

# SINGLE-PHASE TWO-WIRE DIN-RAIL ENERGY METER

(New MODBUS-RTU communication protocol)

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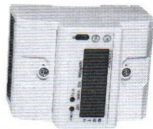
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1 MODULES



2 MODULES



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Version number : 1.0

## 1.1 Safety Guidance

Information about your personal safety

Due to different conditions or requirements, this manual cannot cover all the safety matters related to the operation of this instrument, but it is very important to understand the following items to ensure your personal safety and prevent damage to the instrument. These items are highlighted with a triangular safety symbol, depending on the degree of potential hazard indicated:

### Danger

This symbol indicates that failure to follow the relevant regulatory procedures will result in serious damage to the instrument, personal injury or death.

### Warning

This symbol indicates the risk of electric shock. Failure to take appropriate safety precautions will result in serious damage to the instrument, personal injury or death.

## Qualified Personnel

Only qualified personnel should perform the operations described in this manual for this instrument.

In this manual, qualified personnel refer to the professional technicians who are authorized or appointed to properly install and debug the instrument in accordance with the power safety management standards.

## Scope of Use

This instrument may only be used in the specific fields specified in this manual and in the products catalogue, and only on devices or components recommended or approved by our company.

## Correct Operation

Reasonable transportation, storage and proper installation and maintenance of this product are necessary conditions for the normal operation of this product. When this product is in operation, some components will carry dangerous voltage; improper handling will damage the instrument and threaten your safety.

- Must use insulating tools.
- Cannot be installed with power applied.
- Keep the energy meter in a dry place.
- Do not expose the meter to places that are dusty, muddy or wormy.
- Make sure that the current used does not exceed the maximum current of the meter.
- Make sure the wiring is correct before using the meter.
- In order to prevent electric shock, do not touch the connection clip of the meter directly with hands, metal, etc.

## RS-485 Cable

RS-485 can use international and Chinese standard communication cables. The international cable standard is: the wire diameter is larger than AWG18. The Chinese standard is RVVP1x2x0.5mm<sup>2</sup>

### Isolation and Anti-jamming of RS-485 Communication Lines

The shield of the shielded twisted pair should be connected to the shield terminals of each RS-485 device. The shield is only allowed to be grounded at one point.

## 1.11 Menu Operation Instructions

The operation instructions are only for the meter with the button, the first button is the turn button, and the second button is the set button.

1. When not in the setup state, short press the turn button to scroll through the screen. Short press the set button and there is no action.
2. When in the setup state, long press the turn button to cancel, long press the set button to set.

### How to Set Parameters

1. Long press the (set) button, enter the input password interface on the screen, the password is 4 digits, you can short press the turn button to add 1 to the flashing digit, short press the (set) button to switch the flashing digit. After inputting, long press the set button to enter the para. "set setting mode."
2. After entering the setting mode, short press the turn button to switch the setting item. When you need to set an item, long press the set button to enter into the parameter setting. At this time, the parameter will flash, and the operation is similar to step 1.
3. After the setting is completed, you can long press the set button to set confirm. If the setting is correct, it will display good. If the setting is unsuccessful, Err will be displayed.
4. When in the setting state, long press the turn button to exit or cancel, and the menu will return to the previous one.
5. Display instructions

Pass	0000	Login password
Address	001	Meter address
Bd	9600	Baud rate
PrL1	E	Check digit
Scrl	L	Cycle time
SEL	Pass	Change password

## 1.12 Technical Support. Please contact your supplier

No pulse output	Whether DC power is connected?  The pulse port correctly connected?	Check if the external voltage is 5-27V DC.  1 module: port 6 is connected to the positive pole and the 7 port is connected to the negative pole.  2 modules: port 21 is connected to the positive pole and the 20 port is connected to the negative pole.  4 modules: port 1 is connected to the positive pole and the 2 port is connected to the negative pole.
Pulse output error	There may be a problem with the internal circuit  There may be a problem with the internal circuit	Please contact your technical support to replace the meter.  Please contact your technical support to replace the meter.

#### RS-485 Network Common Problems and Solutions

##### RS-485 Communication Distance

Like RS-422, RS-485 has a maximum transmission distance of approximately 1219 meters and a maximum transmission rate of 10 Mb/s. The length of the balanced twisted pair is inversely proportional to the transmission rate. It is possible to use the longest specified cable length only when the transmission rate is below 100 kbs. The highest rate transmission is only possible at very short distances. Generally, the maximum transmission rate of a 100-meter twisted pair cable is only 1 Mb/s.

##### RS-485 Network Topology

The network topology of RS-485 generally adopts a terminal-matched bus type structure and does not support ring or star networks. It is preferable to use a bus to connect the various nodes in series, and the length of the lead line from the bus to each node should be as short as possible so that the reflected signal in the lead line has the least influence on the bus signal. In summary, a single, continuous signal path should be provided as the bus.

##### RS-485 Terminal Matching Resistor

RS-485 requires two terminal matching resistors whose resistance are equal to the characteristic impedance of the transmission cable. In most cases, the termination is matched between 1000 and 1200. Terminal matching resistors are not required for transmission distances below 300 meters. The terminal resistors are connected to both ends of the transmission bus.

##### Polarity of RS-485 Cable

RS-485 uses two wires for transmission. The two wires are different and are labeled A and B respectively. The A line is the one with a higher voltage in the idle state.

- Don't forget to install protective cover.
- Only qualified personnel can install, maintain and repair this product.
- Only by keeping the seal and the front panel cover intact can the meter work properly and have relevant after-sales service.
- Filling and hitting will damage the fine components inside the meter.

#### Disclaimer

Although we have carefully reviewed the contents of this manual and tried to make our description as accurate as possible, we cannot guarantee that our description is completely accurate, as there are some differences in the description methods or standards. We are not responsible for any errors that may appear below. At the same time, we will continue to check ourselves, and the errors will be corrected in the subsequent versions. We will be very grateful if you can provide suggestions for our description.

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## 1.2 Preamble

Thank you for purchasing our single-phase two-wire din-rail energy meter with following features: Large screen LCD display; RS485 (communication protocol MODBUS-RTU) remote meter reading function, which can accurately measure active energy; Designed according to the national standard GB/T17215.321-2008 "Class 1 and 2 static AC active energy meter" and international IEC62053-21. Using advanced ultra-low power and large-scale integrated circuit technology and SMT manufacturing process. The key components are long-life devices from internationally renowned brands, which improve the reliability and longevity of the products.

A special metering chip is used to accurately measure the active energy with high reliability and high precision. The product uses a linear power supply mode, and the metering chip converts the energy into pulses. The microprocessor completes functions such as power collection, power calculation, energy pulse output, LCD display processing, etc. Redundant design is adopted for data security, and multiple backups of data are ensuring the reliability of measurement.

We offer a wide range of products from 110VAC to 240VAC (50 or 60Hz). In addition to providing conventional power meters, we have also developed our own prepaid smart energy meters and rechargeable smart cards, together with a complete set of PC-based prepaid management systems. Please contact us for more information on more products.

We strictly follow the requirements of GB/T 17215.321-2008 and IEC 62053-2-1, we also have a strict quality control system, but still, defects of a small number of products is inevitable. And if the causes any inconvenience to you, we apologize here in advance. Under normal circumstances, our products can bring you long-term comfort. In case of problems, please contact your seller in time. All products are sealed, and only when the seals and panel covers are kept intact can the products have relevant after-sales service. Therefore, please do not damage the seals and panel covers. This product has a warranty period of 18 months and man-made damage will not be covered by the warranty.

### 1.3 Environmental Indicators:

Working Humidity	≤ 75%
Storage Humidity	≤ 95%
Operating Temperature	-10°C~+50°C
Storage Temperature	-30°C~+70°C
International standard	IEC 62053-21
Domestic Standard	GB/T17215.321-2008
Accuracy Class	1
Dustproof and Waterproof	IP 51
Protective Insulation Encapsulation Type	II

### 1.4 Technical Parameters and Display Type:

Model	(LCD Display)
Reference Voltage (Un)	220V 230V 240V
Operating Voltage	181/279V AC(3~)
Rated Current (Ib)	2.5 5A 10A 15A 20A 30A
Maximum Current (Imax)	10A 20A 40A 60A 80A 100A
Starting Current	≤0.004h (Direct Access)
Withstand Overload Current	30Imax 0.01s
Working Frequency	50Hz±10%
Internal Power Consumption	≤2W / 10VA
Pulse Constant	1000imp(1 modules) 1000imp(2 modules) 1600imp(4 modules)
RS485 Port	4/5(1 modules) 2/3/2(4 modules) 3/4(4 modules)
Data Storage Time	>20 Years

Error	Check	Solution
No indication of communication	Is there power supply in the meter?  Is the communication device connected?  There may be a problem with the internal circuit.	Check the power supply of the meter  The communication symbol will only flash when the external device is connected to the RS485 or far infrared port.  Please contact your technical support to replace the meter.
RS485 no transmission	Is the ID number of the meter correct?  Is the instrument baud rate wrong?  Is it too far?  Is there too much energy meter on the bus?  Is the wiring correct?	Check the ID number of the meter (default setting is the number on the front panel of the meter)  Verify that the meter baud rate matches the baud rate of other devices it communicates with.  Transmission distance cannot exceed 1200m.  No more than 247 tokens per bus  Make sure the RS485 A and B signal lines are connected correctly.
LCD does not go	Is the meter connected to the power supply?  Is the power consumption too low?  There may be a problem with the internal circuit.	Check if the pulse light is flashing.  When the power is too low, the LCD screen will take a long time to change digitally.  Please contact your technical support to replace the meter.

Modify the communication rate:

Deliver Data(HEX): 01 10 00 00 02 04 44 96 00 00 07 73(Change the communication baud rate of to:

1200bps)

Data Description:

Data	Detailed Description
01	Instrument address
10	Function code, write meter internal register data
00 00	Write data starting from the 00 00 register address inside the meter
00 02	Number of registers, 2 (4 bytes)
04	Bytes, 4 bytes
44 96	The meter address of the written meter, 4 bytes of data, floating-point data
00 00	
25 7B	CRC check

Return data: 01 10 00 00 02 04 1C 8

Indicates that the setting is successful.

## 1.10 Troubleshooting

Fault Condition Check



Warning

- During maintenance, do not touch the wiring of the meter with your hands, metal, or bare wires to prevent electric shock.
- Always disconnect the power to the meter and disconnect the power to the meter installation device before performing maintenance.



Danger

- Only qualified personnel who are familiar with the relevant operations and procedures can perform maintenance on this meter.
- Use insulation tools for maintenance.
- Make sure to restore the protective cover after maintenance.
- Do not damage the seal of the meter.

## LCD Display

1 <sup>st</sup> Screen displays ID address	Add	001
2 <sup>nd</sup> Screen displays baud rate	Bd	9600
3 <sup>rd</sup> Screen displays constant	Cose	1600imp
The fourth screen keeps displaying		
4 <sup>th</sup> Screen displays the total amount of electricity	000000.00	Kwh

## 1.5 Intrinsic Error.

Single phase balanced load

0.05lb	Cosp=1	± 1.5%
0.1lb	Cosp=0.5L	± 1.5%
0.1lb~1max	Cosp=0.8C	± 1.5%
	Cosp=1	± 1.0%
0.2lb~1max	Cosp=0.5L	± 1.0%
	Cosp=0.8C	± 1.0%

## 1.6 Outline and Structure

		A: Front panel B: Cover C: Bottom D: Seal
Front panel	Flame-retardant PC	
Cover	Flame-retardant ABS or PC	
Bottom	Flame-retardant ABS or PC	
Dimension	89.9mmx35mmx72mm	
Weight	0.12 Kg (Net Weight)	
Terminal	Notice	
1/3	Input/output	
4/5	RS485 port	
6/7	Pulse output	
8/9	Neutral line	



1 MODULES ( Note:This model have not set button )

Return: 01 03 04 40 00 00 00 EF F3

Data Description:

Data	Detailed Description
01	Instrument address
03	Return function code
04	The returned data length is 4 bytes
40 00 00 00	The returned data is 4-byte float type
EF F3	Returned CRC check

(3)Write of the second type register (parameter register)

Modify meter address:

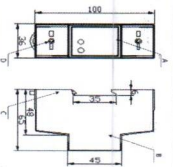
Deliver Data (HEX): 01 10 00 08 00 02 04 40 00 00 00 E7 C8 (Change the meter address to 02)

Data Description:

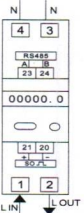
Data	Detailed Description
01	Instrument address
10	Function code, write meter internal register data
00 08	Write data starting from the 00 08 register address inside the meter
00 02	Number of registers, 2 (4 bytes)
04	Bytes, 4 bytes
40 00 00 00	The meter address of two written meter, 4 bytes of data, floating-point data
E7 C9	CRC check

Return: 01 10 00 08 00 02 C0 0A

Indicates that the setting is successful.

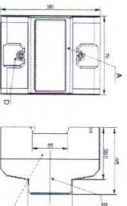


A: Front panel	
B: Cover	
C: Bottom	
D: Seal	
Front panel	Flame-retardant PC
Cover	Flame-retardant ABS or PC
Bottom	Flame-retardant ABS or PC
Dimension	100mmx35mmx36mm
Weight	0.2 Kg (Net Weight)

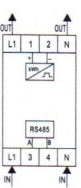


Terminal	Notice
1/2	Input/output
3/4	Neutral line
20/21	Pulse output
23/24	RS485 port

## 2 MODULES



A: Front panel	
B: Cover	
C: Bottom	
D: Seal	
Front panel	Flame-retardant PC
Cover	Flame-retardant ABS or PC
Bottom	Flame-retardant ABS or PC
Dimension	100mmx35mmx36mm
Weight	0.35 Kg (Net Weight)



Terminal	Notice
L1/L1	Input/output
N/N	Input/output
1/2	Pulse output
3/4	RS485 port

## 4 MODULES

6 Example

(1) Read operation of the first type register (data register)

Read Voltage:

Deliver Data (HEX): 01 04 00 00 02 71 CB

Data Description:

Data	Detailed Description
01	Instrument address
04	Function code, read data register
00 00	Read data from the 00 00 register address inside the meter
00 02	Read data length, 2 words (4 bytes)
71 CB	For the CRC check of the previous data, where the low bit is first and the high bit is after

Return: 01 04 04 6B 58 0E 25 D8

Data Description:

Data	Detailed Description
01	Instrument address
04	Return function code
04	The returned data length is 4 bytes
43 6B	The returned data is 4-byte float type
58 0E	
25 D8	Returned CRC check

(2) Read operation of the second type register (parameter register) read meter address:

Deliver Data (HEX): 01 03 00 08 00 02 45 C9

Data Description:

Data	Detailed Description
01	Instrument address
03	Function code, read parameter register
00 08	Read data from the 00 08 register address inside the meter
00 02	Read data length, 2 words (4 bytes)
45 C9	For the CRC check of the previous data, where the low bit is first and the high bit is after

## 1.8 Installation

**Danger**  
 Only qualified personnel who are familiar with the relevant operations and procedures can install this meter.

- Use insulating tools when installing.
- Do not force to power on when the fuse is disconnected or the circuit breaker cannot be closed.
- Do not damage the seal of the meter.

**Warning**  
 Turn off all relevant power supplies before proceeding with the installation.

- Use a measuring instrument to ensure that the power is off.
- The connection line of the meter should be selected according to the overload current device in the circuit, the performance of the circuit breaker and the relevant local standard procedures.

- When selecting an external air-break switch or circuit breaker, it should be based on local relevant standards and the power design of the building, and the external air-break switch or circuit breaker should be installed on the incoming line to use it as a power-off device for the meter. Also note that it is placed close to the meter for easy operation.

- The meter can be installed either indoors or outdoors in a waterproof box. The specific situation is based on local relevant standards.

- Please install a padlock or similar device to prevent electricity theft.

- The meter must be installed on a fireproof wall.

- The meter must be installed in a dry, ventilated place.

- When you need to install the meter in a dusty or dangerous place, be sure to place the meter in a protective box.

- Before the meter is installed, it must be tested and sealed with a qualified mark.

- Install the meter in a place where you can easily read.

- When the meter is installed in a place with a lot of interference, such as a thundery area or beside a welder or a converter, please install an anti-interference device.

- When installation is complete, please seal the meter to prevent electricity theft.

Please follow the wiring diagram below to connect the meter wiring.

## 1.9 User Guide and Function Introduction

### 1.9.1 Power Indication

The two LEDs on the front panel of the single-phase two-wire din-rail energy meters are the pulse (red) and power (green) indicators.

### 1.9.2 Features

The meter has RS485 remote reading function and the following optional functions (blue backlight, to display power failure, total power, current, voltage, power, power factor, frequency, etc.) and can accurately measure active energy. The energy meter has a large screen LCD screen.

### 1.9.3 Pulse Output and RS485 Output

The single-phase two-wire din-rail energy meter also has pulse output independent of the internal circuit. The port 6 of the meter is connected to the positive pole, and the port 7 is connected to the negative pole. The 4 is the positive pole of RS485, and the port 5 is the negative pole of RS485. The circuit requires a voltage of 5-27V DC and a maximum current of 27mA DC. (1 MODULE)

The single-phase two-wire din-rail energy meter also has pulse output independent of the internal circuit. The port 21 of the meter is connected to the positive pole, and the port 20 is connected to the negative pole. The 23 is the positive pole of RS485, and the port 24 is the negative pole of RS485. The circuit requires a voltage of 5-27V DC and a maximum current of 27mA DC. (2 MODULES)

The single-phase two-wire din-rail energy meter also has pulse output independent of the internal circuit. The port 1 of the meter is connected to the positive pole, and the port 2 is connected to the negative pole. The 3 is the positive pole of RS485, and the port 4 is the negative pole of RS485. The circuit requires a voltage of 5-27V DC and a maximum current of 27mA DC. (4 MODULES)

### 1.9.4 RS485 Communication Meter Reading Application (Communication Protocol) and Register Address

The meter can remotely record data such as electric energy in the meter through its RS485 interface and transmit the electric energy data in the meter at close range with the handheld computer through its infrared communication interface. The encoding format, parity (even parity) and data transmission mode (eight data bits, one stop bit) meet the MODBUS-RTU standard requirements. The communication baud rate can be 1200bps, 2400bps, 4800bps or 9600bps (default). If there is no special requirement, the meter is set according to the default baud rate of 9600bps. The meter address and communication baud rate can be modified by the software we provide.

MODBUS-RTU Communication Protocol Description:

1 Data Format:  
Address + Function Code + Data + CRC/Check code

### 2 Register Type

The meter uses two types of registers, independently addressed.

The first type is the data register, read-only, using command code 0x04 to read. The second type is the parameter register, which is readable and writable, read using command code 0x03, and set using command code 0x10.

### 3 Data Format

Float type data: The data read from the meter conforms to the IEEE754 standard floating point number, and the data format is a 32-bit 4-byte single-precision floating-point data format.

### 4 Data Register List

Data Register Address	High Byte	Low Byte	Description	Register Description		
				Unit	Format	Mode
00	00	00	Voltage	V	Floating-point	Read only
00	08	08	Current	A	Floating-point	Read only
00	12	12	Active Power	Kwh	Floating-point	Read only
00	2A	2A	Power Factor	Cosp	Floating-point	Read only
00	36	36	Frequency	Hz	Floating-point	Read only
01	00	00	Total Active Power	Kwh	Floating-point	Read only

### 5 Parameter Register List

Parameter register address	High Byte	Low Byte	Description	Register Description	
				Format	Mode
00	00	00	Baud rate (1200 2400 4800 9600)	Floating-point	Read write
00	02	02	Check digit (0: even 1: odd 2: none)	Floating-point	Read write
00	08	08	Communication address (meter number 1,247)	Floating-point	Read write
00	10	10	Relay control(1 switch on 2 switch out)	Floating-point	Read write