency, 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 1 TTL communication interface, 3.3V interface.

1.2.4. The communication protocol adopts standard Modbus-RTU, which has good compatibility and is convenient for programming.

1.2.5. Low voltage DC3.3V power supply with anti-reverse connection protection function. Reverse power supply will not damage the module but it will not work.

1.2.6. High isolation voltage, withstand voltage up to AC 4000V.

1.2.7. Different specifications can be selected, single-turn through-core PCB fixed or open transformer, convenient and easy to use.

1.3、 Technical Parameters

1.3.1 Single-phase AC input

1) Voltage range: 100V, 220V, 380V, etc. optional.

2) Current range: 50A, 63A.

3) Signal processing: using dedicated measurement chip, 24- bit AD sampling.

4) Overload capacity: 1.2 times the range is sustainable. instantaneous (<20mS) current 5 times, voltage 1.5 times the range is not damaged.

5) Input impedance: voltage channel＞1 kΩ／V.

1.3.2 Communication interface

1) Interface type: 1-way TTL communication interface, compatible with 3.3V .

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: The baud rate can be set to 1200, 2400, 4800, 9600Bps. the baud rate defaults to 9600bps.

1.3.3 Measurement output data

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

1.3.4 Measurement accuracy

Voltage , current , power: less than ± 1.0 % . active power level 1

1.3.5 isolation

The power supply under test is isolated from the power supply. the isolation withstand voltage is 4000 AC.

1.3.6 power supply

1) The power supply is 3.3V DC, and the power consumption is 8-10mA.

1.3.7 Work Environment

1) Working temperature: -20～+60℃ . Storage temperature: -40～+85℃ .

2) Relative humidity: 5-95%, no condensation (at 40 °C) .

3) Altitude: 0-3000m.

4) Environment: A place without explosive, corrosive gas and conductive dust, and without significant shaking, vibration and impact.
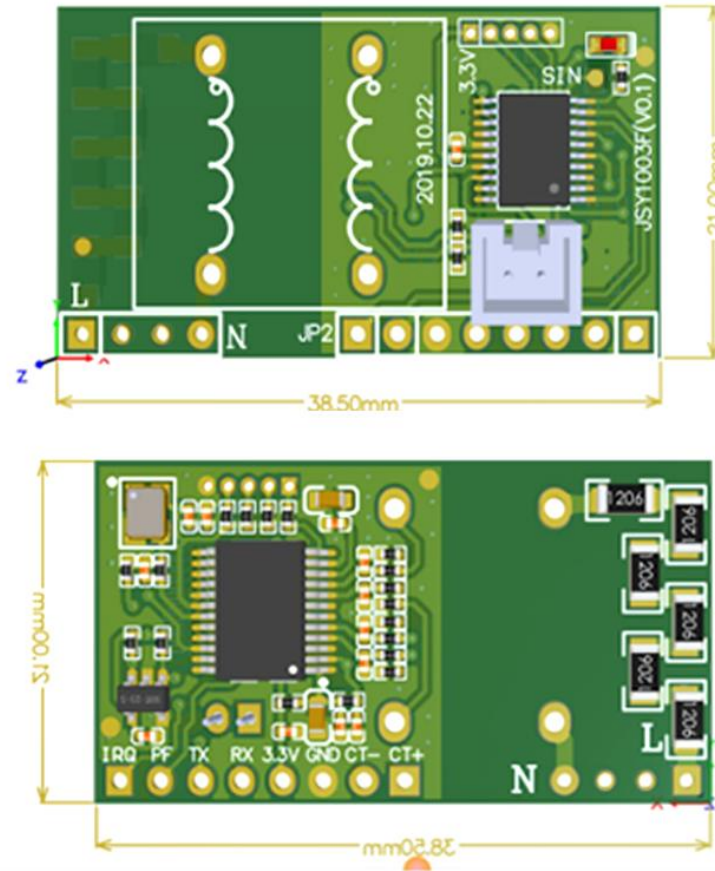
1.3.8 Temperature drift: ≤100ppm/ ℃ .

1.3.9 Installation method: PCB welding, the module plane size is 38.5*21.0mm.

1.3.10 Module size : 38.5*21.0*15mm

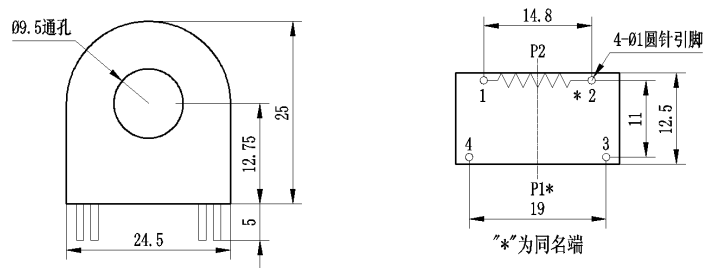# 2. Application

2.1、 **Appearance and installation**

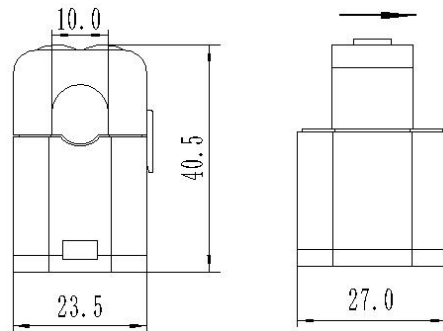**Current transformer outline drawing**

Current transformer appearance and dimensions:

Dimensional drawing of 50A core-type current transformer

Dimensional drawing of 63A split-core type current transformer

2.2、 Interface Definition

2.2.1 Pin Description

Logo	characteristic	Functional Description
L	FireWire	Live wire connection port of the voltage being tested
N	Neutral	Measured voltage neutral line connection port
PF	Output	Active energy check pulse output, low level output by default, generally do not need to connect this pin, but leave a pin position
TX	Output	Module TTL level transmission

RX	enter	Module TTL level receiving
3.3V	Power+	Metering module power supply pin , 3.3V power supply
GND	power supply-	Power Ground
IRQ	Output	Multi-function output interface
CT-	enter	Onboard current transformer negative input
CT+	enter	Onboard current transformer positive input

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.

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

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, ratio 1.

The JSY-1050 product testing software we provide can be used to change and set product parameters and perform general product tests.

2.4、 Energy metering function

Can provide single-phase voltage, current, power, power factor, frequency, active energy, carbon emissions 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.

2. JSY1003F Modbus register list

3.

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 instructions
1	Address and baud rate	0004H	Read/Write	The default value is 0105H. the default address is 01H, and the default communication format is 8, N, 1,9600bps illustrate: The high byte 8 bits are the address, 1~255. 0 is the broadcast address. The high 2 bits of the low byte are the data format bits. "00" means 10 bits, no checksum, that is, "8, N, 1". "01" means 11 bits, even parity, that is, "8, E, 1". "10" means 11 bits, odd parity, that is, "8, 0, 1". "11" means 11 bits, no parity, and 2 stop bits, that is, "8, N, 2". The lower four bits of the low byte are the baud rate, 3-1200bps, 4-2400bps, 5-4800bps, 6-9600bps,

Table 2: System read-only parameter register address and communication data table (function code 03H, read-only)

Serial number	definition	Register Address	Read/Write	Specific instructions
1	Model 1	0000H	read	The value is 1050H
2	Model 2	0001H	read	The value is 0110H
3	Voltage range	0002H	read	The value is 250, which means 250V
4	Current range	0003H	read	The value is 50, which means 5A

Table 3: Electric energy register address and communication data table (function code 03H read, 10H write)

Serial number	definition	Register Address	Read/Write	Specific instructions
1	Total active energy	000CH	Read/Write	Total active energy (high level)
2	Total active energy	000DH	Read/Write	Total active energy (low)
3	Active power (clear power)	000CH	Read/Write	Use function 10H, write data to 0000000

Table 4: Measurement electrical parameter register and communication data table (function code 03H, read only)

Serial number	definition	Register Address	Read/Write	Data Type and Calculation Instructions
1	Voltage	0048H	read	Unsigned number, value = DATA/100, unit V
2	Current	0049H	read	Unsigned number, value = DATA/1000 (maximum current/100), unit A
3	Active Power	004AH	read	Unsigned number, value = DATA/10 (maximum current/1), unit is W
4	Positive active energy	004BH	read	Unsigned number, value = DATA/3200, unit is kWh, value is the same as 000CH, 000DH register
		004CH	read	
5	Power Factor	004DH	read	Unsigned number, value = DATA/1000
6	Carbon dioxide emissions	004EH	read	High carbon dioxide emissions,
		004FH	read	Low carbon dioxide emissions, value = DATA/1000, unit is Kg

7	temperature	0050H	read	Reserved (this module does not have this function)
8	frequency	0051H	read	Value = DATA/100, in Hz
9	Warning information	0052H	read	Bit0: Overvoltage alarm status 0: Normal 1: Alarm Bit1: Undervoltage alarm status 0: Normal 1: Alarm Bit2: Overcurrent alarm status 0: Normal 1: Alarm
10	Reactive power	0053H	read	Unsigned number, value = DATA/10 (maximum current/1), unit is var
11	Apparent power	0054H	read	Unsigned number, value = DATA/10 (maximum current/1), unit is VA
12	Active power direction	0055H	read	Unsigned number, 0: forward 1: reverse
13	reserve	0056H	read	reserve
14	Reverse active energy	0057H 0058H	read	Unsigned number, value = DATA/3200, unit is kWh

4. MODBUS Communication Protocol

This instrument provides a serial asynchronous half-duplex RS485 communication interface, using the standard MODBUS-RTU protocol, and 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 a shielded twisted pair with a copper mesh, 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.

The MODBUS protocol uses a master-slave response communication connection method on a 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: on a separate communication line, the signal 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 device, and does not allow data exchange between independent terminal devices, so that each terminal device will not occupy the communication line when they are initialized, but is limited to responding to the query signal that reaches the machine.

Modbus protocol query response data flow
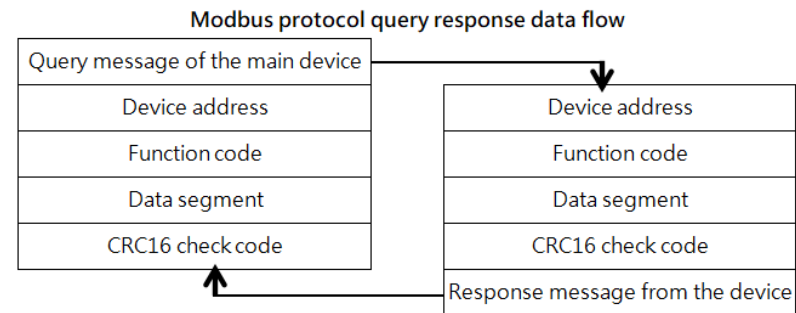
Host query: The query message frame includes the device address, function code, data information code, and check code. The address code indicates the slave device to be selected. the function code tells the selected slave device what function to perform, for example, function code 03 or 04 requires the slave device to read the register and return their contents. the data segment contains any additional information for the slave device to perform the function, and 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, which uses the CRC16 calibration rule.

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. The data information code includes the data collected by the slave device: such as register value or status. If an error occurs, we agree that the slave 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 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 checksum
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. 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 1 relay
05H	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. 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 then attached to the data frame. The receiving device recalculates the CRC value when receiving data and then compares it with the value in the received CRC field. If the two values are not equal, an error has occurred.

The process of generating a CRC16 is:

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

(2) Perform an 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 in the CRC register.

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

(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 are made. This completes the processing of a full eight bits.

(6) Repeat steps 2 to 5 to process the next eight bits until all bytes have been 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 the data of two slave registers with address 01 and starting 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 Return 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 at address 000C,000D (the 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 Write Register Quantity Byte Count Save Data 1 2 CRC Code

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

Address function code starting address write register quantity CRC code

4.3 Description

The registers in the MODBUS-RTU communication protocol refer to 16 bits (i.e. 2 bytes), with the high bit first.

When setting parameters, be careful not to write illegal data (i.e. 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 is not supported by the module.

82: Read or write an illegal data address, that is, the data location exceeds the module's readable or writable address range.

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

4.4、Instruction parsing example:

4.4.1 Read electrical parameter instructions (taking module address 0x01 as an example):

Send data: 01 03 00 48 00 0A 45 DB (read 10 registers starting from 0048)

Receive data: 01 03 14 5F C0 01 8F 03 D5 00 00 07 C0 03 E8 00 00 01 E6 6E 5E 13 86 F9 F1

The red part is the relevant electrical parameters, and the decomposed results are as follows: The red data 5 F C0 corresponds to register 0048 , which is the voltage: 0x5 FC0 = 2 4512, divided by 100 is 245.12 V. The data of each register is 2 bytes. The other data are calculated in the same way. The electric energy and carbon dioxide data are 2 registers, 4 bytes of combined data.

4.4.2 Clear power command (taking module address 0x01 as an example):

Send data: 01 10 00 0C 00 02 04 00 00 00 00 F3 FA

Receive data: 01 10 00 0C 00 02 81 CB

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 centrally, 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.