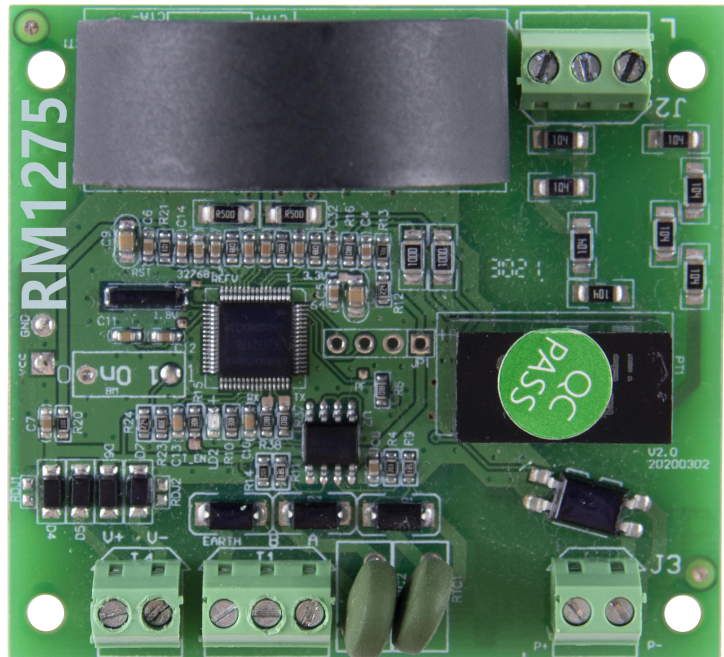




Energy Metering Module

RM1275

Product specification

Version: Ver.1.0

Update Record

No.	Version	Updates	Revision Date
1	Ver.1.0	Initial Release	2022.05.18

The document is subject to change without prior notice.

SHENZHEN SYSOLUTION TECHNOLOGY CO., LTD

Product Introduction

RM1275 single-phase AC energy metering module is a new product released by Sysolution Technology to accommodate various manufacturers to monitor the power consumption of their products. The software and hardware platform it uses has been applied in a large number of industrial products such as smart meters, and is the smallest unit to achieve power metering.

RM1275 has been applied on a large scale in many industries, such as AC charging pile, street lamp post monitoring, machine room, base station monitoring, energy-saving transformation, intelligent power management, dynamic loop, security monitoring, equipment energy consumption monitoring, etc. The accuracy of the module is better than the national level 1 standard; it can measure AC voltage, current, power, power factor, frequency and other electrical data from 45 to 65Hz; its communication protocol conforms to Modbus RTU communication protocol and DL/T645-2007 multi-functional energy meter communication, and it is easy to connect with other microcontrollers and ARM to realize automatic data acquisition and monitoring through corresponding interfaces.

This module can be easily embedded in street lamp post monitoring, smart home, smart household appliances, energy-saving transformation, intelligent power management, security monitoring, equipment energy consumption monitoring and many other industries, is an important supporting module to follow the trend of Internet of Things.

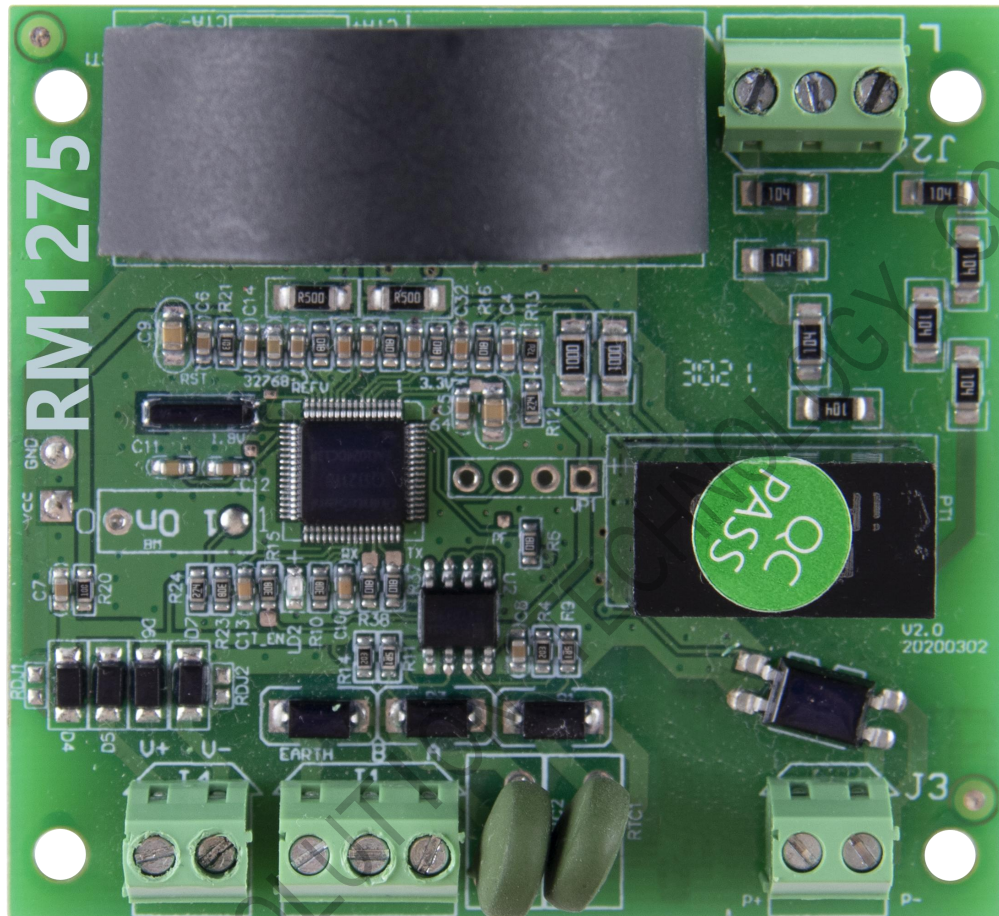
Product features

1. Single module can achieve the collection of single-phase AC parameters, including

voltage, current, power, power factor, frequency, electrical energy, temperature multiple electrical parameters, which provide overall information.

2. Adopt industrial-grade special power metering SOC chip, with high measurement accuracy.
3. Standard 485 communication, communication port with ESD protection, communication protocol supports DL/T 645-2007 and MODBUS-RTU dual statute.
4. Flip over and restart the measurement after the electricity is fully stored, and the electricity data is protected by power down.
5. Adopt current transformer with aperture $\Phi 12.8\text{mm}$, user can use Cable lug, which is convenient for user.
6. When the load uses electricity, the PF pin will output the corresponding pulse. This pin can also be used for the calibration bench to check the power measurement accuracy of the metering module through pulse acquisition.
7. the product has obtained the test report of the metrology institute.

Product Image



Product Parameters

Measuring Parameters	
Watt-hour	Level 1.0 (Note 1)
Mete Level	
Voltage Range	1-380V $\pm 0.5\%$ F.S
Current Range	20mA-50A $\pm 0.5\%$ F.S
Current Range	Expandable range, open-ended transformer (customized)
Extension	
Frequency	AC45~65Hz
Temperature	Chip Temperature
Minimum	0.0001kW
Power Variable	
Power Factor	Measurable
Pulse Constant	1000imp/kWh
Minimum	0.001kWh
Electrical	
Energy Variable	
CO₂	National standard formula calculation
Communication Functions	
Interface Type	485 communication (built-in ESD protection)
Communication	DL/T 645-2007 and MODBUS-RTU dual protocol

Protocol	
Data Format	Default "n,8,1" (no parity bit, 8 data bits, 1 stop bit)
Baud Rate	2400bps-19200bps, default 4800bps
Data Refresh Interval	≥250ms
Indicator	Power indicator / communication indicator (red)

Note 1: Here has some relative error.

Working Parameters

Power	
Typical Power Consumption	≤10mA
Power Supply	DC5.0V power supply, 3.3V power supply is available for shortly connect
Pressure Resistance Level	AC3000Vrms
Overload Capacity	1.2 times the range
Environment	
Working Temperature	-40 ~ +80℃
Relative Humidity	5 ~ 95%, no condensation (Under 40℃)
Altitude	0 ~ 3000 m
Working Environment	No explosive, corrosive gas and conductive dust, no significant vibration and shock places
Structure	
Size	Length 60mmx width 65mmx height 40 mm
Wiring Pin Pitch	3.81mm pitch (standard 3.81 green terminal)
Transformer Aperture	Φ12.8mm
Installation Method	Four corner fixing holes (3.5 aperture) installation

Module Pin Definitions



Pin	Function
V+	positive power supply for metering module
V-	Negative power supply for metering module
Description: This group voltage is the module power supply voltage, default DC5V, while shortly connected the module RDJ1 and RDJ2 points can support 3.3V power supply, at this time the reverse protection function fails, pay attention to the correct wiring, reverse connection will directly burn out the chip.	
EARTH	Connected to earth, can be suspended when not needed
B	External 485B

A	External 485A
P+	External pulse port P+
P-	External pulse port P-
L	Connect the measured live wire
N	Connect the measured Neutral wire

Modbus Communication Protocols

Modbus protocol electrical parameter register list 1 (default, 4 bytes per address, high byte first)

Number	Project	Register Address	Word Length	Read/Write	Data Type & Description
1	Voltage	0048H	4	Read	Hexadecimal unsigned number Unit 0.0001V Actual value = HEX2DEC (register value) x unit, same as below
2	Current	0049H	4	Read	Hexadecimal unsigned number Unit 0.0001A
3	Active power	004AH	4	Read	Hexadecimal unsigned number Unit 0.0001W Negative power initial F, actual power is 2^{32} - decimal register value
4	Active energy	004BH	4	Read/Write	Hexadecimal unsigned number Unit 0.0001KWh
5	Power Factor	004CH	4	Read	Hexadecimal unsigned number Unit 0.001
6	Carbon	004DH	4	Read	Hexadecimal unsigned number

	dioxide emission				Unit 0.0001Kg
7	Temperature	004EH	4	Read	Hexadecimal unsigned number Unit 0.01°C
8	Frequency	004FH	4	Read	Hexadecimal unsigned number Unit 0.01 Hz
9	Address & Baud Rate	0004H	2	Read/Write	Hexadecimal system Default value is 0105H: (Address 01H 8,N,1,4800), the default address is 1 High byte represents address, range 1~255, 0 is broadcast address Low byte: High 2 bits data format (00: 10-bit data "8,N,1") No checksum 1-bit end bit (01: 11-bit data "8,E,1") Even parity 1-bit end bit (10: 11-bit data "8,O,1") Odd-check 1-bit end bit Low byte: Lower 4 bits are baud rate (3: 1200bps 4: 2400bps)

					(5: 4800bps 6: 9600bps) (7: 19200bps)
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Note 1: The power direction function is an optional function

Modbus protocol electrical parameter register list 2 (customized, 2 bytes per address, high byte first)

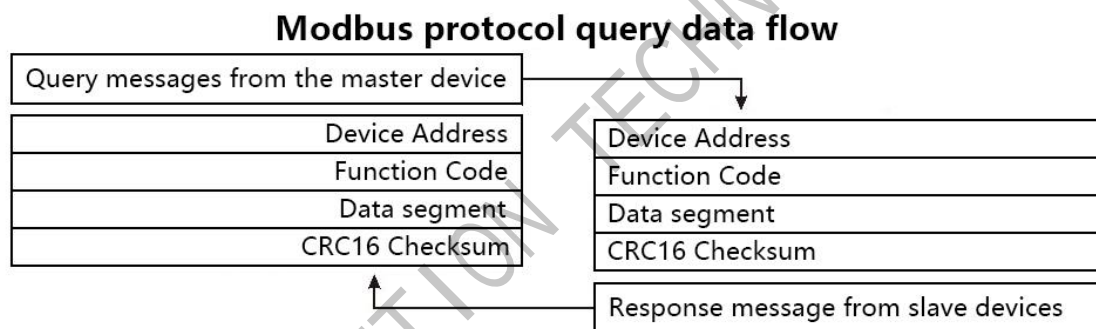
Number	Definition	Register Address	Read/Write	Data Type & Calculate Description
1	Voltage	0048H	Read	Unsigned number, value=DATA/100, unit V
2	Current	0049H	Read	Unsigned number, value=DATA/100, unit A
3	Active power	004AH	Read	Unsigned number, value=DATA, unit W
4	Active energy	004BH	Read	Unsigned number, value=DATA/3200, unit kWh
		004CH	Read	
5	Power Factor	004DH	Read	Unsigned number, value=DATA/1000
6	Carbon dioxide emission	004EH	Read	High CO2 emission
		004FH	Read	Low CO2 emission, value = DATA/1000, unit Kg
7	Temperature	0050H	Read	Reserved (this function is not available in this

				module)
8	Frequency	0051H	Read	Value = DATA/100, unit Hz
9	Address & Baud Rate	0004H	Read/ Write	Hexadecimal system Default value is 0105H: (Address 01H 8,N,1,4800), the default address is 1 High byte represents the address, range 1~255, 0 is the broadcast address Low Byte: High 2 bits data format (00: 10-bit data "8,N,1") No parity 1-bit end bit (01: 11-bit data "8,E,1") Even parity 1-bit end bit (10: 11-bit data "8,O,1") Odd-check 1-bit end bit Low Byte: The low 4 bits are baud rate (3: 1200bps 4: 2400bps) (5: 4800bps 6: 9600bps) (7: 19200bps)

Modbus communication protocol description (take example of register 4 bytes)

The instrument provides a Uart TTL communication interface with the standard Modbus-RTU protocol, so that all kinds of data information can be transmitted on the communication line. Each network instrument can set its communication address, and the communication connection should be made with shielded twisted pair cable with copper mesh, with a wire diameter of not less than 0.5mm². The wiring should keep the communication line away from strong electric cables or other strong electric field environment.

The Modbus protocol uses a master-slave answering connection on a single communication line. First, the signal from the master computer is addressed to a uniquely addressed terminal device (slave), and then the reply signal from the terminal device is transmitted to the master in the opposite direction, i.e., all communication data streams are transmitted in two opposite directions on a single communication line (half-duplex mode of operation). The Modbus protocol allows communication only between the host (PC, PLC, etc.) and the end devices, but not between independent end devices, so that each end device does not occupy the communication line during their initialization, but is limited to responding to the query signals arriving at the local machine.



Host query: The query message frame includes the device address, function code, data information code, and check digit. 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 asks the slave device to read the registers and return their contents; the data segment contains any additional information about the function to be performed by the slave device, the checksum is used to verify the correctness of a frame of information, the slave device provides a way to verify the correctness of the message content, it uses CRC16 calibration rules.

Slave Response: If the slave device generates a normal response, there is a slave address

code, function code, data information code, and CRC16 checksum in the response message. The data information code includes the 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 to be 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, i.e. the message format:

Device Address	Function Code	Data segment	CRC16 Checksum
One byte	One byte	N bytes	2 bytes (lower byte first)

Device address: consists of one byte, the address of each terminal device must be unique, only the terminal 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 meters and what they can achieve.

Function code	Functions
03H	Read one or multiple register values
10H	write one or multiple register values

data segment: it contains the data required for 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 set values.

Checksum: CRC16 occupies two bytes and contains a 16 bit binary value. The CRC value is calculated by the transmission device and attached to the data frame. The receiving device recalculates the CRC value when receiving the data, and then compares it with the values in the

received CRC domain. If these two values are not equal, an error occurs.

process of creating a CRC16:

1. Preset a 16 bit register as 0FFFFH (all 1), 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. Move the CRC register one bit to the right, fill the highest bit with 0, and move the lowest bit out and detect;
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 steps 3 and 4 until 8 shifts. This completes a complete eight digit process;
6. Repeat steps 2 to 5 to process the next octet until all byte processing is completed;
7. The final value of the CRC register is the value of CRC16.

Example of Modbus - RTU communication protocols

function code 0x03 : read multiplexer register

For example: The host needs to read the data from two slave registers with address 01 and starting address 0048H

Host send	01	03	00 48	00 02	CRC	
	address	function code	starting address	data length	CRC code	
slave response	01	03	08	HH HH	HH HH	CRC

	address	function code	Return Bytes	register data 1	register data2	CRC code
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Code function code 0x10: Write multiplexer register

Example: The host needs to save 000000 to the slave register with addresses 000C and 000D

(slave address code 0x01)

Host send	01	10	00 0C	00 02	04	00 00	00 00	F3 FA
	address	function code	starting address	write registers numbers	byte count	register data 1	register data 2	CRC code
slave response	01	03	00 0C	00 02	81 CB			
	address	function code	starting address	write registers numbers	CRC code			

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

Example of communication message

1. Read data register (function code 03H): Read 8 register values starting from 48H,

Host reading data frame: 01 03 00 48 00 08 C4 1A

Address	Command	Starting address (high order first)	Number of registers (high order first)	Check code (low order first)
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01H	03H	00H,48H	00H,08H	C4H,1AH
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Instrument response data frame : 01 03 20 00 21 8D D8 00 01 38 75 01 0C 63 08 00 00 00 5A

00 00 03 E8 00 00 00 59 00 00 0C CB 00 00 13 88 1B C2

Result: instrument address is 01, voltage 219.9000V, current 7.9989A, power 1758.9000W

Electric energy 0.0090kWh Power factor 1.000 Carbon dioxide 0.0089Kg Frequency 50.00Hz

Example: Actual voltage calculation=HEX2DEC (00 21 8D D8) hexadecimal to decimal x 0.0001V Unit=219.9000V

Address	Command	Data length	Data segment(4 byte/32 byte),16 hexadecimal	Verification code
01H	03H	20H	00 21 8D D8 00 01 38 75 01 0C 63 08 00 00 00 5A 00 00 03 E8 00 00 00 59 00 00 0C CB 00 00 13 88	1BH,C2H

1. Write data register (function code 10H): reset

Host writes data frames: 01 10 00 4B 00 02 04 00 00 00 00 B6 2C

Address	Comm and	Starting address	Number of Registers	Bytes	Data segment	Verification code
01H	10H	00H,4BH	00H,02H	04H	00H,00H,00H,00H	B6H,2CH

Instrument response data frame: 01 10 00 4B 00 02 2B F0

Address	Comm	Starting	Number of Registers	Verification code
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	and	address		
01H	10H	00H,4BH	00H,02H	2BH,F0H

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Energy Meter Communication Protocol

The DL/T645 protocol is an industry communication protocol developed for meter communication. If not familiar with it, it is not recommended to use it.

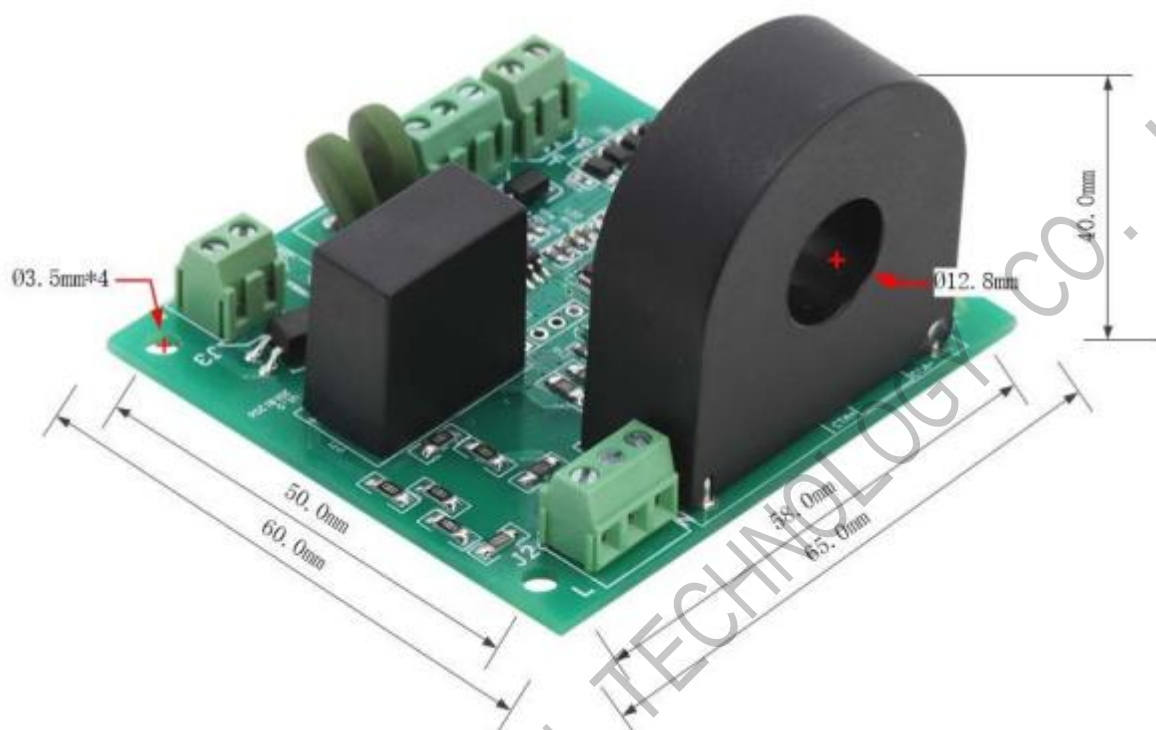
645 protocol electrical parameter register list

No.	definition (name)	register address	word length	read/write	Data type and description
1	power voltage	02010100	2	read	XXX.X Unit 0.1V
2	power current	02020100	3	read	XXX.XXX Unit 0.001A
3	active power	02030000	3	read	XX.XXXX Unit 0.0001kW
4	Total active power	00000000	4	read/write 0	XXXXXX.XX Unit 0.01KWh
5	Extended total power	80800001	4	read/write 0	Base unsigned number unit 0.001KWh
6	Power factor	02060000	2	read	X.XXX Unit 0.001
7	temperature	02800007	2	read	XXX.X Unit 0.1°C
8	frequency	02800002	2	read	XX.XX Unit 0.01Hz
9	address	04000401	6	read/write	NNNNNNNNNNNNN default 111111111111

10	baud rate	04000703	1	read/write	Base unsigned number(04: 1200bps 08:2400bps) (10:4800bps 209600bps) (40: 19200bps)
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Dimension

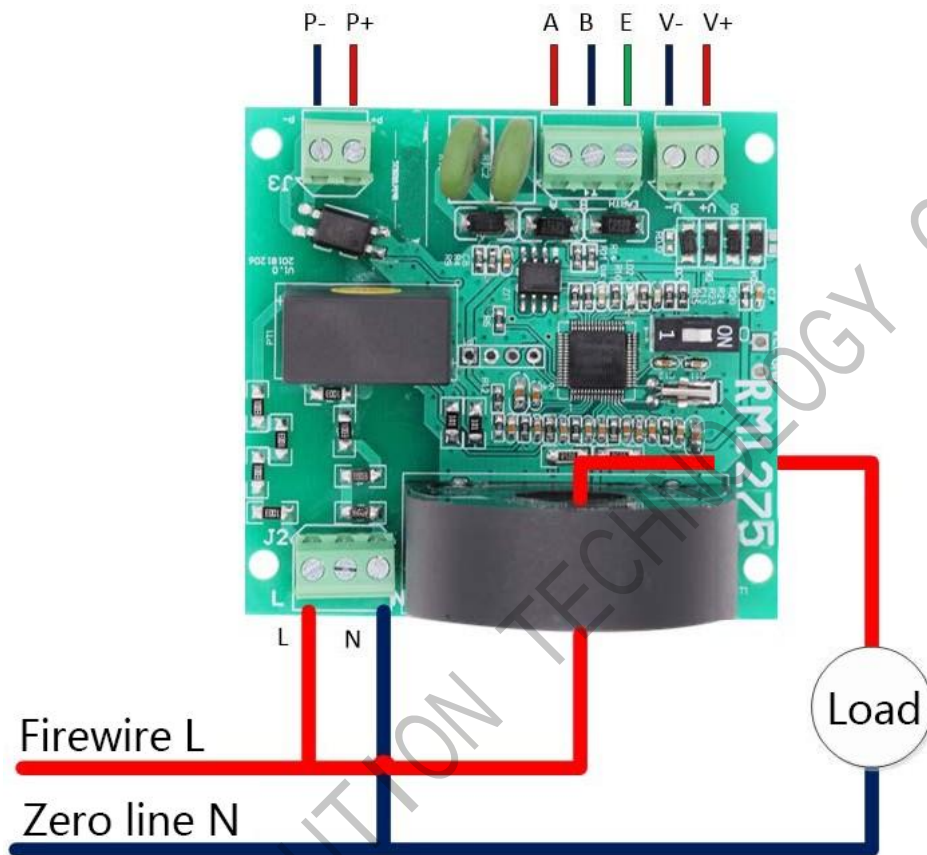


Unmarked dimensional tolerance: GB1804-m

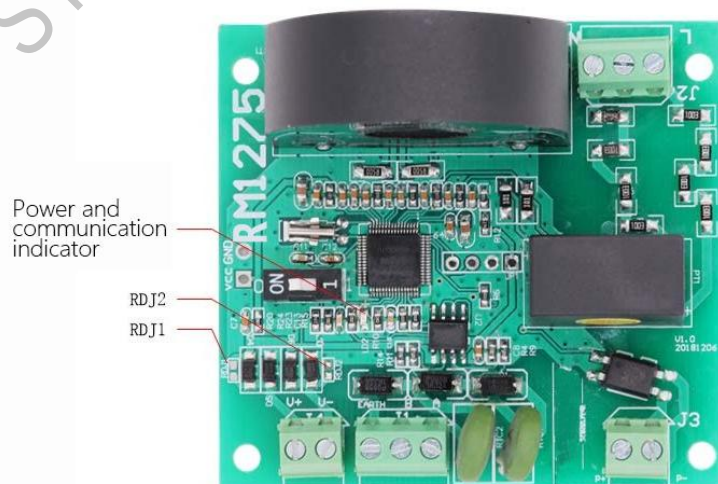
Unit: mm

Wire Connection

Standard Application Wiring Diagram



Short contact indication diagram



Notes

1. This product contains quartz crystals. It is strictly prohibited to use ultrasonic cleaning on this product.
2. The surface of this product is sprayed with three proof paint for protection, and it is strictly prohibited to clean the product surface.
3. Please wire correctly according to the product specifications and model, as shown in the diagram. Before wiring, ensure that all signal sources and power supplies are disconnected to avoid danger and damage to the equipment. After checking and confirming that the wiring is correct, connect the power supply for testing.
4. The voltage circuit or the secondary circuit of PT cannot be short circuited.
5. When there is current on the primary side of the CT, it is strictly prohibited to open the secondary circuit of the CT; It is strictly prohibited to wire or unplug terminals with electricity.
6. When using the product in environments with strong electromagnetic interference, please pay attention to the shielding of the input and output signal lines.
7. During centralized installation, the minimum installation interval should not be less than 10mm.
8. This series of products is not equipped with lightning protection circuits internally. When the input and output feeders of the module are exposed to harsh outdoor weather conditions, lightning protection measures should be taken.
9. Do not damage or modify the labels or logos of the product, do not disassemble or

modify the product, otherwise our company will no longer provide "three guarantees"
(replacement, return, repair) services for the product.

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