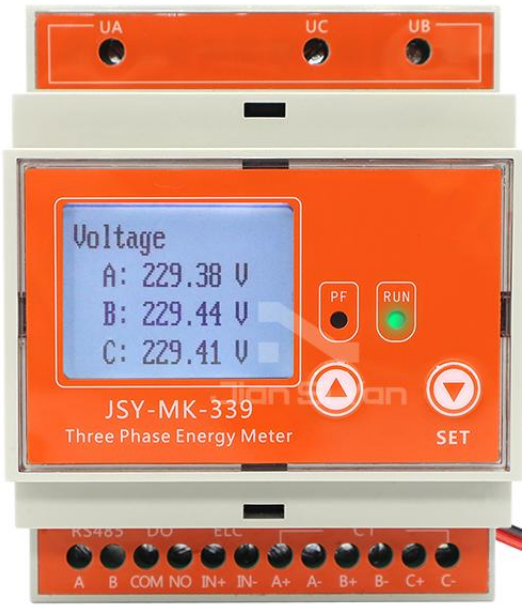
JSY-MK-339
Three-phase Bi-directional Din-rail Energy Meter

Three-phase Three Wire



Three-phase Four Wire

Disclaimer

Our company reserves the right to modify the product specifications described in this manual without prior notice. Before placing an order, please contact our sales representative or local agent to learn the current specifications of this product.

Manual Revision Record

Date	Old version	New version	Author	Modifications
2024 .02.21		V 1.0	HCC	1. New construction

Table of contents

1 Introduction

The JSY-MK-339 three-phase din-rail energy meter, independently developed and manufactured by our company, utilizes microelectronics technology and dedicated large-scale integrated circuits to convert analog signals into digital outputs. With complete intellectual property rights, the module fully complies with the technical requirements for Class 1S three-phase active energy meters in the IEC 62053-21 national standard. It can directly and accurately measure electrical parameters such as voltage, current, power, power factor, phase angle, energy, and harmonics in three-phase AC power grids with a rated frequency of 50Hz or 60Hz . It also features a built-in RS485 communication interface, allowing users to freely select the desired communication interface. The module utilizes the standard MODBUS-RTU protocol, facilitating communication with various monitoring systems. It offers high reliability, compact size, light weight, and easy installation.

JSY-MK- 339 three-phase energy meter 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.

2 Features

Table 1 Function Description List

Function	Functional Description
Energy metering	Active energy measurement (total, forward, and reverse of A/B/C/combined phases)
	Reactive energy measurement (total, forward, and reverse of A/B/C/combined phases)
	Apparent energy measurement (A/B/C/combined phase)
Electrical parameter measurement	U (line voltage, phase voltage) , I
	P, Q, S, PF, F
	to 21st harmonics of A /B/C three-phase voltage and current
	Voltage and current phase difference
Pulse output	Active and reactive pulse output
Communication	1 RS 485 interface Supports Modbus and DL/T645 protocols
Indicator light	RUN: Running indicator light Pulse output flashes
Switching output	Three modes of programmable control output
Expanded functionality	Support customization

3 Technical Parameters

Table 2 Technical Parameters

project			Performance parameters	
Specification			Three-phase three-wire	Three-phase Four-wire
Measurement	Voltage	Reference voltage	3 × 100V , 3 × 380V	3 × 57.7/100V , 3 × 220/380V
		Voltage range	3 × 100V~3 × 450V	3 × 57.7/100V~3 × 260/450V
		impedance	>1 kΩ / V	
		Accuracy grade	Error ± 1.0 %	
	Current	Current specifications	80A, 150A, 250A, 500A are optional (GB/T17215.321-2008)	
		Accuracy grade	Error ± 1.0 %	
	Power		Active, reactive, apparent power, error ± 1.0 %	
	Grid frequency		45~65 Hz , error ± 1.0 %	
	Phase difference		Voltage, current, voltage-current phase difference: error ± 1.0 %	
Measurement	Active energy accuracy		1s level (GB/T 17215.321-2008)	
Pulse	Power pulse output		1 active pulse output (CF1) , 1 reactive pulse output (CF2)	
	Pulse width		80 ± 20 m s	
	Pulse constant		5A (10000 imp /kWh) , 150A (excluding 150A) and above specifications (200imp /kWh), other specifications 800imp / kWh	
Communication	interface		1 RS 485	
	Communication Protocol		Modbus RTU protocol, DL/T 645 protocol	
	Communication address range		Modbus RTU: 1~255	
	Baud rate		Supports 600 ~ 38400 bps	
	Data format		Software setting: “n,8,1” , “e,8,1” , “o,8,1” , “n,8,2”	
Show	12864 LCD screen		The two buttons can turn pages up and down, and long press the right button to enter the settings page	
Powered by	AC power supply		Rated voltage 220V	
Environment	Operating temperature		-20～+60℃	
	Storage temperature		-40～+85℃	
	relative humidity		≤95%, no condensation (at 40°C)	
	Altitude		0～3000 meters	
	Usage Environment		A place without explosive, corrosive gas, conductive dust, significant shaking, vibration and impact	
Parameter	Temperature drift		≤100ppm/℃	
	Installation		DIN-rail installation	
	Module size		72*58*92mm	

4 Product Information

Image 1 Product appearance

Table 3 Terminal Description

Terminal	Function Description
A	Measured A-phase voltage input terminal
B	Measured B-phase voltage input terminal
C	Measured C-phase voltage input terminal
N	Measured neutral line input terminal
IC-	Negative input terminal of the C -phase current transformer under test
IC+	Positive input terminal of the C -phase current transformer under test
IB-	Input terminal of the measured B -phase current transformer
IB+	Positive input terminal of the measured B -phase current transformer
IA-	Negative input terminal of the measured A- phase current transformer
IA+	Positive input terminal of the measured A- phase current transformer
IN-	Input terminal of the leakage current transformer under test
IN+	Input terminal of the leakage current transformer under test
COM	Switch output point
NO	Switch output point
B	RS485 B port
A	RS485 A terminal

(Note: Pins not specified are empty)

5 Wiring and installation

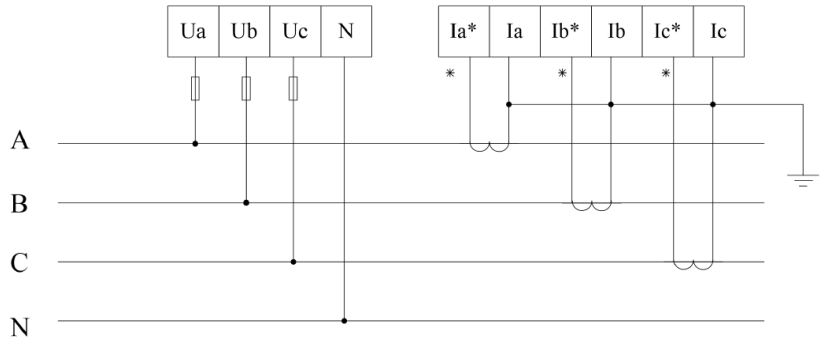


Image 2 Three-phase four-wire voltage and current connection method

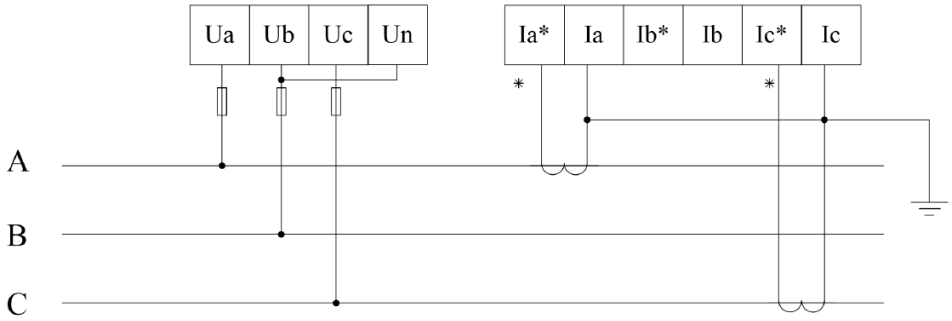


Image 3 Three-phase three-wire voltage and current connection method

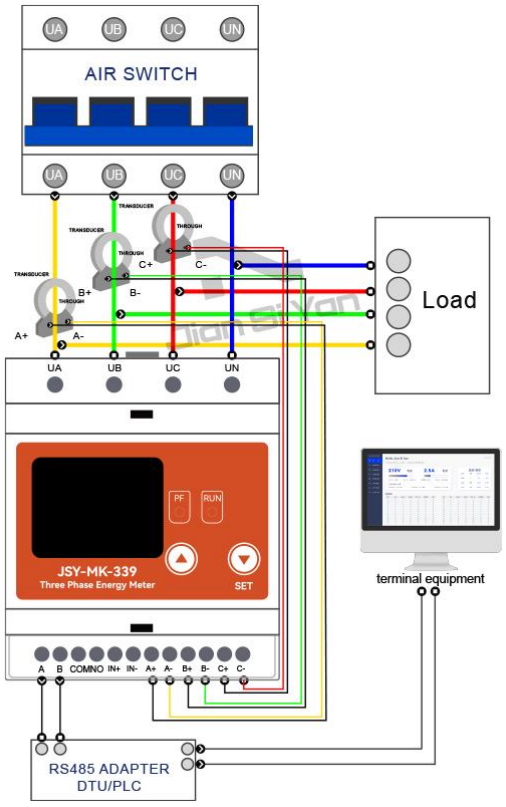


Image 4 Three-phase four-wire wiring example

Note: Ia, Ib , and Ic may not be grounded.

6 Application Notes

Please refer to the diagrams above and connect the cables correctly according to the product specifications. Before wiring, be sure to disconnect all signal sources to avoid danger and damage to the equipment. After checking that the wiring is correct, connect the power supply for testing.

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

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, and ratio 1;

The JSY-MK-339 product testing software we provide can be used to change the product parameters and general product testing.

6.1 Connection of RS-485 network :

It is recommended to use an isolated 485 converter to communicate with the device to improve the reliability of the system;

All devices on a bus must have their A+ and B- terminals connected in parallel, not reversed. Up to 32 network modules can be connected simultaneously on a single line, and each module can have its communication address set. Shielded twisted-pair cables with a minimum diameter of 0.5 mm^2 should be used for communication connections · Keep communication cables away from strong power cables or other areas with strong electric fields .

RS - 485 communication lines should use shielded twisted pair cables; the communication distance of 485 can reach 1200 meters. When there are many RS485 devices connected to a bus , or when a high baud rate is used, the communication distance will be shortened accordingly. At this time, a 485 repeater can be used for extension.

RS - 485 networking has various topologies, but a linear connection is generally used. This involves connecting multiple devices one by one, starting from the host computer and working your way toward the farthest end. A 120-300 Ω/0.25 watt termination resistor can be connected at the farthest end (depending on the communication quality; it may not be necessary if communication is excellent).

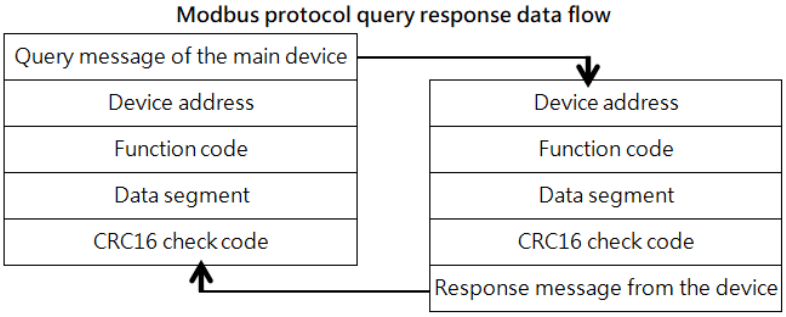
6.2 Electric energy metering function:

Can provide three-phase voltage, current, power, power factor, active and reactive energy and other parameters;

The electricity data is a 4-byte unsigned number. If it exceeds 42949672.95 kWh, it will overflow and be cleared. The data will be saved when the power is off.

6.3 MODBUS communication applications

The MODBUS protocol uses a master-slave communication connection method over a single communication line. First, the host computer's signal is addressed to a uniquely addressed terminal device (slave). The terminal device then transmits its response signal in the opposite direction to the host. This means that all communication data flows in opposite directions over a single communication line (half-duplex operation). The MODBUS protocol only allows communication between a host (PC, PLC, etc.) and a terminal device, not between independent terminal devices. Consequently, each terminal device does not occupy the communication line during initialization and is limited to responding to query signals received by the slave.



Host Query: The query message frame includes the device address, function code, data information code, and checksum. The address code indicates the selected slave device; the function code tells the selected slave device what function to perform. For example, function codes 03 or 04 request the slave device to read registers and return their contents. The data segment contains any additional information for 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 method to verify the correctness of the message content, which uses the CRC16 calibration rule.

Slave Response: If a slave device generates a normal response, the response message includes the slave address code, function code, data information code, and CRC16 checksum. The data information code includes the data collected by the slave device, such as register values or status. If an error occurs, the slave device will not respond.

We specify the communication data format used in this module: bits of each 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 modules and their functions.

Function Code	Function
03H	Read the value of one or more registers
10H	Write the value of one or more registers

Data segment: Contains data required by the terminal to perform specific functions or data collected when the terminal responds to queries. The content of this data may be numerical values, reference addresses, or settings.

Checksum: CRC16 occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and then appended to the data frame. The receiving device recalculates the CRC value upon receiving data and 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), which is 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 are processed.

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

Code example:

```
uint16_t GetModBusCRC16(uint8_t *aucData, u16 iBytesCount)
{
    uint8_t wHi = 0;
    uint8_t wLo = 0;
    uint16_t wCRC = 0xFFFF;
    u16 i, j;
    uint8_t wCheck = 0;
    for (i = 0; i < iBytesCount; i++)
    {
        Wdt_Feed();
        wCRC ^= aucData[i];
        for (j = 0; j < 8; j++)
        {
            wCheck = wCRC & 1;
            wCRC = wCRC >> 1;
            wCRC = wCRC & 0x7fff;
            if (wCheck == 1)
                wCRC = wCRC ^ 0xa001;
            wCRC = wCRC & 0xffff;
        }
    }
    wHi = wCRC / 256;
    wLo = wCRC % 256;
    wCRC = (wHi << 8) | wLo;
    return wCRC;
}
```

6.4 MODBUS-RTU communication protocol example:

6.4.1 Function code 0x03: Read multiple registers

Example: The host wants to read the data of three slave registers with address 01 and starting address 0100H.

Host sends: 01 03 01 00 00 03 04 37

Address function code starting address data length CRC code

Slave response: 01 03 06 56 11 56 22 56 33 1F 77

Address Function Code Return Bytes Register Data 1 Register 2 Register 3 CRC Code

6.4.2 Function code 0x10: Write multiple registers

Example: The host wants to save 0104H, 01F4H to the slave register with address 0020H, 0021H (the slave address code is 0x01)

Host sends: 01 10 00 20 00 02 04 01 04 01 F4 B1 9D

Address Function Code Starting Address Write Register Quantity Byte Count Save Data 1 2 CRC Code

Slave response: 01 10 00 20 00 02 40 02

Address function code starting address write register quantity CRC code

6.4.3 illustrate

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 following error code is returned in response:

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.

6.4.4 Communication message example

Read data register (function code 03H): Read the three register values of the three-phase voltage. The results are: Phase A voltage 220.33V, Phase B voltage 220.5V, Phase C voltage 220.67V, and the module address is 1.

The host reads the data frame:

address	Order	Starting address (high first)	Register number (MSB first)	Check code (low bit first)
01H	03H	01H,00H	00H,03H	04H,37H

The module responds with a data frame:

address	Order	Data length	Data segment (6 bytes)	Check code

01H	03H	06H	56H,11H,56H,22H,56H,33H	1FH,77H

Write data register (function code 10H): Set the voltage upper limit to 260V, the current upper limit to 50A, and the module address to 1.

The host writes data frame:

address	Order	Starting address	Number of registers	Number of bytes	Data segment	Check code
01H	10H	00H,20H	00H,02H	04H	01H,04H,01H,F4H	B1H,9DH

The module responds with a data frame:

address	Order	Starting address	Number of registers	Check code
01H	10H	00H,20H	00H,02H	40H,02H

Clear all electric energy data (function code 10H, write 2 registers starting from 000CH, the written data is 4 bytes of 00H):

address	Order	Starting address	Number of registers	Number of bytes	Data segment	Check code
01H	10H	00H,0CH	00H,02H	04H	00H,00H,00H,F0H	F3H,FAH

The module responds with a data frame:

address	Order	Starting address	Number of registers	Check code
01H	10H	00H,0CH	00H,02H	81H,CBH

6.5 Modbus register list

Table 1 - Measurement electrical parameter registers and communication data table (function code 03H, read only)

Note: In the secondary ratio version, the energy data in the table below are the data after the ratio is changed.

Serial number	definition	Register address	Read/Write	Data types and calculation instructions
1	Phase A voltage	0100H	read	Unsigned number, value = DATA/100, unit V
2	Phase B voltage	0101H	read	Unsigned number, value = DATA/100, unit V
3	Phase C voltage	0102H	read	Unsigned number, value = DATA/100, unit V
4	Phase A current	0103H	read	Unsigned number, value = DATA/100, unit A 5A version: unsigned number, value = DATA/1 0 00, unit A
5	Phase B current	0104H	read	Unsigned number, value = DATA/100, unit A 5A version: unsigned number, value = DATA/1 0 00, unit A
6	Phase C current	0105H	read	Unsigned number, value = DATA/100, unit A 5A version: unsigned number, value = DATA/1 0 00, unit A
7	Phase A active power	0106H	read	Unsigned number, value = DATA, unit is W 150A and above version: unsigned number, value = DATA, unit 10W
8	Phase B active power	0107H	read	Unsigned number, value = DATA, unit is W 150A and above version: unsigned number, value = DATA, unit 10W
9	Phase C active power	0108H	read	Unsigned number, value = DATA, unit is W 150A and above version: unsigned number, value = DATA, unit 10W
10	Three-phase total active power	0109H 010AH	read	Unsigned number, value = DATA, unit is W (Register 0109H corresponds to the upper 16 bits)
11	Phase A reactive power	010BH	read	Unsigned number, value = DATA, unit is Var 150A and above version: Unsigned number, value = DATA, unit 10V ar
12	B phase reactive power	010CH	read	Unsigned number, value = DATA, unit is Var 150A and above version: Unsigned number, value = DATA, unit 10V ar
13	Phase C reactive power	010DH	read	Unsigned number, value = DATA, unit is Var 150A and above version: Unsigned number, value = DATA,

				unit 10V ar
14	Three-phase total reactive power	010EH 010FH	read	Unsigned number, value = DATA, unit is Var
15	Phase A apparent power	0110H	read	Unsigned number, value = DATA, unit is VA above 150A : Unsigned number, value = DATA, unit 10VA
16	B phase apparent power	0111H	read	Unsigned number, value = DATA, unit is VA above 150A : Unsigned number, value = DATA, unit 10VA
17	Phase C apparent power	0112H	read	Unsigned number, value = DATA, unit is VA above 150A : Unsigned number, value = DATA, unit 10VA
18	Three-phase total apparent power	0113H 0114H	read	Unsigned number, value = DATA, unit is VA (Register 0114H corresponds to the upper 16 bits)
19	Voltage frequency	0115H	read	Unsigned number, value = DATA/100, unit is Hz
20	Phase A power factor	0116H	read	Unsigned number, value = DATA/1000
21	Phase B power factor	0117H	read	Unsigned number, value = DATA/1000
22	Phase C power factor	0118H	read	Unsigned number, value = DATA/1000
23	Three-phase total power factor	0119H	read	Unsigned number, value = DATA/1000
24	Phase A active energy (forward + reverse)	011AH 011BH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit kWh
25	Phase B active energy (forward + reverse)	011CH 011DH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit kWh
26	Phase C active energy (forward + reverse)	011EH 011FH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit kWh
28	Three-phase total active energy (absolute value accumulation)	0120H 0121H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit kWh
29	Phase A reactive energy (forward + reverse)	0122H 0123H	read	Unsigned number, value = DATA/100, unit is kV arh 5A version: unsigned number, value = DATA/1 0 00, unit kV arh
30	B phase reactive energy (forward + reverse)	0124H 0125H	read	Unsigned number, value = DATA/100, unit is kV arh 5A version: unsigned number, value = DATA/1 0 00, unit kV arh
31	C phase reactive energy (forward + reverse)	0126H 0127H	read	Unsigned number, value = DATA/100, unit is kV arh 5A version: unsigned number, value = DATA/1 0 00, unit kV arh

32	Three-phase total reactive energy (absolute value accumulation)	0128H 0129H	read	Unsigned number, value = DATA/100, unit is kV arh 5A version: unsigned number, value = DATA/1 0 00, unit kV arh
33	Phase A apparent energy	012AH 012BH	read	Unsigned number, value = DATA/100, unit is kVAh 5A version: unsigned number, value = DATA/1 0 00, unit kVAh
34	B phase apparent energy	012CH 012DH	read	Unsigned number, value = DATA/100, unit is kVAh 5A version: unsigned number, value = DATA/1 0 00, unit kVAh
35	Phase C apparent energy	012EH 012FH	read	Unsigned number, value = DATA/100, unit is kVAh 5A version: unsigned number, value = DATA/1 0 00, unit kVAh
36	Three-phase apparent total energy (PQS calculation method)	0130H 0131H	read	Unsigned number, value = DATA/100, unit is kVAh 5A version: unsigned number, value = DATA/1 0 00, unit kVAh
37	Current power direction	0132H	read	The high byte is not used, and the low byte bit7~bit0 are the corresponding bits of total reactive power, C phase reactive power, B phase reactive power, A phase reactive power, total active power, C phase active power, B phase active power, and A phase active power status (0 is forward, 1 is reverse), see status word 1
38	Current alarm status	0133H	read	When the high byte bit 0 is 1, it indicates reverse phase sequence, and 0 is normal; Low byte bit7 = 1 means leakage current exceeds the limit, bit6~bit4 means C~A phase current exceeds the limit, bit2~bit0 means C~A phase voltage exceeds the limit, see status word 2
39	Phase A positive active energy	0134H 0135H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
40	B phase forward active energy	0136H 0137H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
41	C phase forward active energy	0138H 0139H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
42	Three-phase forward total active energy	013AH 013BH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
43	Phase A active energy in reverse direction	013CH 013DH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
44	Phase B active energy in reverse direction	013EH 013FH	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h

45	Phase C active energy in reverse direction	0140H 0141H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
46	Three-phase reverse total active energy	0142H 0143H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
47	A phase positive reactive energy	0144H 0145H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
48	B phase forward reactive energy	0146H 0147H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
49	C phase forward reactive energy	0148H 0149H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
50	Three-phase forward total reactive energy	014AH 014BH	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
51	Phase A reactive power	014CH 014DH	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
52	Phase B reactive energy	014EH 014FH	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
53	Phase C reactive energy	0150H 0151H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
54	Three-phase total reactive energy	0152H 0153H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
5 5	Uab line voltage	015 4 H	read	Unsigned number, value = DATA/100, unit V
5 6	U bc line voltage	015 5 H	read	Unsigned number, value = DATA/100, unit V
5 7	U c a line voltage	015 6 H	read	Unsigned number, value = DATA/100, unit V
5 8	Y_Uab voltage phase angle difference	0 157H	read	Unsigned number, value = DATA/100, unit: °
5 9	Y_U bc voltage phase angle difference	0 158H	read	Unsigned number, value = DATA/100, unit: °
6 0	Y_Uca voltage phase angle	0 159H	read	Unsigned number, value = DATA/100, unit: °

	difference			
6 1	Y_Iab current phase angle difference	0 15AH	read	Unsigned number, value = DATA/100, unit: °
6 2	Y_Ibc current phase angle difference	0 15BH	read	Unsigned number, value = DATA/100, unit: °
6 3	Y_Ica current phase angle difference	0 15CH	read	Unsigned number, value = DATA/100, unit: °
6 4	Y_UaIabvoltage and current phase angle difference	0 15DH	read	Unsigned number, value = DATA/100, unit: °
6 5	Y _ Ub Ib voltage and current phase angle difference	0 15EH	read	Unsigned number, value = DATA/100, unit: °
6 6	Y_UcIc voltage and current phase angle difference	0 15FH	read	Unsigned number, value = DATA/100, unit: °
6 7	Phase A voltage total harmonics	0 160H	read	Unsigned number, value = DATA/100, unit %
6 8	B voltage total harmonics	0 161H	read	Unsigned number, value = DATA/100, unit %
6 9	C voltage total harmonics	0 162H	read	Unsigned number, value = DATA/100, unit %
7 0	Total harmonics of phase A current	0 163H	read	Unsigned number, value = DATA/100, unit %
7 1	Total harmonics of phase B current	0 164H	read	Unsigned number, value = DATA/100, unit %
7 2	Total harmonics of phase C current	0 165H	read	Unsigned number, value = DATA/100, unit %
73	Three-phase total active energy (algebraic sum accumulation)	01 66 H 01 67 H	read	Unsigned number, value = DATA/100, unit is kWh 5A version: unsigned number, value = DATA/1 0 00, unit k W h
75	Three-phase total reactive energy (algebraic sum accumulation)	01 68 H 01 69 H	read	Unsigned number, value = DATA/100, unit is kV a r h 5A version: unsigned number, value = DATA/1 0 00, unit kV a r h
77	Leakage current	01 6A H	read	Unsigned number, value = DATA/100 0 , unit A

1	Phase A voltage total harmonics	0200H	read	Unsigned number, value = DATA/100, unit % (same as 0160H)

2	Phase A voltage second harmonic	0201H	read	Unsigned number, value = DATA/100, unit %
3	Phase A voltage third harmonic	0202H	read	Unsigned number, value = DATA/100, unit %
4	The fourth harmonic of phase A voltage	0203H	read	Unsigned number, value = DATA/100, unit %
5	5th harmonic of phase A voltage	0204H	read	Unsigned number, value = DATA/100, unit %
6	The sixth harmonic of phase A voltage	0205H	read	Unsigned number, value = DATA/100, unit %
7	7th harmonic of phase A voltage	0206H	read	Unsigned number, value = DATA/100, unit %
8	8th harmonic of phase A voltage	0207H	read	Unsigned number, value = DATA/100, unit %
9	9th harmonic of phase A voltage	0208H	read	Unsigned number, value = DATA/100, unit %
10	10th harmonic of phase A voltage	0209H	read	Unsigned number, value = DATA/100, unit %
11	11th harmonic of phase A voltage	020AH	read	Unsigned number, value = DATA/100, unit %
12	12th harmonic of phase A voltage	020BH	read	Unsigned number, value = DATA/100, unit %
13	13th harmonic of phase A voltage	020CH	read	Unsigned number, value = DATA/100, unit %
14	14th harmonic of phase A voltage	020DH	read	Unsigned number, value = DATA/100, unit %
15	15th harmonic of phase A voltage	020EH	read	Unsigned number, value = DATA/100, unit %
16	16th harmonic of phase A voltage	020FH	read	Unsigned number, value = DATA/100, unit %
17	17th harmonic of phase A voltage	0210H	read	Unsigned number, value = DATA/100, unit %
18	18th harmonic of phase A voltage	0211H	read	Unsigned number, value = DATA/100, unit %
19	19th harmonic of phase A	0212H	read	Unsigned number, value = DATA/100, unit %

	voltage			
20	20th harmonic of phase A voltage	0213H	read	Unsigned number, value = DATA/100, unit %
21	21st harmonic of phase A voltage	0214H	read	Unsigned number, value = DATA/100, unit %
22	Phase B voltage total harmonics	0215H	read	Unsigned number, value = DATA/100, unit % (same as 0161H)
23	Second harmonic of phase B voltage	0216H	read	Unsigned number, value = DATA/100, unit %
24	B phase voltage third harmonic	0217H	read	Unsigned number, value = DATA/100, unit %
25	4th harmonic of phase B voltage	0218H	read	Unsigned number, value = DATA/100, unit %
26	5th harmonic of phase B voltage	0219H	read	Unsigned number, value = DATA/100, unit %
27	The sixth harmonic of phase B voltage	021AH	read	Unsigned number, value = DATA/100, unit %
28	7th harmonic of phase B voltage	021BH	read	Unsigned number, value = DATA/100, unit %
29	8th harmonic of phase B voltage	021CH	read	Unsigned number, value = DATA/100, unit %
30	9th harmonic of phase B voltage	021DH	read	Unsigned number, value = DATA/100, unit %
31	10th harmonic of phase B voltage	021EH	read	Unsigned number, value = DATA/100, unit %
32	11th harmonic of phase B voltage	021FH	read	Unsigned number, value = DATA/100, unit %
33	12th harmonic of phase B voltage	0220H	read	Unsigned number, value = DATA/100, unit %
34	13th harmonic of phase B voltage	0221H	read	Unsigned number, value = DATA/100, unit %
35	14th harmonic of phase B voltage	0222H	read	Unsigned number, value = DATA/100, unit %
36	15th harmonic of phase B voltage	0223H	read	Unsigned number, value = DATA/100, unit %

37	16th harmonic of phase B voltage	0224H	read	Unsigned number, value = DATA/100, unit %
38	17th harmonic of phase B voltage	0225H	read	Unsigned number, value = DATA/100, unit %
39	18th harmonic of phase B voltage	0226H	read	Unsigned number, value = DATA/100, unit %
40	19th harmonic of phase B voltage	0227H	read	Unsigned number, value = DATA/100, unit %
41	20th harmonic of phase B voltage	0228H	read	Unsigned number, value = DATA/100, unit %
42	21st harmonic of phase B voltage	0229H	read	Unsigned number, value = DATA/100, unit %
43	Phase C voltage total harmonics	022AH	read	Unsigned number, value = DATA/100, unit % (same as 0162H)
44	C phase voltage second harmonic	022BH	read	Unsigned number, value = DATA/100, unit %
45	C phase voltage third harmonic	022CH	read	Unsigned number, value = DATA/100, unit %
46	4th harmonic of phase C voltage	022DH	read	Unsigned number, value = DATA/100, unit %
47	5th harmonic of phase C voltage	022EH	read	Unsigned number, value = DATA/100, unit %
48	C phase voltage sixth harmonic	022FH	read	Unsigned number, value = DATA/100, unit %
49	7th harmonic of phase C voltage	0230H	read	Unsigned number, value = DATA/100, unit %
50	8th harmonic of phase C voltage	0231H	read	Unsigned number, value = DATA/100, unit %
51	9th harmonic of phase C voltage	0232H	read	Unsigned number, value = DATA/100, unit %
52	10th harmonic of phase C voltage	0233H	read	Unsigned number, value = DATA/100, unit %
53	11th harmonic of phase C voltage	0234H	read	Unsigned number, value = DATA/100, unit %
54	12th harmonic of phase C	0235H	read	Unsigned number, value = DATA/100, unit %

	voltage			
55	13th harmonic of phase C voltage	0236H	read	Unsigned number, value = DATA/100, unit %
56	14th harmonic of phase C voltage	0237H	read	Unsigned number, value = DATA/100, unit %
57	15th harmonic of phase C voltage	0238H	read	Unsigned number, value = DATA/100, unit %
58	16th harmonic of phase C voltage	0239H	read	Unsigned number, value = DATA/100, unit %
59	17th harmonic of phase C voltage	023AH	read	Unsigned number, value = DATA/100, unit %
60	18th harmonic of phase C voltage	023BH	read	Unsigned number, value = DATA/100, unit %
61	19th harmonic of phase C voltage	023CH	read	Unsigned number, value = DATA/100, unit %
62	20th harmonic of phase C voltage	023DH	read	Unsigned number, value = DATA/100, unit %
63	21st harmonic of phase C voltage	023EH	read	Unsigned number, value = DATA/100, unit %
64	Total harmonics of phase A current	023FH	read	Unsigned number, value = DATA/100, unit % (same as 0163H)
65	Second harmonic of phase A current	0240H	read	Unsigned number, value = DATA/100, unit %
66	A phase current third harmonic	0241H	read	Unsigned number, value = DATA/100, unit %
67	4th harmonic of phase A current	0242H	read	Unsigned number, value = DATA/100, unit %
68	5th harmonic of phase A current	0243H	read	Unsigned number, value = DATA/100, unit %
69	The sixth harmonic of phase A current	0244H	read	Unsigned number, value = DATA/100, unit %
70	7th harmonic of phase A current	0245H	read	Unsigned number, value = DATA/100, unit %
71	8th harmonic of phase A current	0246H	read	Unsigned number, value = DATA/100, unit %

72	9th harmonic of phase A current	0247H	read	Unsigned number, value = DATA/100, unit %
73	10th harmonic of phase A current	0248H	read	Unsigned number, value = DATA/100, unit %
74	11th harmonic of phase A current	0249H	read	Unsigned number, value = DATA/100, unit %
75	12th harmonic of phase A current	024AH	read	Unsigned number, value = DATA/100, unit %
76	13th harmonic of phase A current	024BH	read	Unsigned number, value = DATA/100, unit %
77	14th harmonic of phase A current	024CH	read	Unsigned number, value = DATA/100, unit %
78	15th harmonic of phase A current	024DH	read	Unsigned number, value = DATA/100, unit %
79	16th harmonic of phase A current	024EH	read	Unsigned number, value = DATA/100, unit %
80	17th harmonic of phase A current	024FH	read	Unsigned number, value = DATA/100, unit %
81	18th harmonic of phase A current	0250H	read	Unsigned number, value = DATA/100, unit %
82	19th harmonic of phase A current	0251H	read	Unsigned number, value = DATA/100, unit %
83	20th harmonic of phase A current	0252H	read	Unsigned number, value = DATA/100, unit %
84	21st harmonic of phase A current	0253H	read	Unsigned number, value = DATA/100, unit %
85	Total harmonics of phase B current	0254H	read	Unsigned number, value = DATA/100, unit % (same as 0164H)
86	Second harmonic of phase B current	0255H	read	Unsigned number, value = DATA/100, unit %
87	The third harmonic of phase B current	0256H	read	Unsigned number, value = DATA/100, unit %
88	4th harmonic of phase B current	0257H	read	Unsigned number, value = DATA/100, unit %
89	5th harmonic of phase B	0258H	read	Unsigned number, value = DATA/100, unit %

	current			
90	6th harmonic of phase B current	0259H	read	Unsigned number, value = DATA/100, unit %
91	7th harmonic of phase B current	025AH	read	Unsigned number, value = DATA/100, unit %
92	8th harmonic of phase B current	025BH	read	Unsigned number, value = DATA/100, unit %
93	9th harmonic of phase B current	025CH	read	Unsigned number, value = DATA/100, unit %
94	10th harmonic of phase B current	025DH	read	Unsigned number, value = DATA/100, unit %
95	11th harmonic of phase B current	025EH	read	Unsigned number, value = DATA/100, unit %
96	12th harmonic of phase B current	025FH	read	Unsigned number, value = DATA/100, unit %
97	13th harmonic of phase B current	0260H	read	Unsigned number, value = DATA/100, unit %
98	14th harmonic of phase B current	0261H	read	Unsigned number, value = DATA/100, unit %
99	15th harmonic of phase B current	0262H	read	Unsigned number, value = DATA/100, unit %
100	16th harmonic of phase B current	0263H	read	Unsigned number, value = DATA/100, unit %
101	17th harmonic of phase B current	0264H	read	Unsigned number, value = DATA/100, unit %
102	18th harmonic of phase B current	0265H	read	Unsigned number, value = DATA/100, unit %
103	19th harmonic of phase B current	0266H	read	Unsigned number, value = DATA/100, unit %
104	20th harmonic of phase B current	0267H	read	Unsigned number, value = DATA/100, unit %
105	21st harmonic of phase B current	0268H	read	Unsigned number, value = DATA/100, unit %
106	Total harmonics of phase C current	0269H	read	Unsigned number, value = DATA/100, unit % (same as 0165H)

107	Second harmonic of phase C current	026AH	read	Unsigned number, value = DATA/100, unit %
108	C phase current third harmonic	026BH	read	Unsigned number, value = DATA/100, unit %
109	4th harmonic of phase C current	026CH	read	Unsigned number, value = DATA/100, unit %
110	5th harmonic of phase C current	026DH	read	Unsigned number, value = DATA/100, unit %
111	6th harmonic of phase C current	026EH	read	Unsigned number, value = DATA/100, unit %
112	7th harmonic of phase C current	026FH	read	Unsigned number, value = DATA/100, unit %
113	8th harmonic of phase C current	0270H	read	Unsigned number, value = DATA/100, unit %
114	9th harmonic of phase C current	0271H	read	Unsigned number, value = DATA/100, unit %
115	10th harmonic of phase C current	0272H	read	Unsigned number, value = DATA/100, unit %
116	11th harmonic of phase C current	0273H	read	Unsigned number, value = DATA/100, unit %
117	12th harmonic of phase C current	0274H	read	Unsigned number, value = DATA/100, unit %
118	13th harmonic of phase C current	0275H	read	Unsigned number, value = DATA/100, unit %
119	14th harmonic of phase C current	0276H	read	Unsigned number, value = DATA/100, unit %
120	15th harmonic of phase C current	0277H	read	Unsigned number, value = DATA/100, unit %
121	16th harmonic of phase C current	0278H	read	Unsigned number, value = DATA/100, unit %
122	17th harmonic of phase C current	0279H	read	Unsigned number, value = DATA/100, unit %
123	18th harmonic of phase C current	027AH	read	Unsigned number, value = DATA/100, unit %
124	19th harmonic of phase C	027BH	read	Unsigned number, value = DATA/100, unit %

	current			
125	20th harmonic of phase C current	027CH	read	Unsigned number, value = DATA/100, unit %
126	21st harmonic of phase C current	027DH	read	Unsigned number, value = DATA/100, unit %

0x0300 to 0x0322 are the values obtained by multiplying the module measurement value by the voltage-current ratio.

1	Phase A voltage	0300H	read	Floating point number, unit V
2	Phase B voltage	0302H	read	Floating point number, unit V
3	Phase C voltage	0304H	read	Floating point number, unit V
4	Phase A current	0306H	read	Floating point number, unit A
5	Phase B current	0308H	read	Floating point number, unit A
6	Phase C current	030AH	read	Floating point number, unit A
7	Phase A active power	030CH	read	Floating point number, unit is kW
8	Phase B active power	030EH	read	Floating point number, unit is kW
9	Phase C active power	0310H	read	Floating point number, unit is kW
10	Three-phase total active power	0312H	read	Floating point number, unit is kW
11	Phase A reactive power	0314H	read	Floating point number, unit is kV ar
12	B phase reactive power	0316H	read	Floating point number, unit is kV ar
13	Phase C reactive power	0318H	read	Floating point number, unit is kV ar
14	Three-phase total reactive power	031AH	read	Floating point number, unit is kV ar
15	Phase A apparent power	031CH	read	Floating point number, unit is kVA
16	B phase apparent power	031EH	read	Floating point number, unit is kVA
17	Phase C apparent power	0320H	read	Floating point number, unit is kVA
18	Three-phase total apparent power	0322H	read	Floating point number, unit is kVA
19	Leakage current	032 4 H	read	Floating point number, unit is A

Table 2 - System parameter register address and communication data table (function code 03H read, 10H write)

Serial number	definition	Register address	Read/Write	Specific instructions
1	Model 1	0000H	read	The value is 33 9 H
2	Hardware version	000 1H	read	0x1001-> V 1.00.1
3	Software version	0002 H	read	0x1001-> V 1.00.1
4	Protocol version	0003 H	read	0x1001-> V 1.00.1
5	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 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"; lower four bits of the low byte are the baud rate , 2-600bps , 3 —1 2 00bps , 4-24 00bps , 5-4800bps, 6-9600bps, 7-19200bps, 8-38400bps (The communication baud rates of the 485 port and the TTL port are both related to this register, and the baud rates of the two are consistent)

Table 3 - Set parameter registers and communication data table (function code 03H for reading, 10H for writing)

Serial number	definition	Register address	Read/Write	Specific instructions
1	Voltage upper limit	0020H	Read/Write	Default value 0x104 = 260V
2	Current limit	0021H	Read/Write	Default value 0x1F4, 0x1F4/10=50A
3	Voltage transformer ratio	002 2 H	Read/Write	Default value 0x 0001 ; Transformation ratio 1 (Do not modify for non-secondary mutual inductance versions)
4	Current transformer ratio	002 3 H	Read/Write	Default value 0x 0001 ; Transformation ratio 1 (Do not modify for non-secondary mutual inductance versions)
5	Current noise	0 024H	Read/Write	Unit: mA

6	Mode Selection	0 025H	Read/Write	The default value is 0x 0001, 0x 0001 three-phase three-wire, other values are three-phase four-wire
7	Leakage current upper limit	002 6 H	Read/Write	Default value 1A , 0x 3E8 /1 00 0 = 1 A
8	Buzzer control	0 0 27 H	Read/Write	On: 0x0001, Off: 0x0000, Default Off
9	Switch output control	0 02 8 H	Read/Write	0: RS485 control 1: Time period control 2: Fault control, the relay closes after the voltage and current values exceed the limit Default: RS485 control
10	Time period control start time/minute	0 0 29 H	Read/Write	Hour and minute time, such as 0x0700 means the relay is open at 7:00
11	Time period control accepts hours/minutes	0 0 2A H	Read/Write	Hour and minute time, for example, 0x1400 means 20:00, the relay is closed
11	Relay status	0 0 2F H	Read/Write	When the value of register 0x0028 is 0, you can write 0x0000 to register 0x002F to control the relay to be closed, and write 0x0001 to control the relay to be open. When the value of register 0x0028 is not 0, you can only read the relay status.
12	Device time minutes/seconds	0 0 30 H	Read/Write	Minutes and seconds, such as 0x2010 is 32 minutes and 16 seconds (this function is only available with a clock chip)
13	Device time date/hour	0 0 31 H	Read/Write	Time of day, such as 0x0510 means 16:00 on the 5th
14	Equipment time year/month	0 0 32 H	Read/Write	Year and month time, such as 0x1605 is May 2022

Table 4 - Power Direction Register (Status Word 1)

Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
Total reactive power: 1—Reverse 0—Forward	Phase C reactive power: 1—Reverse 0—Forward	Phase B reactive power: 1—Reverse 0—Forward	Phase A reactive power: 1—Reverse 0—Forward	Total merit: 1—Reverse 0—Forward	Phase C active power: 1—Reverse 0—Forward	Phase B active power: 1—Reverse 0—Forward	Phase A active power: 1—Reverse 0—Forward

Table 5 - Alarm status indication word meaning (status word 2) :

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Leakage current : 1—Overcurrent 0—Normal	Phase C current: 1-Overcurrent 0—Normal	Phase B current: 1-Overcurrent 0—Normal	Phase A current: 1—Overcurrent 0—Normal	Not used	Phase C voltage: 1—Overvoltage 0—Normal	Phase B voltage: 1—Overvoltage 0—Normal	Phase A voltage: 1—Overvoltage 0—Normal

7 Precautions

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 the cables correctly according to the product specifications and model numbers and refer to the diagrams. Before connecting cables, ensure that all signal sources and power sources are disconnected to avoid danger and damage to the equipment. After checking that the wiring is correct, connect the power supply 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 using the product in an environment with strong electromagnetic interference, please pay attention to the shielding of the input and output signal lines.

6) When installing in a centralized manner, the minimum installation interval should not be less than 10mm.

7) This series of products does not have an internal lightning protection circuit. When the module's input and output feeders 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.

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