JSY-MK-333

Three-phase embedded metering module

Installation and User Manual V 1.1

Statement

Our company reserves the right to modify the product specifications described in this manual without prior notice. Please consult our sales representative or your local distributor for the current specifications of this product before ordering.

Instruction manual revision record

Date	Old version	New version	Author	Modifications
2024.02.21		V 1.0	HCC	1. Create a new
2025.06.21	V 1.0	V 1. 1	HCC	1. Add total power algebra and register.

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1 Introduction

The JSY-MK-333 three-phase embedded metering module is a three-phase power quality inspection module independently developed and manufactured by our company. Utilizing microelectronics technology and dedicated large-scale integrated circuits, it converts analog signals into digital outputs. The module's performance fully complies with the relevant technical requirements of the IEC 62053-21 national standard for Class 1S three-phase active energy meters. It can directly and accurately measure electrical parameters such as voltage, current, power, power factor, phase angle, energy consumption, and harmonics in a three-phase AC power grid with a rated frequency of 50Hz or 60Hz. The module has one built-in RS485 communication interface and one TTL communication interface, allowing users to freely select the communication interface according to actual needs. The module adopts the standard MODBUS-RTU communication protocol for convenient communication with various monitoring systems. It features high reliability, small size, light weight, and easy installation.

The JSY-MK-333 three-phase embedded metering module can be widely used in energy-saving renovation , power, communication, railway, transportation, environmental protection, petrochemical, steel and other industries to monitor the current and power consumption of AC equipment.

2 Feature list

Table 1 - Function Description List

Function	Function Description	Remark
Electricity metering	Active energy metering (A/B/C/total, forward, reverse phases)	
	Reactive energy metering (A/B/C/total, forward, reverse phases)	
	Apparent energy metering (A/B/C/Combined phase)	
Electrical parameter measurement	U (line voltage, phase voltage) , I	
	P, Q, S, PF, F	
	to 21st harmonics of three-phase voltage and current in phases A , B, and C.	
	Voltage and current phase difference	
Pulse output	Active and reactive pulse output	
Communication	1 RS 485 interface 1 TTL interface It supports both Modbus and DL/T645 protocols .	
Indicator lights	RUN: Run indicator light AL ARM : Stays on during overvoltage and overcurrent, flashes during data communication.	
Extended functions	Customization supported	

3 Technical parameters

Table 2 - Technical Specifications

Project			Performance parameters	
Specification			Three-phase three-wire	Third-tier and fourth-tier cities
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 level	Error ± 1.0 %	
	Current	Current Specifications	5A (suitable for secondary mutual inductance) , 50A, 100A, 150A, 250A , and above 500A are available (GB/T17215.321-2008).	
		Accuracy level	Error ± 1.0 %	
	power		Active power, reactive power, and apparent power, with an error of ± 1.0 % .	
	Grid frequency		45~65 Hz , error ± 1.0 %	
	Phase difference		Voltage, current, and voltage-current phase difference: error ±1.0 % .	
Measurement	Active power accuracy		1. S -level (GB/T 17215.321-2008)	
pulse	Electrical pulse output		One active pulse output (CF1) , one reactive pulse output (CF2)	
	Pulse width		8 0 ± 20 m s	
	Pulse constant		5A (1000 0 imp/kWh) , 150A (excluding 150A) and above (200 imp/kWh), other specifications 800 imp /kWh	
communication	interface		1 RS 485 port , 1 TTL port	
	Communication Protocol		Modbus RTU protocol, DL/T 645 protocol	
	Communication address range		Modbus RTU: 1~255	
	baud rate		Supports 600 ~ 38400 bps	
	Data format		The software can be configured with the following options: “n,8,1”, “e,8,1”, “o,8,1”, and “n,8,2”.	
Powered by	Independent power supply		When powered by DC 5~12V, the peak voltage must not exceed 15V; typical power consumption: ⩽ 20mA	
Environment	Operating temperature		-20 ~ +60℃	
	Storage temperature		-40 ~ +85℃	
	relative humidity		⩽95%, no condensation (at 40℃)	
	Altitude		0 to 3000 meters	
	Usage Environment		Locations free from explosive or corrosive gases and conductive dust,	

		and free from significant shaking, vibration, and impact.
Parameter	Temperature drift	⩽100ppm/℃
	Installation method	2.54mm pitch pin header soldering
	Module size	65 × 57 × 41 mm

4 Product Information

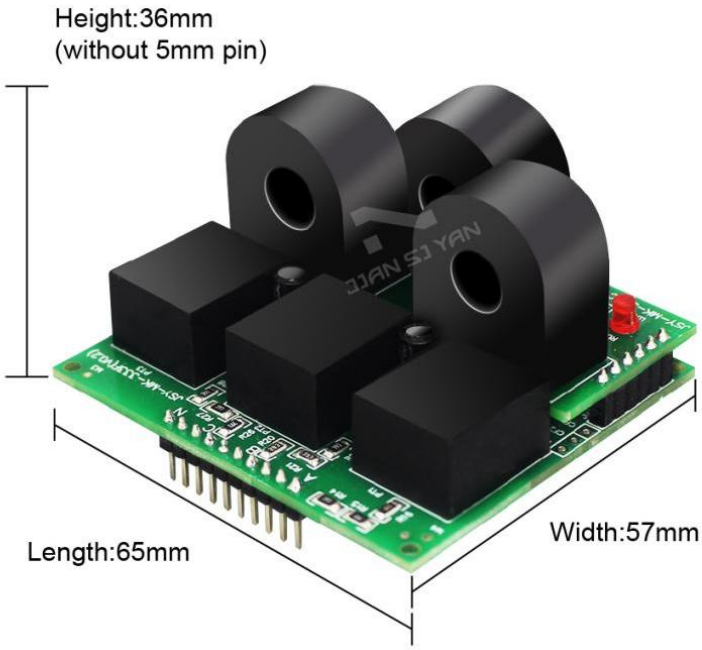


Image 1 - Product outline drawing

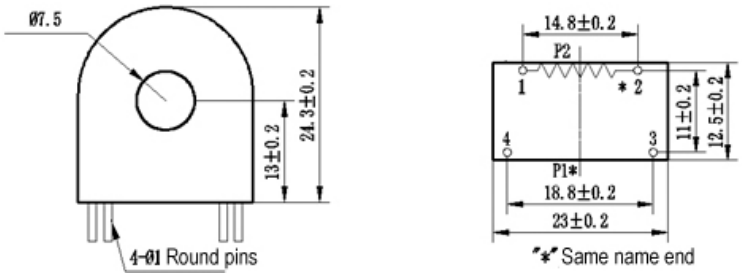


Image 2 - Dimensions of 50A Through-Type Current Transformer

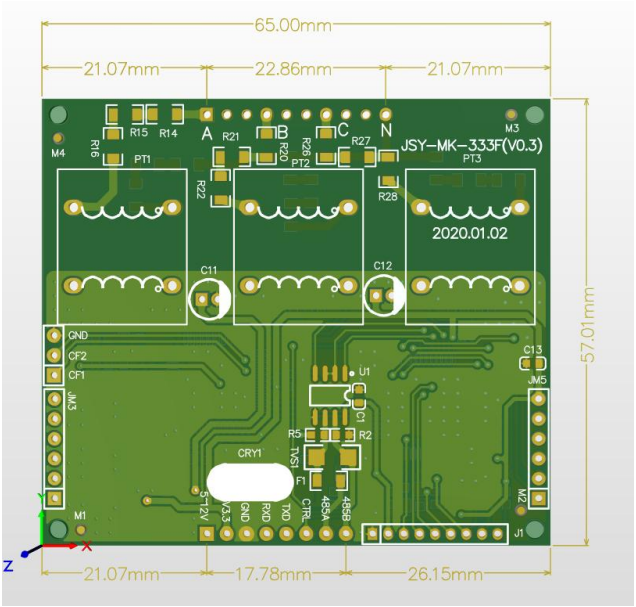


Image 3 - Board frame dimensions and functional pins

Table 3 - Terminal Description

terminal	illustrate
A	The input terminal of the measured phase A voltage
B	The input terminal of the measured phase B voltage
C	The measured C-phase voltage input terminal
N	Neutral input terminal under test
5-12V	Wide voltage supply input positive terminal (5~24VDC)
3.3V	3.3VDC power supply input positive terminal (5-12V/3.3V pins can only be selected from either one)
GND	Negative power input
RXD	TTL receiver pin (3.3V level)
TXD	TTL transmit pin (3.3V level)
IO	Reserved function
485A	485 Communication Port A
485B	485 Communication Port B

(Note: Pins not specified are unused .)

5 Wiring and Installation

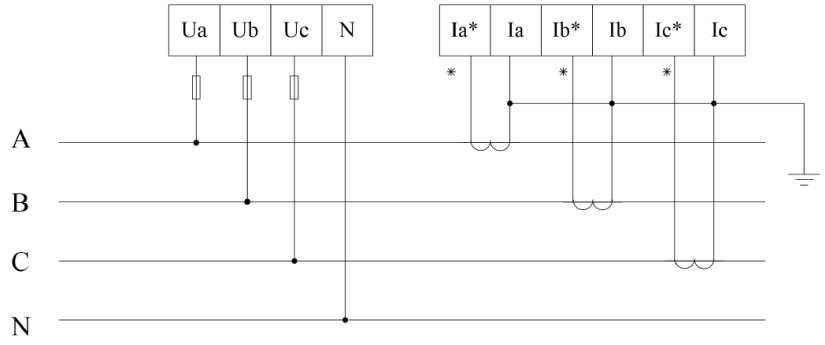


Image 4 - Three-phase four-wire voltage and current connection method

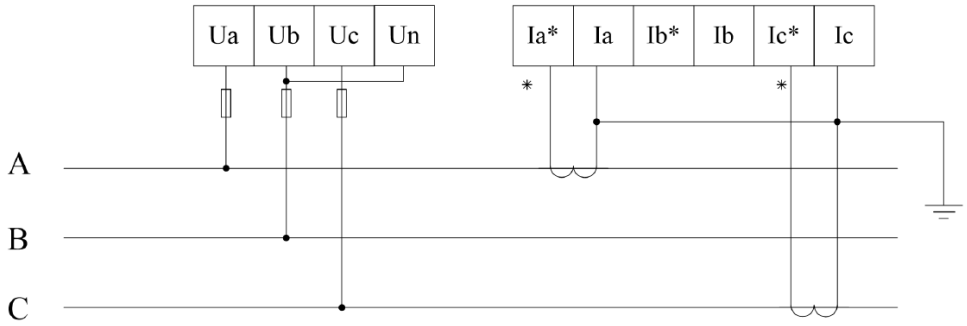


Image 5 - Three-phase three-wire voltage and current connection method

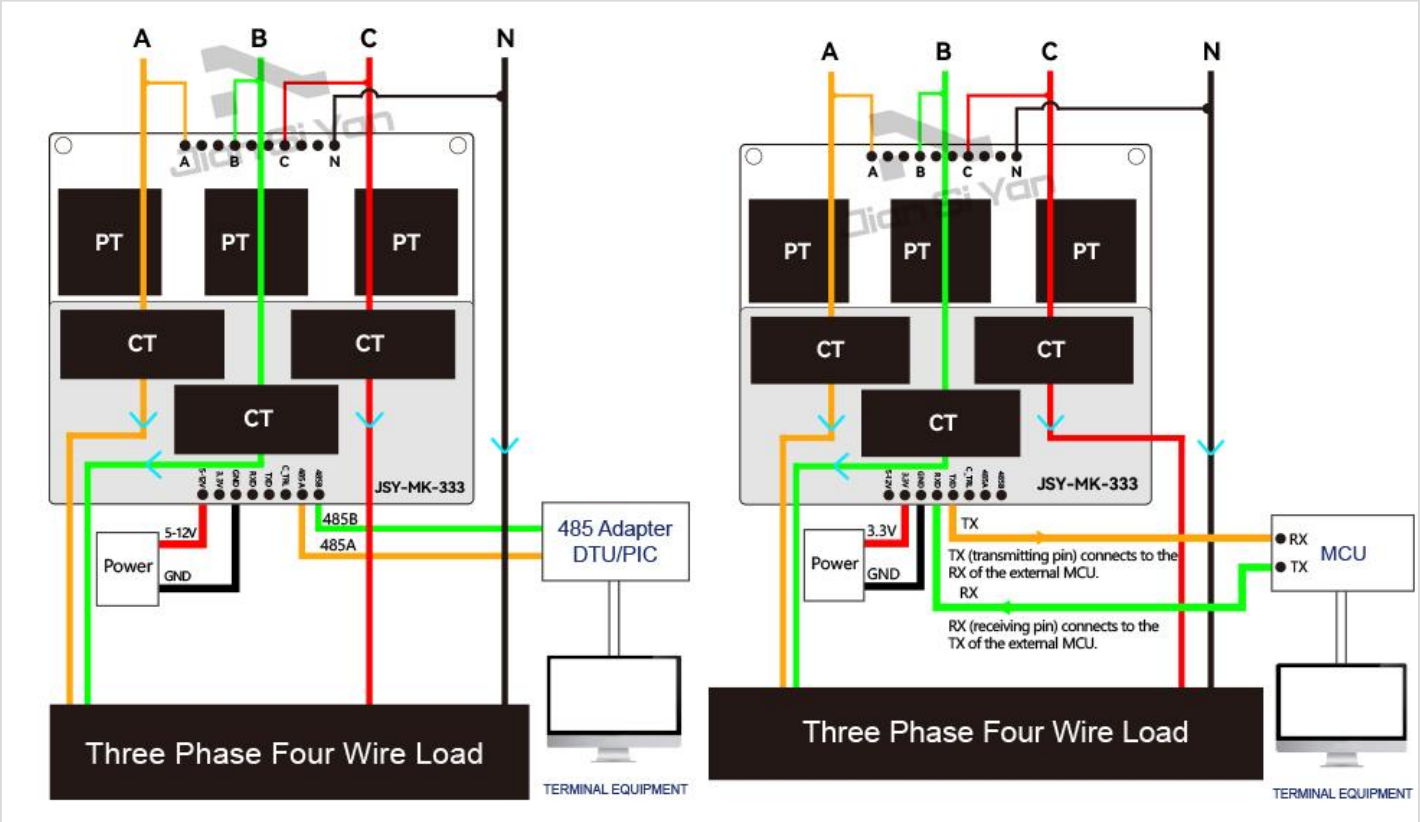


Image 6 - Example of three-phase four-wire connection

Note: Ia, Ib , and Ic do not need to be grounded.

6 Application Notes

Please connect the wires correctly according to the product specifications and model, referring to the diagram above. Before wiring, ensure all signal sources are disconnected to avoid danger and damage to the equipment. After verifying that the wiring is correct, then connect the power for testing.

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

When the products leave the factory, they are all set to the default configuration: address 1, baud rate 9600bps, data format "n,8,1", data update rate 1000ms, and transformation ratio 1;

Product parameters and general product testing can be modified and set using the JSY-MK-333 product testing software we provide.

6.1 RS-485 network connection:

For communication with the device, it is recommended to use an isolated 485 converter to improve system reliability;

On a single bus, the A+ terminals of all devices are connected in parallel, and the B- terminals are also connected in parallel. These connections must not be reversed. Up to 32 network modules can be connected simultaneously on a single line. Each network module can be configured with its own communication address. Shielded twisted-pair cable with a wire diameter of at least 0.5 mm^2 should be used for communication connections . During cabling, communication lines should be kept away from

high-voltage cables or other strong electric fields .

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

RS - 485 networking has various topologies, but a linear connection is generally used, where multiple devices are connected to the network one after another, starting from the host computer and working outwards. A terminating resistor of 120–300 Ω /0.25 watts can be connected at the furthest point (this needs to be determined based on the specific communication quality; if communication is good, it is not necessary).

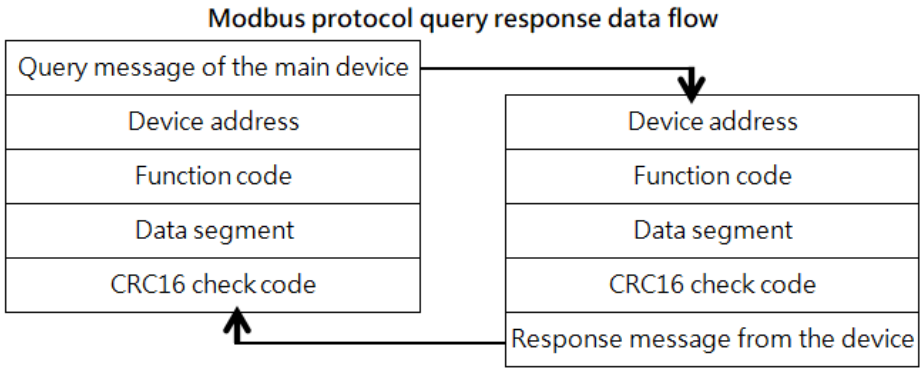
6.2 Electricity metering function:

It can provide parameters such as three-phase voltage, current, power, power factor, active and reactive energy;

The electricity consumption data is a 4-byte unsigned number that will not overflow after 10 years of continuous accumulation and is preserved even after power failure.

6.3 MODBUS communication applications

The MODBUS protocol uses a master-slave response communication method on a single communication line. First, the master computer addresses a terminal device (slave) with a unique address. Then, the terminal device sends a response signal in the opposite direction to the master. That is, all communication data streams are transmitted in opposite directions on a single communication line (half-duplex operation). The MODBUS protocol only allows communication between the master (PC, PLC, etc.) and the terminal devices, and does not allow data exchange between independent terminal devices. This ensures that each terminal device does not occupy the communication line during initialization, but is limited to responding to query signals arriving at its local machine.



Master 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 code 03 or 04 requests the slave device to read registers and return their contents; the data segment contains any additional information about the function the slave device is to perform; 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 the slave device generates a normal response, the response message will contain the slave address code, function code, data information code, and CRC16 checksum. The data information code includes the data collected from the

slave device, such as register values or status. If an error occurs, we agree that the slave device will not respond.

We specify the communication data format used in this module: bits per byte (1 start bit, 8 data bits, odd parity or even parity or no parity, 1 or 2 stop bits).

The structure of a data frame, i.e., 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 terminal that is addressed will respond to the corresponding query.

Function codes: These tell the addressed terminal what function to perform. The table below lists the function codes supported by this series of modules, along with 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 needed by the terminal to perform specific functions or data collected when the terminal responds to queries. This data may contain 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 when 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 for generating a CRC16 is as follows:

(1) A 16-bit register is preset to 0FFFFH (all 1s), which is called the CRC register.

(2) Perform an XOR operation between 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, shift the lowest bit out and check.

(4) If the least significant bit is 0: repeat step 3 (next shift); if the least significant bit is 1: perform an XOR operation between the CRC register and a preset fixed value (0A001H).

(5) Repeat steps three and four until eight shifts are completed. This completes one full eight bits.

(6) Repeat steps 2 through 5 to process the next octet until all bytes have been processed.

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

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 multiplex register

Example: The master needs to read data from three slave registers with address 01 and starting address 0100H.

Host sends: 01 03 01 00 00 03 04 37

Address function code, start address, data length, CRC code

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

Address function code returns the number of bytes in register 1, register 2, register 3, and CRC code.

6.4.2 Function code 0x10: Write multiplexer register

Example: The master needs to save 0104H, 01F4H to the slave register at address 0020H, 0021H (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, stored data, 1, 2, CRC code.

Slave response: 01 10 00 20 00 02 40 02

Address function code, starting address, number of registers to write, CRC code.

6.4.3 illustrate

The registers in the MODBUS-RTU communication protocol refer to 16 bits (i.e., 2 bytes), with the most significant 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 device is as follows:

Address code: 1 byte

Function code: 1 byte (most significant bit is 1)

Error code: 1 byte

CRC: 2 bytes

The response returned the following error code:

81: Invalid function code, meaning the received function code is not supported by the module.

82: Reading or writing an illegal data address, i.e., the data location is outside the readable or writable address range of the module.

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

6.4.4 Example of a communication message

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.

Host reads data frames:

address	Order	Starting address (most significant byte first)	Register number (most significant byte first)	Check digit (least significant digit first)
01H	03H	01H,00H	00H,03H	04H, 37H

Module response data frame:

address	Order	Data length	Data segment (6 bytes)	Verification code
01H	03H	06H	56H, 11H, 56H, 22H, 56H, 33H	1FH,77H

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

Host writes data frames:

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

Module response data frame:

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

Clear all power data (function code 10H, write to the two registers starting at 000CH, write 4 bytes of 00H data):

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

Module response data frame:

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

6.5 Modbus Register List

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

Note: In the second-ratio version, the energy data in the table below is already the data after the ratio has been adjusted.

Serial Number	definition	Register address	Reading/ Writing	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	C-phase voltage	0102H	read	Unsigned number, value = DATA/100, unit V
4	Phase A current	0103H	read	Unsigned number, value = DATA/100, unit: A Version 5A: Unsigned number, value = DATA/1 0 00, unit: A
5	B-phase current	0104H	read	Unsigned number, value = DATA/100, unit: A Version 5A: Unsigned number, value = DATA/1 0 00, unit: A
6	C-phase current	0105H	read	Unsigned number, value = DATA/100, unit: A Version 5A: Unsigned number, value = DATA/1 0 00, unit: A
7	Phase A active power	0106H	read	Unsigned number, value = DATA, unit is W 150 A and above : Unsigned number, value = DATA, unit: 100,000
8	Phase B active power	0107H	read	Unsigned number, value = DATA, unit is W 150A and above : Unsigned number, value = DATA, unit 100,000
9	C-phase active power	0108H	read	Unsigned number, value = DATA, unit is W 150A and above : Unsigned number, value = DATA, unit 100,000

10	Total three-phase active power	0109H 010AH	read	Unsigned number, value = DATA, unit is W (Register 0109H corresponds to the high 16 bits)
11	Phase A reactive power	010BH	read	Unsigned number, value = DATA, unit is Var 150A and above : Unsigned number, value = DATA, unit 10 Var
12	Phase B reactive power	010CH	read	Unsigned number, value = DATA, unit is Var 150A and above : Unsigned number, value = DATA, unit 10 Var
13	C-phase reactive power	010DH	read	Unsigned number, value = DATA, unit is Var 150A and above : Unsigned number, value = DATA, unit 10 Var
14	Total three-phase reactive power	010EH 010FH	read	Unsigned number, value = DATA, unit is Var
15	Phase A appears to have power	0110H	read	Unsigned number, value = DATA, unit is VA 150A and above : Unsigned number, value = DATA, unit 10VA
16	Phase B apparent power	0111H	read	Unsigned number, value = DATA, unit is VA 150A and above : Unsigned number, value = DATA, unit 10VA
17	C-phase power	0112H	read	Unsigned number, value = DATA, unit is VA 150A and above : 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 high 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	C-phase 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 Version 5A: 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 Version 5A: Unsigned number, value = DATA/1 0 00, unit kWh
26	C-phase active energy (forward + reverse)	011EH 011FH	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00, unit kWh
28	Total three-phase active power (cumulative absolute value)	0120H 0121H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00, unit kWh
29	Phase A reactive	0122H	read	Unsigned number, value = DATA/100, unit is kV arh

	power (forward + reverse)	0123H		Version 5A: Unsigned number, value = DATA/1 0 00, unit kVA arh
30	Phase B reactive power (forward + reverse)	0124H 0125H	read	Unsigned number, value = DATA/100, unit is kV arh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVA arh
31	C-phase reactive power (forward + reverse)	0126H 0127H	read	Unsigned number, value = DATA/100, unit is kV arh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVA arh
32	Total three-phase reactive power (cumulative absolute value)	0128H 0129H	read	Unsigned number, value = DATA/100, unit is kV arh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVA arh
33	A phase view in electrical energy	012AH 012BH	read	Unsigned number, value = DATA/100, unit is kVAh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVAh
34	Phase B appears to be related to electrical energy.	012CH 012DH	read	Unsigned number, value = DATA/100, unit is kVAh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVAh
35	Phase C is considered in terms of electrical energy	012EH 012FH	read	Unsigned number, value = DATA/100, unit is kVAh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVAh
36	Three-phase apparent total electrical energy (PQS calculation method)	0130H 0131H	read	Unsigned number, value = DATA/100, unit is kVAh Version 5A: Unsigned number, value = DATA/1 0 00, unit kVAh
37	Current power direction	0132H	read	The high byte is unused. Bits 7 to 0 of the low byte correspond to the total reactive power, reactive power of phase C, reactive power of phase B, reactive power of phase A, total active power, active power of phase C, active power of phase B, and active power of phase A, respectively (0 for positive, 1 for negative). See status word 1.
38	Current alarm status	0133H	read	When the high byte bit0 is 1, it represents reverse phase sequence; a value of 0 is normal. The low byte bits 6-4 indicate that the current of phases C-A is out of control, and bits 2-0 indicate that the voltage of phases C-A is out of control. See status word 2.
39	A-phase positive	0134H	read	Unsigned number, value = DATA/100, unit is kWh

	active energy	0135H		Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
40	B-phase positive active energy	0136H 0137H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
41	C-phase positive active energy	0138H 0139H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
42	Three-phase positive total active power	013AH 013BH	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
43	A. Reverse active energy	013CH 013DH	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
44	B. Reverse active energy	013EH 013FH	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
45	C. Reverse active energy	0140H 0141H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
46	Three-way reverse total active energy	0142H 0143H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
47	A-phase positive reactive power	0144H 0145H	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
48	B-phase positive reactive power	0146H 0147H	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
49	C-phase positive reactive power	0148H 0149H	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
50	Three-phase positive total reactive power	014AH 014BH	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
51	A reverse reactive power	014CH 014DH	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
52	B is the opposite reactive power.	014EH 014FH	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
53	C. Reverse reactive energy	0150H 0151H	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
54	Three-way reverse total reactive power	0152H 0153H	read	Unsigned number, value = DATA/100 , unit is kVArh : Unsigned number, value = DATA / 1000 , unit kVArh
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 difference	0 159H	read	Unsigned number, value = DATA/100, unit: °
6 1	Y _ I ab Current Phase Angle Difference	0 15AH	read	Unsigned number, value = DATA/100, unit: °
6 2	Y _I bc 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 _ U a I ab Voltage current phase angle difference	0 15DH	read	Unsigned number, value = DATA/100, unit: °
6 5	Y _ Ub Ib Voltage Current Phase Angle Difference	0 15EH	read	Unsigned number, value = DATA/100, unit: °
6 6	Y _ U clc voltage 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- phase voltage total harmonics	0 161H	read	Unsigned number, value = DATA/100, unit %
6 9	C- phase voltage total harmonics	0 162H	read	Unsigned number, value = DATA/100, unit %
7 0	A-phase current total harmonics	0 163H	read	Unsigned number, value = DATA/100, unit %
7 1	B -phase current total harmonics	0 164H	read	Unsigned number, value = DATA/100, unit %
7 2	C- phase current total harmonics	0 165H	read	Unsigned number, value = DATA/100, unit %
73	Total active energy of three phases (algebraic sum and cumulative)	01 66 H 01 67 H	read	Unsigned number, value = DATA/100, unit is kWh Version 5A: Unsigned number, value = DATA/1 0 00 , unit kWh
75	Total three-phase	01 68 H	read	Unsigned number, value = DATA/ 100 , unit is kVArh

	reactive power (algebraic sum and cumulative)	01 69 H		: Unsigned number, value = DATA / 1000 , unit kVArh

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	Phase A voltage fourth harmonic	0203H	read	Unsigned number, value = DATA/100, unit %
5	Phase A voltage 5th harmonic	0204H	read	Unsigned number, value = DATA/100, unit %
6	Phase A voltage 6th harmonic	0205H	read	Unsigned number, value = DATA/100, unit %
7	Phase A voltage 7th harmonic	0206H	read	Unsigned number, value = DATA/100, unit %
8	Phase A voltage 8th harmonic	0207H	read	Unsigned number, value = DATA/100, unit %
9	Phase A voltage 9th harmonic	0208H	read	Unsigned number, value = DATA/100, unit %
10	Phase A voltage 10th harmonic	0209H	read	Unsigned number, value = DATA/100, unit %
11	Phase A voltage 11th harmonic	020AH	read	Unsigned number, value = DATA/100, unit %
12	Phase A voltage 12th harmonic	020BH	read	Unsigned number, value = DATA/100, unit %
13	Phase A voltage 13th harmonic	020CH	read	Unsigned number, value = DATA/100, unit %
14	Phase A voltage 14th harmonic	020DH	read	Unsigned number, value = DATA/100, unit %
15	Phase A voltage 15th harmonic	020EH	read	Unsigned number, value = DATA/100, unit %
16	Phase A voltage 16th harmonic	020FH	read	Unsigned number, value = DATA/100, unit %

17	Phase A voltage 17th harmonic	0210H	read	Unsigned number, value = DATA/100, unit %
18	Phase A voltage 18th harmonic	0211H	read	Unsigned number, value = DATA/100, unit %
19	Phase A voltage 19th harmonic	0212H	read	Unsigned number, value = DATA/100, unit %
20	Phase A voltage 20th harmonic	0213H	read	Unsigned number, value = DATA/100, unit %
21	Phase A voltage 21st harmonic	0214H	read	Unsigned number, value = DATA/100, unit %
22	B-phase voltage total harmonics	0215H	read	Unsigned number, value = DATA/100, unit % (same as 0161H)
23	Phase B voltage second harmonic	0216H	read	Unsigned number, value = DATA/100, unit %
24	Phase B voltage third harmonic	0217H	read	Unsigned number, value = DATA/100, unit %
25	Phase B voltage fourth harmonic	0218H	read	Unsigned number, value = DATA/100, unit %
26	Phase B voltage 5th harmonic	0219H	read	Unsigned number, value = DATA/100, unit %
27	Phase B voltage sixth harmonic	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	Phase B voltage 10th harmonic	021EH	read	Unsigned number, value = DATA/100, unit %
32	11th harmonic of phase B voltage	021FH	read	Unsigned number, value = DATA/100, unit %
33	Phase B voltage 12th harmonic	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	Phase B voltage 20th harmonic	0228H	read	Unsigned number, value = DATA/100, unit %
42	21st harmonic of phase B voltage	0229H	read	Unsigned number, value = DATA/100, unit %
43	C-phase 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	C-phase voltage fourth harmonic	022DH	read	Unsigned number, value = DATA/100, unit %
47	C-phase voltage 5th harmonic	022EH	read	Unsigned number, value = DATA/100, unit %
48	C-phase voltage sixth harmonic	022FH	read	Unsigned number, value = DATA/100, unit %
49	C-phase voltage 7th harmonic	0230H	read	Unsigned number, value = DATA/100, unit %
50	C-phase voltage 8th harmonic	0231H	read	Unsigned number, value = DATA/100, unit %
51	C-phase voltage 9th harmonic	0232H	read	Unsigned number, value = DATA/100, unit %
52	C-phase voltage 10th harmonic	0233H	read	Unsigned number, value = DATA/100, unit %

53	11th harmonic of C-phase voltage	0234H	read	Unsigned number, value = DATA/100, unit %
54	C-phase voltage 12th harmonic	0235H	read	Unsigned number, value = DATA/100, unit %
55	C-phase voltage 13th harmonic	0236H	read	Unsigned number, value = DATA/100, unit %
56	14th harmonic of C-phase voltage	0237H	read	Unsigned number, value = DATA/100, unit %
57	C-phase voltage 15th harmonic	0238H	read	Unsigned number, value = DATA/100, unit %
58	C-phase voltage 16th harmonic	0239H	read	Unsigned number, value = DATA/100, unit %
59	C-phase voltage 17th harmonic	023AH	read	Unsigned number, value = DATA/100, unit %
60	18th harmonic of C-phase voltage	023BH	read	Unsigned number, value = DATA/100, unit %
61	C-phase voltage 19th harmonic	023CH	read	Unsigned number, value = DATA/100, unit %
62	C-phase voltage 20th harmonic	023DH	read	Unsigned number, value = DATA/100, unit %
63	C-phase voltage 21st harmonic	023EH	read	Unsigned number, value = DATA/100, unit %
64	A-phase current total harmonics	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	Phase A current third harmonic	0241H	read	Unsigned number, value = DATA/100, unit %
67	Phase A current fourth harmonic	0242H	read	Unsigned number, value = DATA/100, unit %
68	Phase A current 5th harmonic	0243H	read	Unsigned number, value = DATA/100, unit %
69	Phase A current 6th harmonic	0244H	read	Unsigned number, value = DATA/100, unit %
70	Phase A current 7th harmonic	0245H	read	Unsigned number, value = DATA/100, unit %

71	Phase A current 8th harmonic	0246H	read	Unsigned number, value = DATA/100, unit %
72	Phase A current 9th harmonic	0247H	read	Unsigned number, value = DATA/100, unit %
73	Phase A current 10th harmonic	0248H	read	Unsigned number, value = DATA/100, unit %
74	11th harmonic of phase A current	0249H	read	Unsigned number, value = DATA/100, unit %
75	Phase A current 12th harmonic	024AH	read	Unsigned number, value = DATA/100, unit %
76	Phase A current 13th harmonic	024BH	read	Unsigned number, value = DATA/100, unit %
77	14th harmonic of phase A current	024CH	read	Unsigned number, value = DATA/100, unit %
78	Phase A current 15th harmonic	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	Phase A current 18th harmonic	0250H	read	Unsigned number, value = DATA/100, unit %
82	Phase A current 19th harmonic	0251H	read	Unsigned number, value = DATA/100, unit %
83	Phase A current 20th harmonic	0252H	read	Unsigned number, value = DATA/100, unit %
84	Phase A current 21st harmonic	0253H	read	Unsigned number, value = DATA/100, unit %
85	B-phase current total harmonics	0254H	read	Unsigned number, value = DATA/100, unit % (same as 0164H)
86	B-phase current second harmonic	0255H	read	Unsigned number, value = DATA/100, unit %
87	B-phase current third harmonic	0256H	read	Unsigned number, value = DATA/100, unit %
88	B-phase current fourth harmonic	0257H	read	Unsigned number, value = DATA/100, unit %

89	5th harmonic of phase B current	0258H	read	Unsigned number, value = DATA/100, unit %
90	B-phase current sixth harmonic	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	C-phase current total harmonics	0269H	read	Unsigned number, value = DATA/100, unit % (same as 0165H)

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

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

0x0300 ~0x0322 contain the module 's measured values multiplied 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	C-phase voltage	0304H	read	Floating-point number, unit V
4	Phase A current	0306H	read	Floating-point number, unit A
5	B-phase current	0308H	read	Floating-point number, unit A
6	C-phase current	030AH	read	Floating-point number, unit A
7	Phase A active power	030CH	read	Floating-point number, unit is W
8	Phase B active power	030EH	read	Floating-point number, unit is W
9	C-phase active power	0310H	read	Floating-point number, unit is W
10	Total three-phase active power	0312H	read	Floating-point number, unit is W
11	Phase A reactive power	0314H	read	Floating-point number, unit is Var
12	Phase B reactive power	0316H	read	Floating-point number, unit is Var
13	C-phase reactive power	0318H	read	Floating-point number, unit is Var
14	Total three-phase reactive power	031AH	read	Floating-point number, unit is Var
15	Phase A appears to have power	031CH	read	Floating-point number, unit is VA
16	Phase B apparent power	031EH	read	Floating-point number, unit is VA
17	C-phase power	0320H	read	Floating-point number, unit is VA
18	Three-phase total apparent power	0322H	read	Floating-point number, unit is VA

Table 5 - System parameter register address and communication data table (function code 03H for reading, 10H for writing)

Serial Number	definition	Register address	Reading/ Writing	Detailed Explanation
1	Model 1	0000H	read	The value is 333H
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	Reading/ Writing	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) is the address, ranging from 1 to 255; 0 represents the broadcast address. The high 2 bits of the low byte are the data format bits. "00" indicates 10 bits with no parity, i.e., "8, N, 1"; "01" indicates 11 bits, even parity, i.e. "8, E, 1"; A value of "10" indicates 11 bits, odd parity, i.e., "8, 0, 1"; "11" indicates 11 bits, no parity, and 2 stop bits, i.e., "8, N, 2"; The lower four bits of the low byte represent the baud rate , 2–600 bps . 3 — 1 2 00bps , 4-24 00bps , 5-4800bps, 6-9600bps, 7-19200bps, 8-38400bps (The communication baud rate of both the 485 port and the TTL port is related to this register, and the baud rate of both is the same.)

Table 6 - Configure parameter registers and communication data tables (function code 03H for reading, 10H for writing).

Serial Number	Definition	Register address	Reading/ Writing	Detailed Explanation
1	Voltage limit	0020H	Reading/ Writing	Default value 0x104=260V
2	Current limit	0021H	Reading/ Writing	The default value is 0x1F4, 0x1F4/10 = 50A
3	Voltage transformer ratio	002 2 H	Reading/ Writing	Default value 0x 0001 ; ratio 1

4	Current transformer ratio	002 3 H	Reading/ Writing	Default value 0x 0001 ; ratio 1
5	Current noise	0 024H	Reading/ Writing	Default value 0x000A, unit mA
6	Mode Selection	0 025H	Reading/ Writing	The default value is 0x0001, 0x0001 for three-phase three-wire; other values are three-phase four-wire .
7	minutes/second	0 0 30 H	Reading/ Writing	Time in minutes and seconds, such as 0x2010 which represents 32 minutes and 16 seconds (this function is only available with a clock chip).
8	Day/Hour	0 0 31 H	Reading/ Writing	Day and time, such as 0x0510, which represents the 5th day at 16:00.
9	years	0 0 32 H	Reading/ Writing	Year, month, and time; for example, 0x1605 represents May 2022.

Table 7 - Power Direction Register (Status Word 1)

Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
No results achieved: 1—Reverse 0—positive	Phase C is reactive: 1—Reverse 0—positive	Phase B is inactive: 1—Reverse 0—positive	Phase A is inactive: 1—Reverse 0—positive	Always meritorious: 1—Reverse 0—positive	Phase C is effective: 1—Reverse 0—positive	Phase B is commendable: 1—Reverse 0—positive	Phase A is meritorious: 1—Reverse 0—positive

Table 8 - Meaning of alarm status indicator words (status word 2) :

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

7 Safety Information

1) Pay attention to the auxiliary power information on the product label. The auxiliary power rating and polarity of the product must not be connected incorrectly, otherwise the product may be damaged.

2) Please connect the wires correctly according to the product specifications and model, referring to the diagram. Before wiring, ensure that all signal sources and power supplies are disconnected to avoid danger and damage to the equipment. After verifying that the wiring is correct, then connect the power for testing.

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

4) When there is current on the primary side of the CT, the secondary circuit of the CT must not be opened; it is strictly forbidden to connect wires or disconnect terminals while the circuit is energized.

5) When using the product in an environment with strong electromagnetic interference, please ensure that the input and output signal lines are shielded.

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

7) This series of products does not have internal lightning protection circuits. When the input and output feeders of the module are exposed to harsh outdoor weather conditions, lightning protection measures should be taken.

8) Do not damage or modify the product's labels or markings, and do not disassemble or modify the product; otherwise, our company will no longer provide the "three guarantees" (replacement, return, and repair) service for that product.

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