JSY1050 single-phase mutual inductance metering module

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1. Product introduction

1.1、 Introduction

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

    JSY1050 single-phase mutual inductance power metering module can be widely used in energy-saving power, electric power, communications, railway, transportation, environmental protection, petrochemical, steel and other industries, used to monitor AC equipment current and power consumption.

1.2、 Functional features

    1.2.1. Acquisition of single-phase AC electrical parameters, including voltage, current, power,power factor, frequency, electrical energy and other electrical parameters.

    1.2.2. Using special measurement chip, effective value measurement method, high measurement accuracy.

    1.2.3. With 1 channel 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.

    1.2.6. High isolation voltage, withstand voltage up to DC3000V.

    1.2.7. Optional different specifications, single-turn core PCB fixed or open transformer, easy to use.

1.3、 Technical parameters

1.3.1 Single-phase AC input

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

    2) Current range: 5A, 50A, 100A and other optional. external opening current transformer model optional.

    3) Signal processing: using dedicated measurement chip, 24 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 channel communication interface, compatible with 3.3V TTL.

    2) Communication Statute: MODBUS-RTU Statute.

    3) Data format: "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 Modbus data register list.

1.3.4 Measurement accuracy

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

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

1) DC single power supply 3.3V power supply, power consumption 8 ~ 10mA.

1.3.7 Working environment

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

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

3) Altitude: 0~3000 meters.

4) Environment: no explosion, corrosive gas and conductive dust, no significant shaking, vibration and impact of the place.
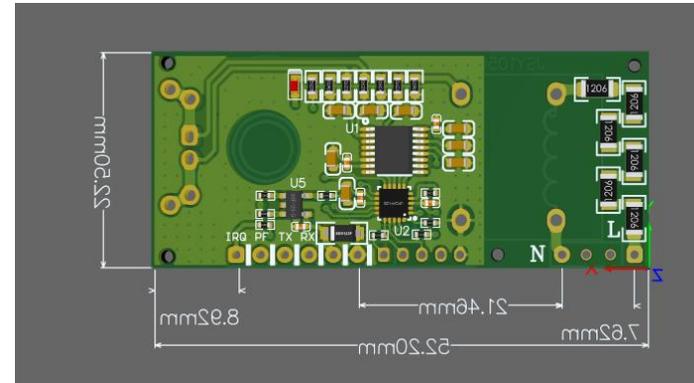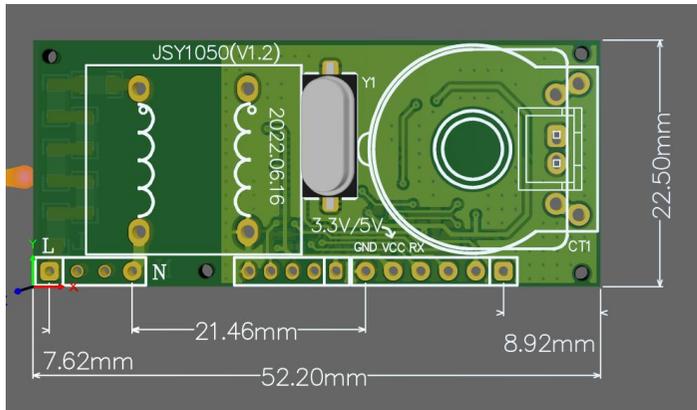
1.3.8 Temperature drift: 100ppm/ ℃.

1.3.9 Installation method: PCB welding, the plane size of the module is 52.2*22.5mm.

1.3.10 Module size: 52.2*22.5*15mm

2. application

2.1、 Appearance and installation

2.2、 Interface Definition

2.2.1 Pin Description

Identification	Characteristics	Function Description
L	Live Line	Measured voltage live wire connection port
N	Zero line	Measured voltage zero line connection port
PF	Output	Active energy calibration pulse output, default state low level output, generally do not need to connect this pin, but to leave the pin position
TX	Output	Module TTL level transmission
RX	Input	Module TTL level reception
3.3V	Power +	Metering module power supply pin, 3.3V power supply
GND	Power supply-	Power ground
IRQ	Output	Multi-function output interface
CT-	Input	On-board current transformer negative input
CT+	Input	On-board current transformer positive input

2.3、 Application Description

Please refer to the above figure for correct wiring according to the product specification

and model. 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 supply for testing.

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

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, change ratio 1.

You can change the set product parameters and the general testing of the product through the JSY-1050 product testing software provided by us.

2.4、 Electric energy metering function

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

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

List of registers 3. JSY1050 Modbus

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	The default value is 0106H. The default address is 01H, and the default communication format is 8,N,1,9600bps Description: The 8 bits of the high byte are the address, 1~255.0 is the broadcast address. The upper 2 bits of the lower byte are the data format bits, "00" means 10 bits, no check, "8,N,1". "01" means 11 bits, even parity, "8,E,1". "10" means 11 bits, odd parity, "8,O,1". "11" means 11 bits, no check, 2 stop bits, "8,N,2". The low 4 bits of the low byte are baud rate, 3-1200bps,4-2400bps,5-4800bps,6-9600bps,

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	Value is 1050H
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 50, representing 50A

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

Serial Number	Definition	register address	Read/Write	Specific Description
1	Total active energy	000CH	Read/Write	Total active energy (high)
2	Total active energy	000DH	Read/Write	Total active energy (low level)
3	Active energy (clean electricity)	000CH	Read/Write	use the function 10H, write data is 00000000

**Table 4: Measurement Electrical Parameter Register and Communication Data Sheet (Function Code 03H, Read Only)**

Serial Number	Definition	register address	Read/Write	Data Type and Calculation Description
1	Voltage	0048h	Read	Unsigned data, value = DATA/100, unit V
2	Current	0049H	Read	Unsigned data, value = DATA/100 , unit A
3	Active power	004AH	Read	Unsigned data, value = DATA, unit is W
4	Total active energy	004BH	Read	Unsigned data, value = DATA/3200, kWh, same value as 000CH,000DH register
		004CH	Read	
5	power factor	004DH	Read	Unsigned data, value = DATA/1000
6	Carbon dioxide	004EH	Read	High carbon dioxide emissions,

	emissions	004FH	Read	Low carbon dioxide emission, 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,unit is Hz

4. MODBUS Communication Protocol

This instrument provides serial asynchronous half duplex RS485 communication interface, using standard MODBUS-RTU protocol, all kinds of data information can be transmitted on the communication line. Up to 255 network meters can be connected on one line at the same time. Each network meter can set its communication address. Shielded twisted pair with copper mesh shall be used for communication connection, and the wire diameter shall not be less than $0.5mm^2$. When wiring, the communication line should be kept away from strong electric cables or other strong electric field environment.

The MODBUS protocol uses a master-slave response communication connection on the 1 root communication line. First, the host computer's signal is addressed to a terminal device (slave) with a unique address, and then the reply signal sent by the terminal device is transmitted to the host in the opposite direction, that is, the signal on 1 single communication line transmits all communication data streams in the opposite directions (half-duplex mode of operation). 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 the terminal equipment will not occupy the communication line when they are initialized, but only respond to the inquiry signal arriving at the machine.

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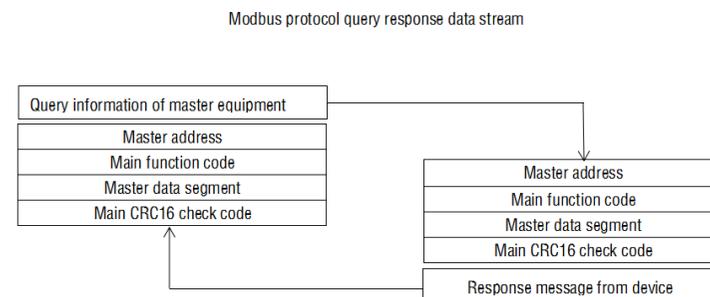
Host query: the query message frame includes a device address, a function code, a data information code, and a check code. The address code indicates the slave device to be selected. the function code indicates what function the selected slave device will perform, for example, the function code 03 or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

The slave response: if the slave device generates a normal response, there are the slave address code, function code, data information code and CRC16 check code in the response message. The data information code includes data collected from the device: like register values 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 of each byte (1 start bit, 8 data bits, odd check or even check 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 byte first)

Device address: consisting of one byte, the address of each terminal device must be unique, and only the addressed terminal will respond to the corresponding query.

Function code: tells what function the addressed terminal performs. The following table lists

the function codes supported by this series of instruments, as well as 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 1 relay output status
05h	Write the output status of 1 relay

Data segment: contains data required by the terminal to perform a specific function or data collected when the terminal responds to a query. The contents of these data may be numerical values, reference addresses, or setting values.

Check code: CRC16 takes 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 the 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 for generating a CRC16 is:

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

(2) The 8 bits of the first byte in the data frame are XOR-operated with the low byte in the CRC register, and the result is stored back in the CRC register.

(3) The CRC register is shifted to the right by the 1 bit, the highest bit is filled with 0, and the lowest bit is shifted out and detected.

(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 completes a complete eight.

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

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

MODBUS-RTU Communication Protocol Example:

4.1. Function Code 0x 03: Read Multiway Register

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

Host Sent:

    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 Return Bytes Register Data 1 Register Data 2 CRC Code

4.2. Function Code 0x 10: Write Multiway Register

Example: The host should save 0000 and 0000 to the slave register with address 000C,000D (the slave address code is 0x 01)

Host Sent:

    01   10   00 0C   00 02   04   00 00

Address function code start address write register number byte count save data 1

00 00   F3 FA

data 2   CRC code

SLOVER 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 bits preceded.

When setting parameters, be careful not to write illegal data (that is, 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 (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: Read or write 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 host received by the module exceeds the data range of the corresponding address.

4.4. Example of instruction analysis:

4.4.1 Instruction for reading electrical parameters (taking the module address 0x 01 as an example):

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

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:

Red data 5F C0 corresponds to 0048 register, that is, voltage: 0x5FC0=24512, divided by 100 is 245.12V, the data in each register is 2 bytes, and other data are obtained according to the calculation formula. Electric energy and carbon dioxide data are 2 registers and 4 bytes of combined data.

4.4.2 Clear power instruction (take the module address as 0x 01 as an example):

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

Receiving Data: 01 10 00 0C 00 02 81 CB

5. considerations

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 refer to the figure for correct wiring according to the product specification and model. Make sure to disconnect all signal sources and power supplies before wiring to avoid danger and damage to equipment. After checking and confirming that the wiring is correct, turn on the power supply for testing.

3) The voltage circuit or the secondary circuit of PT shall not be short-circuited.

4) When there is current on the primary side of CT, the secondary circuit of CT is strictly prohibited to open circuit. it is strictly prohibited 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) When centralized installation, the minimum installation interval shall not be less than 10mm.

7) There is no lightning protection circuit in this series of products. When the input and output feeders of the module are exposed to outdoor harsh weather 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 provide "three guarantees" (replacement, return, repair) service for the product.

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