

PMAC770

**MODBUS PROTOCOL
AND REGISTER LIST**

V2.0

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1. Introduction

This document describes the input and output command, information and data of the PMAC770 under MODBUS communication mode. So it is convenient for the 3rd part using and developing.

1.1 Purpose of the Communication Protocol

The purpose of the PMAC770 MODBUS communications protocol is to allow setup information and measured data to be efficiently transferred between a MODBUS Master Station and a PMAC770. It includes:

- 1) Allowing setting and reading all PMAC770 set-up parameters from a MODBUS Master Station.
- 2) Allowing reading all data measured by a PMAC770 and SOE (Event log).

1.2 Version of Communication Protocol

This document is proper for all versions of PMAC770 meters. If any change happens later, it will be declared.

2. Detailed Description of the PMAC770 Modbus Protocol

2.1. PMAC770 Modbus Protocol Rules

The following rules define the protocol rules for information transfer between a MODBUS Master device and the PMAC770 in a RS-485 serial communications loop.

- 1) All communications on the RS-485 loop conforms to a MASTER/SLAVE scheme. In this scheme, information and data is transferred between a MODBUS MASTER device and up to 32 SLAVE monitoring devices.
- 2) The MASTER will initiate and control all information transfer on the RS-485 communications loop.
- 3) Under no circumstances will a SLAVE device initiate a communications sequence.
- 4) All communications activity on the RS-485 loop occurs in the form of "PACKETS", a packet being simply a serial string of 8-bit bytes. The maximum number of bytes contained within one packet is 255. The bytes that comprise a packet consist of standard asynchronous serial data, which are generated using equipment similar to that used for RS-232C.
- 5) The packages from MASTER are named request. The packages from SLAVE are named response.
- 6) Under any circumstance, Slave can just respond one request.

2.2. Modes of Transmission

MODBUS protocol supports ASCII and RTU modes of transmissions. The PMAC770 supports only the RTU mode of transmission with 8 data bits, no parity, and one stop bit.

2.3. Description of the Modbus Packet Structure

Every MODBUS packet consists of four fields:

- 1) The Address Field
- 2) The Function Field

- 3) The Data Field
- 4) The Error Check field

2.3.1. Address Field

The address field is 1-byte long and identifies which slave device the packet is for. Valid addresses range between 1 and 247. The slave device whose address matches the value in this field will perform the command specified in the packet.

2.3.2. Function Field

The function field is 1-byte long and tells the addressed slave which function to perform. Slave response packet should include same function field byte as request. The Modbus functions supported by PMAC770 are listed as below:

Function Code	Meaning	Action
0x01	Read Relay Output Status	Obtains ON/ OFF information of one or more relay output in PMAC770 (0/1)
0x02	Read Digital Input Status	Obtains ON/OFF information of one or more digital input in PMAC770 (0/1)
0x03	Read Holding Registers	Obtains the current value in one or more holding registers of the PMAC770.
0x05	Relay control	Write 0xFF00 to close (ON) the relay Write 0x0000 to open (OFF) the relay
0x10	Preset Multiple Registers	Places specific binary values into a series of consecutive holding registers of the PMAC770

2.3.3. Data Field

The length of Data Field is varies in length depending on its function. In general, MODBUS supports "BIG INDIAN" mode, it means high-order byte first, low-order byte second.

For example,

One 16 byte register value is 0x12AB; register is transmitted in below sequence:

High-order byte = 0x12

Low-order byte = 0x0AB

2.3.4. Error Check Field

In Modbus RTU mode, the 16-bit Cyclic Redundancy Check (CRC-16) is used. The sending device calculates a 16-bit value, based on the information stored in the address, function and data fields using the CRC-16 algorithm and appends it to the end of the packet. The receiving device performs the same calculation upon the reception of a packet. If the result does not match the checksum stored in the packet, transmission errors have occurred and the packet will be ignored by the receiving device.

For detail of CRC16 parity arithmetic, please refer to the appendix.

2.4. Exception Responses

If a Modbus master device sends a noneffective command to a PMAC770 or attempts to read a noneffective holding register, an exception response will be generated. The exception response consists of the slave address, function code, error code, and error check field. The high order bit of the function code is set to 1 to indicate that the packet is an exception response.

Below list describes the meanings of exception codes:

Function Code	Meaning
01 illegal function code	PMAC770-Modbus support the function code include: 01H, 02H, 03H, 05H, and 10H. This code means the slave device receive an illegal function code, or the PMAC770 receive the error command.
02 illegal function code	PMAC770 receive the address referenced in the data field is an invalid address.
03 illegal function code	The requested register number is too long.

2.5. Broadcast Packets

The PMAC770 support broadcast commands when communicating in MODBUS mode.

Do write command 0x10 for timing.

3. Packet Communication

Two MODBUS functions are supported by the PMAC770. The standard MODBUS protocol supports only 16-bit registers, which limit the maximum value of any measurement to 65535.

Section 3.1 will describe the format of Read/ Response Packet of relay output.

Section 3.2 will describe the format of Read/ Response Packet of digital input

Section 3.3 will describe the format of Read/ Response Packet of holding register.

Section 3.4 will describe the relay control command

Section 3.5 will describe Preset Multiple Registers packet and the acknowledge packet.

3.1 Read the Relay Output Status (Function Code 01H)

Use 01 command to read the relay status. Relays are addressed starting at 0: relay 1 is addressed as 0.

The relay status data in response packet is packed as one bit for one relay. 1 = ON, 0 = OFF.

The LSB (Least Significant Bit) of the first data byte contains the request addressing output. Other relay is same as this, until to the high bit of this byte, and rank from low bit to high bit in the followed byte.

If the return output Num. is not a multiple of 8, it will use zero to fill in the remainder bit of last data byte (until to the high bit of the byte). The byte count field specifies all byte num. of the data.

Request Packet (Master→PMAC770)		Response Packet (PMAC770→Master)	
Unit ID/ Slave address	1 byte	Unit ID/ Slave address	1 byte
01H (Function Code)	1 byte	01H (Function Code)	1 byte
Starting address	2 bytes	Byte num. (N)	1 byte
Relay num.	2 bytes	Relay status	N bytes
CRC check code	2 bytes	CRC check code	2 bytes

$N = \text{output num.} \div 8$, if remainder $\neq 0$, then $N=N+1$.

3.2 Read the Digital Input Status (Function Code 01H)

Use 02 command to read the status. Digital input are addressed starting at 0: Digital input 1 is addressed as 0.

The DI data in response packet is packed as one bit for one DI. 1 = ON, 0 = OFF.

The LSB (Least Significant Bit) of the first data byte contains the request addressing output. Other DI is same as this, until to the high bit of this byte, and rank from low bit to high bit in the followed byte.

If the return output Num. is not a multiple of 8, it will use zero to fill in the remainder bit of last data byte (until to the high bit of the byte). The byte count field specifies all byte num. of the data.

Request Packet (Master→PMAC770)		Response Packet (PMAC770→Master)	
Unit ID/ Slave address	1 byte	Unit ID/ Slave address	1 byte
02H (Function Code)	1 byte	02H (Function Code)	1 byte
Starting address	2 bytes	Byte num. (N)	1 byte
DI num.	2 bytes	DI status	N bytes
CRC check code	2 bytes	CRC check code	2 bytes

N = output num. ÷ 8, if remainder ≠ 0, then N=N+1.

3.3. Read Holding Registers (Function Code 03H)

This command packet requests that the PMAC770 responds all valid registers. The value of reserved registers is 0.

Request Packet (Master→PMAC770)		Response Packet (PMAC770→Master)	
Unit ID/ Slave address	1 byte	Unit ID/ Slave address	1 byte
03 H (Function Code)	1 byte	03 H (Function Code)	1 byte
Start register address	2 bytes	Byte num. (2 * register num.)	1 byte
Registers num.	2 bytes	First register data	2 bytes
CRC check code	2 bytes	Second register data	2 bytes
		
		CRC check code	2 bytes

3.4 Relay Control (Function Code 05H)

Use 05 command to control the relay. Relays are addressed starting at 0: relay 1 is addressed as 0.

The requested ON/OFF relay is specified by a constant in the data field.

Data Field is 0xFF00, request the relay to be ON.

Data Field is 0x0000, request the relay to be OFF.

All other values are illegal and will not affect the relay.

Request Packet (Master→PMAC770)		Response Packet (PMAC770→Master)	
Unit ID/ Slave address	1 byte	Unit ID/ Slave address	1 byte
05 H (Function Code)	1 byte	05 H (Function Code)	1 byte
Start register address	2 bytes	Start register address	2 bytes
Data field	FF	Data field	FF
Data field	00	Data field	00
		
CRC check code	2 bytes	CRC check code	2 bytes

3.5. Preset Multiple Registers (Function code 10H)

This command packet allows the Master to program the PMAC770 setup parameters.

Preset Registers Format (Master→PMAC770)		Response Format (PMAC770→Master)	
Unit ID/ Slave address	1 byte	Unit ID/ Slave address	1 byte
10 H (Function Code)	1 byte	10 H (Function Code)	1 byte
Start register address	2 bytes	Start register address	2 bytes
Register num.	2 bytes	Register num.	2 bytes
Byte num. (2 * register num.)	1 byte	CRC check code	2 bytes
First register data	2 bytes		
Second register data	2 bytes		
...			
CRC check code	2 bytes		

Note: PMAC770 presume all registers are continuous from the first one.

4. Calculating the CRC-16 Error Check Field

This section describes the procedure for obtaining the CRC-16 error check field. A packet can be considered as a continuous, serial stream of binary data (0, 1). The 16-bit checksum is obtained by multiplying the serial data stream by 2¹⁶ (1000000000000000) and then dividing it by the **generator polynomial** $x^{16}+x^{15}+x^2+1$, which can be expressed as a binary data 11000000000000101. The quotient is ignored and the 16-bit remainder is the checksum and is appended to end of the packet.

In calculating the CRC, all arithmetic operations (additions and subtractions) are performed using MODULO TWO, or EXCLUSIVE OR operation. **Section 4.1** provides a step by step example to show how to obtain the checksum.

4.1. Steps for the Generating the CRC-16 Checksum:

- 1) Form a new polynomial by dropping the MSB (Most Significant Bit) of the generator polynomial and reversing the bit sequence. This yields the binary number 1010 0000 0000 0001 or A0 01 Hex.
- 2) Load a 16-bit register with initial value FF FF Hex.
- 3) Exclusive OR the first data byte with the loworder byte of the 16-bit register, storing the result in the 16-bit register.
- 4) Shift the 16-bit register one bit to the right.
 - 5a) If the bit shifted out to the right is one, Exclusive OR the 16-bit register with the new generator polynomial, with result stored in the 16-bit register. Return to step 4.
 - 5b) If the bit shifted out to the right is zero, return to step 4.
- 6) Repeat steps 4 and 5 until 8 shifts have been performed.
- 7) Exclusive OR the next data byte with the 16-bit register.

8) Repeat steps 4 through 7 until all bytes of the packet have been Exclusive ORed with the 16-bit register and shifted 8 times.

9) The content of the 16-bit register is the checksum and is appended to the end of the packet.

4.2. Procedure for Calculating the 6403 Bytes of 16 Hex.

Step	Byte	Action	Register	Bit#	Shift
2		Initial Value	1111 1111 1111 1111		
	1	Load the first byte	0000 0000 0110 0100		
3		XOR	1111 1111 1001 1011		
4		SHIFT 1 bit to the right	0111 1111 1100 1101	1	1
5a		XOR polynomial	1101 1111 1100 1100		
4		SHIFT 1 bit to the right	0110 1111 1110 0110	2	0
4		SHIFT 1 bit to the right	0011 0111 1111 0011	3	0
4		SHIFT 1 bit to the right	0001 1011 1111 1001	4	1
5a		XOR polynomial	1011 1011 1111 1000		
4		SHIFT 1 bit to the right	0101 1101 1111 1100	5	0
4		SHIFT 1 bit to the right	0010 1110 1111 1110	6	0
4		SHIFT 1 bit to the right	0001 0111 0111 1111	7	0
4		SHIFT 1 bit to the right	0000 1011 1011 1111	8	1
5a		SHIFT 1 bit to the right	1010 1011 1011 1110		
	2	Load the second byte	0000 0000 0000 0011		
7		XOR	1010 1011 1011 1101		
4		SHIFT 1 bit to the right	0101 0101 1101 1110	1	1
5a		XOR polynomial	1111 0101 1101 1111		
4		SHIFT 1 bit to the right	0111 1010 1110 1111	2	1
5a		XOR polynomial	1101 1010 1110 1110		
4		SHIFT 1 bit to the right	0110 1101 0111 0111	3	0
4		SHIFT 1 bit to the right	0011 0110 1011 1011	4	1
5a		XOR polynomial	1001 0110 1011 1010		
4		SHIFT 1 bit to the right	0100 1011 0101 1101	5	0
4		SHIFT 1 bit to the right	0010 0101 1010 1110	6	1
5a		XOR polynomial	1000 0101 1010 1111		
4		SHIFT 1 bit to the right	0100 0010 1101 0111	7	1
5a		XOR polynomial	1110 0010 1101 0110		
4		SHIFT 1 bit to the right	0111 0001 0110 1011	8	0
		CRC-16	0111 0001 0110 1011		

5. Description of PMAC770 Registers

All PMAC770 measured and setup parameters are treated as HOLDING REGISTERS having addresses **4xxxx** when communicating in MODBUS protocol. According to the MODBUS Protocol, in response to a request for register **4xxxx** of a particular slave device (PMAC770), the MODBUS master reads register **xxxx-1** from the slave (PMAC770). For example register 40011 corresponds to register 10.

Calculation factor

Due to the limitation of the data scope, most registers of PMAC770 use the calculation factor. The calculation formula is: Actual value = value from communication x calculation factor.

For example: The calculation factor of Power Factor is 0.001.

When user read the Power Factor from Modbus is 892, the actual value is $892 \times 0.001 = 0.892$.

Communication value and Actual value

To ensure the data accuracy during transmitting data, PMAC770 uses a special way to describe some real-time data registers. As below sheet:

Item	Parameters	Communication value	Actual value
1	Per phase/ line Voltage Average voltage Neutral voltage	Secondary	= Comm. Value × calculation factor × PT ratio
2	Per phase current Average current Neutral current Demand current & Max. demand	Secondary	= Comm. Value × calculation factor × CT ratio
3	Per phase power (P, Q, S) Total power (P, Q, S) Demand power (P, Q, S)	Secondary	= Comm. Value × calculation factor × PT ratio × CT ratio

PMAC770 uses the secondary data to transmit value can maximum reserve the calculation accuracy. User should pay attention to the PT and CT ratio when read above parameters.

Access and Type of Register

Items	Access and Type	Description
1	RO	Read only
2	WO	Write only
3	RW	Read or Write
4	U16	16 bit, un-sign integer
5	S16	16 bit, sign integer
6	U32	32 bit, un-sign integer
7	S32	32 bit, sign integer

5.1. Real-time Data Register List

Register Address	Access	Type	Description	Remark
40001	RO	U16	Va (ph-N)	× 0.01, unit: V
40002	RO	U16	Vb (ph-N)	× 0.01, unit: V
40003	RO	U16	Vc (ph-N)	× 0.01, unit: V
40004	RO		Reserved	
40005	RO	U16	Average phase voltage (ph-N)	× 0.01, unit: V
40006	RO	U16	Vab (ph-ph)	× 0.01, unit: V
40007	RO	U16	Vbc (ph-ph)	× 0.01, unit: V
40008	RO	U16	Vca (ph-ph)	× 0.01, unit: V
40009	RO		Reserved	
40010	RO	U16	Average line voltage (ph-ph)	× 0.01, unit: V
40011	RO	U16	Positive sequence voltage	× 0.01
40012	RO	U16	Negative sequence voltage	× 0.01
40013	RO	U16	Neutral voltage	× 0.01, unit: V
40014	RO	U16	Ia	× 0.0001, unit: A
40015	RO	U16	Ib	× 0.0001, unit: A
40016	RO	U16	Ic	× 0.0001, unit: A
40017	RO		Reserved	
40018	RO	U16	Average current	× 0.0001, unit: A
40019	RO		Reserved	
40020	RO		Reserved	
40021	RO		Reserved	
40022	RO		Reserved	
40023	RO		Reserved	
40024	RO	U16	Positive sequence current	× 0.0001,
40025	RO	U16	Negative sequence current	× 0.0001,
40026	RO	U16	Neutral current	× 0.0001, unit: A
40027	RO	S16	Phase A active power	× 0.1, unit: W
40028	RO	S16	Phase B active power	× 0.1, unit: W
40029	RO	S16	Phase C active power	× 0.1, unit: W
40030	RO	S32	Total active power	× 0.1, unit: W
40031				
40032	RO	S16	Phase A reactive power	× 0.1, unit: var
40033	RO	S16	Phase B reactive power	× 0.1, unit: var
40034	RO	S16	Phase C reactive power	× 0.1, unit: var
40035	RO	S32	Total reactive power	× 0.1, unit: var
40036				

40037	RO	U16	Phase A apparent power	× 0.1, unit: VA
40038	RO	U16	Phase B apparent power	× 0.1, unit: VA
40039	RO	U16	Phase C apparent power	× 0.1, unit: VA
40040	RO	U16	Total apparent power	× 0.1, unit: VA
40041	RO	S16	Phase A power factor	× 0.001
40042	RO	S16	Phase B power factor	× 0.001
40043	RO	S16	Phase C power factor	× 0.001
40044	RO	S16	Total power factor	× 0.001
40045	RO	U16	Frequency	× 0.01, unit: Hz
40046	RO	U16	Digital input status	
40047	RO	U16	Relay output status	
40048	RO		Reserved	
40049	RO		Reserved	
40050	RO	U16	Analog input 1	× 0.01
40051	RO	U16	Analog input 2	× 0.01
40052	RO	U16	Pulse input	
40053	RO	S16	Phase A voltage deviation	× 0.01, unit: %
40054	RO	S16	Phase B voltage deviation	× 0.01, unit: %
40055	RO	S16	Phase C voltage deviation	× 0.01, unit: %
50056	RO	S16	Frequency deviation	× 0.01, unit: Hz
50057	RO	U16	Vph-N unbalance rate	× 0.01, unit: %

5.2 Energy Data Register List

(In 3P3W system, no each phase energy, only total energy)

Register Address	Access	Type	Description	Remark
40101	RO	S32	1 st quadrant, phase A kWh	× 0.1, unit: kWh (no value in 3P3W system)
40102			1 st quadrant, phase B kWh	
40103	RO	S32	1 st quadrant, phase C kWh	
40104			1 st quadrant, total kWh	
40105	RO	S32	1 st quadrant, phase A kvarh	× 0.1, unit: kvarh (no value in 3P3W
40106			1 st quadrant, phase B kvarh	
40107	RO	S32	1 st quadrant, phase A kvarh	(no value in 3P3W
40108			1 st quadrant, phase B kvarh	
40109	RO	S32	1 st quadrant, phase A kvarh	(no value in 3P3W
40110			1 st quadrant, phase B kvarh	
40111	RO	S32	1 st quadrant, phase B kvarh	

40112				system)
40113	RO	S32	1 st quadrant, phase C kvarh	
40114				
40115	RO	S32	1 st quadrant, total kvarh	
40116				
40117	RO	S32	2 nd quadrant, phase A kWh	
40118				
40119	RO	S32	2 nd quadrant, phase B kWh	× 0.1, unit: kWh
40120				
40121	RO	S32	2 nd quadrant, phase C kWh	(no value in 3P3W system)
40122				
40123	RO	S32	2 nd quadrant, total kWh	
40124				
40125	RO	S32	2 nd quadrant, phase A kvarh	
40126				
40127	RO	S32	2 nd quadrant, phase B kvarh	× 0.1, unit: kvarh
40128				
40129	RO	S32	2 nd quadrant, phase C kvarh	(no value in 3P3W system)
40130				
40131	RO	S32	2 nd quadrant, total kvarh	
40132				
40133	RO	S32	3 rd quadrant, phase A kWh	
40134				
40135	RO	S32	3 rd quadrant, phase B kWh	× 0.1, unit: kWh
40136				
40137	RO	S32	3 rd quadrant, phase C kWh	(no value in 3P3W system)
40138				
40139	RO	S32	3 rd quadrant, total kWh	
40140				
40141	RO	S32	3 rd quadrant, phase A kvarh	
40142				
40143	RO	S32	3 rd quadrant, phase B kvarh	× 0.1, unit: kvarh
40144				
40145	RO	S32	3 rd quadrant, phase C kvarh	(no value in 3P3W system)
40146				
40147	RO	S32	3 rd quadrant, total kvarh	
40148				
40149	RO	S32	4 th quadrant, phase A kWh	× 0.1, unit: kWh

40150				(no value in 3P3W system)
40151	RO	S32	4 th quadrant, phase B kWh	
40152				
40153	RO	S32	4 th quadrant, phase C kWh	
40154				
40155	RO	S32	4 th quadrant, total kWh	
40156				× 0.1, unit: kvarh
40157	RO	S32	4 th quadrant, phase A kvarh	
40158				
40159	RO	S32	4 th quadrant, phase B kvarh	
40160				
40161	RO	S32	4 th quadrant, phase C kvarh	
40162				(no value in 3P3W system)
40163	RO	S32	4 th quadrant, total kvarh	
40164				
40165	RO	S32	Reserved (for Phase A kVAh)	
40166				
40167	RO	S32	Reserved (for Phase B kVAh)	
40168				× 0.1, unit: kVAh
40169	RO	S32	Reserved (for Phase C kVAh)	
40170				
40171	RO	S32	Reserved (for Total kVAh)	
40172				
40173	RO	S32	Total kWh (of 4 quadrant)	
40174				× 0.1, unit: kWh
40175	RO	S32	Total kvarh (of 4 quadrant)	
40176				

5.3. Harmonic Data Register List

Register Address	Access	Type	Description	Remark
40201	RO	U16	Phase A voltage crest factor	× 0.001
40202	RO	U16	Phase B voltage crest factor	
40203	RO	U16	Phase C voltage crest factor	
40204	RO	U16	Phase A current K factor	× 0.001
40205	RO	U16	Phase B current K factor	
40206	RO	U16	Phase C current K factor	

40207	RO	U16	THD for Va	× 0.001
40208	RO	U16	THD for Vb	
40209	RO	U16	THD for Vc	
40210	RO	U16	THD for Ia	× 0.001
40211	RO	U16	THD for Ib	
40212	RO	U16	THD for Ia	
40213	RO	U16	TEHD for Va	× 0.001
40214	RO	U16	TEHD for Vb	
40215	RO	U16	TEHD for Vc	
40216	RO	U16	TEHD for Ia	× 0.001
40217	RO	U16	TEHD for Ib	
40218	RO	U16	TEHD for Ic	
40219	RO	U16	TOHD for Va	× 0.001
40220	RO	U16	TOHD for Vb	
40221	RO	U16	TOHD for Vc	
40222	RO	U16	TOHD for Ia	× 0.001
40223	RO	U16	TOHD for Ib	
40224	RO	U16	TOHD for Ic	
40225	RO	U16	2 nd harmonic ratio for Va	× 0.001, unit: %
40226	RO	U16	3 rd harmonic ratio for Va	
40227-40253	RO	U16	...	
40254	RO	U16	31 st harmonic ratio for Va	× 0.001, unit: %
40255	RO	U16	2 nd harmonic ratio for Vb	
40256	RO	U16	3 rd harmonic ratio for Vb	
40257-40283	RO	U16	...	× 0.001, unit: %
40284	RO	U16	31 st harmonic ratio for Vb	
40285	RO	U16	2 nd harmonic ratio for Vc	
40286	RO	U16	3 rd harmonic ratio for Vc	× 0.001, unit: %
40287-40313	RO	U16	...	
40314	RO	U16	31 st harmonic ratio for Vc	
40315	RO	U16	2 nd harmonic ratio for Ia	× 0.001, unit: %
40316	RO	U16	3 rd harmonic ratio for Ia	
40317-40343	RO	U16	...	
40344	RO	U16	31 st harmonic ratio for Ia	× 0.001, unit: %
40345	RO	U16	2 nd harmonic ratio for Ib	
40346	RO	U16	3 rd harmonic ratio for Ib	
40347-40373	RO	U16	...	× 0.001, unit: %
40374	RO	U16	31 st harmonic ratio for Ib	

40375	RO	U16	2 nd harmonic ratio for I _c	× 0.001, unit: %
40376	RO	U16	3 rd harmonic ratio for I _c	
40377-40403	RO	U16	...	
40404	RO	U16	31 st harmonic ratio for I _c	
40405	RO	U16	DC component for V _a	× 0.01, unit: V
40406	RO	U16	Fundamental RMS for V _a	
40407	RO	U16	2 nd harmonic RMS for V _a	
40408	RO	U16	3 rd harmonic RMS for V _a	
40409-40435	RO	U16	...	
40436	RO	U16	31 st harmonic RMS for V _a	× 0.01, unit: V
40437	RO	U16	DC component for V _b	
40438	RO	U16	Fundamental RMS for V _b	
40439	RO	U16	2 nd harmonic RMS for V _b	
40440	RO	U16	3 rd harmonic RMS for V _a	
40441-40467	RO	U16	...	
40468	RO	U16	31 st harmonic RMS for V _b	× 0.01, unit: V
40469	RO	U16	DC component for V _c	
40470	RO	U16	Fundamental RMS for V _c	
40471	RO	U16	2 nd harmonic RMS for V _c	
40472	RO	U16	3 rd harmonic RMS for V _c	
40473-40499	RO	U16	...	
40500	RO	U16	31 st harmonic RMS for V _c	
40501	RO	U16	DC component for I _a	× 0.0001, unit: A
40502	RO	U16	Fundamental RMS for I _a	
40503	RO	U16	2 nd harmonic RMS for I _a	
40504	RO	U16	3 rd harmonic RMS for I _a	
40505-40531	RO	U16	...	
40532	RO	U16	31 st harmonic RMS for I _a	× 0.0001, unit: A
40533	RO	U16	DC component for I _b	
40534	RO	U16	Fundamental RMS for I _b	
40535	RO	U16	2 nd harmonic RMS for I _b	
40536	RO	U16	3 rd harmonic RMS for I _b	
40537-40563	RO	U16	...	
40564	RO	U16	31 st harmonic RMS for I _b	× 0.0001, unit: A
40565	RO	U16	DC component for I _c	
40566	RO	U16	Fundamental RMS for I _c	
40567	RO	U16	2 nd harmonic RMS for I _c	
40568	RO	U16	3 rd harmonic RMS for I _c	

40569-40595	RO	U16	...	
40596	RO	U16	31 st harmonic RMS for Ic	
40597	RO	S32	Ptot of fundamental	× 0.1, unit: W
40598				
40599	RO	S32	Ptot of 2 nd harmonic	
40600				
40601	RO	S32	Ptot of 3 rd harmonic	
40602				
40603-40656	RO	S32	...	
40657	RO	S32	Ptot of 31 st harmonic	
40658				

5.4 Harmonic Energy Data Register List

Register Address	Access	Type	Description	Remark
40801	RO	U32	Total kWh of fundamental	× 0.1, unit: kWh
40802				
40803	RO	U32	Total kWh of 2 nd harmonic	
40804				
40805	RO	U32	Total kWh of 3 rd harmonic	
40806				
40807-40824	RO	U32	...	
40825	RO	U32	Total kWh of 13 th harmonic	
40826				

5.5 Demand Data Register List

Real-time Demand:

Register Address	Access	Type	Description	Remark
40901	RO	U16	Demand for Ia	× 0.0001, unit: A
40902	RO	U16	Demand for Ib	
40903	RO	U16	Demand for Ic	
40904	RO	S32	Demand for Ptot	× 0.1, unit: W
40905				
40906	RO	S32	Demand for Qtot	× 0.1, unit: var
40907				
40908	RO	U16	Demand for Stot	× 0.1, unit: VA

Max. Demand:

Register Address	Access	Type	Description	Remark
40951	RO	U16	Max. demand for Ia	× 0.0001, unit: A
40952	RO	U32	Time	Unix system time
40953				Low word first, high word second
40954	RO	U16	Max. demand for Ib	× 0.0001, unit: A
40955	RO	U32	Time	Unix system time
40956				Low word first, high word second
40957	RO	U16	Max. demand for Ic	× 0.0001, unit: A
40958	RO	U32	Time	Unix system time
40959				Low word first, high word second
40960	RO	S32	Max. demand for Ptot	× 0.1, unit: W
40961				
40962	RO	U32	Time	Unix system time
40963				Low word first, high word second
40964	RO	S32	Max. demand for Qtot	× 0.1, unit: var
40965				
40966	RO	U32	Time	Unix system time
40967				Low word first, high word second
40968	RO	U16	Max. demand for Stot	× 0.1, unit: VA
40969	RO	U32	Time	Unix system time
40970				Low word first, high word second

5.6 Max./ Min. Data Register List

Register Address	Access	Type	Description	Remark
41001	RO	S16	Max. Va	× 0.01, unit: V
41002	RO	U32	Time	Unix system time
41003	RO			Low word first, high word second
41004	RO	S16	Max. Vb	× 0.01, unit: V
41005	RO	U32	Time	Unix system time
41006	RO			Low word first, high word second

41007	RO	S16	Max. Vc	× 0.01, unit: V
41008	RO	U32	Time	Unix system time
41009	RO			Low word first, high word second
41010	RO	S16	Max. Vab	× 0.01, unit: V
41011	RO	U32	Time	Unix system time
41012	RO			Low word first, high word second
41013	RO	S16	Max. Vbc	× 0.01, unit: V
41014	RO	U32	Time	Unix system time
41015	RO			Low word first, high word second
41016	RO	S16	Max. Vca	× 0.01, unit: V
41017	RO	U32	Time	Unix system time
41018	RO			Low word first, high word second
41019	RO	S16	Max. Ia	× 0.0001, unit: A
41020	RO	U32	Time	Unix system time
41021	RO			Low word first, high word second
41022	RO	S16	Max. Ib	× 0.0001, unit: A
41023	RO	U32	Time	Unix system time
41024	RO			Low word first, high word second
41025	RO	S16	Max. Ic	× 0.0001, unit: A
41026	RO	U32	Time	Unix system time
41027	RO			Low word first, high word second
41028	RO	S16	Max. Pa	× 0.1, unit: W
41029	RO	U32	Time	Unix system time
41030	RO			Low word first, high word second
41031	RO	S16	Max. Pb	× 0.1, unit: W
41032	RO	U32	Time	Unix system time
41033	RO			Low word first, high word second
41034	RO	S16	Max. Pc	× 0.1, unit: W
41035	RO	U32	Time	Unix system time
41036	RO			Low word first, high word second
41037	RO	S16	Max. Qa	× 0.1, unit: var
41038	RO	U32	Time	Unix system time
41039	RO			Low word first, high word second
41040	RO	S16	Max. Qb	× 0.1, unit: var
41041	RO	U32	Time	Unix system time
41042	RO			Low word first, high word second
41043	RO	S16	Max. Qc	× 0.1, unit: var
41044	RO	U32	Time	Unix system time

41045	RO			Low word first, high word second
41046	RO	S16	Min. Va	× 0.01, unit: V
41047	RO	U32	Time	Unix system time
41048	RO			Low word first, high word second
41049	RO	S16	Min. Vb	× 0.01, unit: V
41050	RO	U32	Time	Unix system time
41051	RO			Low word first, high word second
41052	RO	S16	Min. Vc	× 0.01, unit: V
41053	RO	U32	Time	Unix system time
41054	RO			Low word first, high word second
41055	RO	S16	Min. Vab	× 0.01, unit: V
41056	RO	U32	Time	Unix system time
41057	RO			Low word first, high word second
41058	RO	S16	Min. Vbc	× 0.01, unit: V
41059	RO	U32	Time	Unix system time
41060	RO			Low word first, high word second
41061	RO	S16	Min. Vca	× 0.01, unit: V
41062	RO	U32	Time	Unix system time
41063	RO			Low word first, high word second
41064	RO	S16	Min. Ia	× 0.0001, unit: A
41065	RO	U32	Time	Unix system time
41066	RO			Low word first, high word second
41067	RO	S16	Min. Ib	× 0.0001, unit: A
41068	RO	U32	Time	Unix system time
41069	RO			Low word first, high word second
41070	RO	S16	Min. Ic	× 0.0001, unit: A
41071	RO	U32	Time	Unix system time
41072	RO			Low word first, high word second
41073	RO	S16	Min. Pa	× 0.1, unit: W
41074	RO	U32	Time	Unix system time
41075	RO			Low word first, high word second
41076	RO	S16	Min. Pb	× 0.1, unit: W
41077	RO	U32	Time	Unix system time
41078	RO			Low word first, high word second
41079	RO	S16	Min. Pc	× 0.1, unit: W
41080	RO	U32	Time	Unix system time
41081	RO			Low word first, high word second
41082	RO	S16	Min. Qa	× 0.1, unit: var

41083	RO	U32	Time	Unix system time
41084	RO			Low word first, high word second
41085	RO	S16	Min. Qb	× 0.1, unit: var
41086	RO	U32	Time	Unix system time
41087	RO			Low word first, high word second
41088	RO	S16	Min. Qc	× 0.1, unit: var
41089	RO	U32	Time	Unix system time
41090	RO			Low word first, high word second
41091	RO	S16	Max. Va of previous 1 st day	× 0.01, unit: V
41092	RO	U32	Time	Unix system time
41093	RO			Low word first, high word second
41094	RO	S16	Max. Vb of previous 1 st day	× 0.01, unit: V
41095	RO	U32	Time	Unix system time
41096	RO			Low word first, high word second
41097	RO	S16	Max. Vc of previous 1 st day	× 0.01, unit: V
41098	RO	U32	Time	Unix system time
41099	RO			Low word first, high word second
41100	RO	S16	Max. Ia of previous 1 st day	× 0.0001, unit: A
41101	RO	U32	Time	Unix system time
41102	RO			Low word first, high word second
41103	RO	S16	Max. Ib of previous 1 st day	× 0.0001, unit: A
41104	RO	U32	Time	Unix system time
41105	RO			Low word first, high word second
41106	RO	S16	Max. Ic of previous 1 st day	× 0.0001, unit: A
41107	RO	U32	Time	Unix system time
41108	RO			Low word first, high word second
41109	RO	S16	Max. Pa of previous 1 st day	× 0.1, unit: W
41110	RO	U32	Time	Unix system time
41111	RO			Low word first, high word second
41112	RO	S16	Max. Pb of previous 1 st day	× 0.1, unit: W
41113	RO	U32	Time	Unix system time
41114	RO			Low word first, high word second
41115	RO	S16	Max. Pc of previous 1 st day	× 0.1, unit: W
41116	RO	U32	Time	Unix system time
41117	RO			Low word first, high word second
41118	RO	S16	Max. Qa of previous 1 st day	× 0.1, unit: var
41119	RO	U32	Time	Unix system time
41120	RO			Low word first, high word second

41121	RO	S16	Max. Qb of previous 1 st day	× 0.1, unit: var
41122	RO	U32	Time	Unix system time
41123	RO			Low word first, high word second
41124	RO	S16	Max. Qc of previous 1 st day	× 0.1, unit: var
41125	RO	U32	Time	Unix system time
41126	RO			Low word first, high word second
41127	RO	S16	Min. Va of previous 1 st day	× 0.01, unit: V
41128	RO	U32	Time	Unix system time
41129	RO			Low word first, high word second
41130	RO	S16	Min. Vb of previous 1 st day	× 0.01, unit: V
41131	RO	U32	Time	Unix system time
41132	RO			Low word first, high word second
41133	RO	S16	Min. Vc of previous 1 st day	× 0.01, unit: V
41134	RO	U32	Time	Unix system time
41135	RO			Low word first, high word second
41136	RO	S16	Min. Ia of previous 1 st day	× 0.0001, unit: A
41137	RO	U32	Time	Unix system time
41138	RO			Low word first, high word second
41139	RO	S16	Min. Ib of previous 1 st day	× 0.0001, unit: A
41140	RO	U32	Time	Unix system time
41141	RO			Low word first, high word second
41142	RO	S16	Min. Ic of previous 1 st day	× 0.0001, unit: A
41143	RO	U32	Time	Unix system time
41144	RO			Low word first, high word second
41145	RO	S16	Min. Pa of previous 1 st day	× 0.1, unit: W
41146	RO	U32	Time	Unix system time
41147	RO			Low word first, high word second
41148	RO	S16	Min. Pb of previous 1 st day	× 0.1, unit: W
41149	RO	U32	Time	Unix system time
41150	RO			Low word first, high word second
41151	RO	S16	Min. Pc of previous 1 st day	× 0.1, unit: W
41152	RO	U32	Time	Unix system time
41153	RO			Low word first, high word second
41154	RO	S16	Min. Qa of previous 1 st day	× 0.1, unit: var
41155	RO	U32	Time	Unix system time
41156	RO			Low word first, high word second
41157	RO	S16	Min. Qb of previous 1 st day	× 0.1, unit: var
41158	RO	U32	Time	Unix system time

41159	RO			Low word first, high word second
41160	RO	S16	Min. Qc of previous 1 st day	× 0.1, unit: var
41161	RO	U32	Time	Unix system time
41162	RO			Low word first, high word second

5.7 TOU (Multi-tariff) Data Register List

Register Address	Access	Type	Description	Remark
42001	RO	U32	Import kWh of tariff 1#	× 0.1, unit: kWh
42002			Export kWh of tariff 1#	
42003	RO	U32	Import kWh of tariff 1#	
42004			Export kWh of tariff 1#	
42005	RO	U32	Import kvarh of tariff 1#	× 0.1, unit: kvarh
42006			Export kvarh of tariff 1#	
42007	RO	U32	Import kWh of tariff 2#	
42008			Export kWh of tariff 2#	
42009	RO	U32	Import kWh of tariff 2#	× 0.1, unit: kWh
42010			Export kWh of tariff 2#	
42011	RO	U32	Import kWh of tariff 2#	
42012			Export kWh of tariff 2#	
42013	RO	U32	Import kvarh of tariff 2#	× 0.1, unit: kvarh
42014			Export kvarh of tariff 2#	
42015	RO	U32	Import kWh of tariff 3#	
42016			Export kWh of tariff 3#	
42017	RO	U32	Import kWh of tariff 3#	× 0.1, unit: kWh
42018			Export kWh of tariff 3#	
42019	RO	U32	Import kWh of tariff 3#	
42020			Export kWh of tariff 3#	
42021	RO	U32	Import kvarh of tariff 3#	× 0.1, unit: kvarh
42022			Export kvarh of tariff 3#	
42023	RO	U32	Import kWh of tariff 4#	
42024			Export kWh of tariff 4#	
42025	RO	U32	Import kWh of tariff 4#	× 0.1, unit: kWh
42026			Export kWh of tariff 4#	
42027	RO	U32	Import kWh of tariff 4#	
42028			Export kWh of tariff 4#	

42029	RO	U32	Import kvarh of tariff 4#	× 0.1, unit: kvarh	
42030					
42031	RO	U32	Export kvarh of tariff 4#		
42032					
42033	RO	U32	Import kWh of previous 1 st day	× 0.1, unit: kWh	
42034					
42035	RO	U32	Export kWh of previous 1 st day		
42036					
42037	RO	U32	Import kvarh of previous 1 st day	× 0.1, unit: kvarh	
42038					
42039	RO	U32	Export kvarh of previous 1 st day		
42040					
42041	RO	U32	Time		
42042					
42043	RO	U32	Import kWh of previous 2 nd day		× 0.1, unit: kWh
42044					
42045	RO	U32	Export kWh of previous 2 nd day		
42046					
42047	RO	U32	Import kvarh of previous 2 nd day	× 0.1, unit: kvarh	
42048					
42049	RO	U32	Export kvarh of previous 2 nd day		
42050					
42051	RO	U32	Time		
42052					
42053-42332	RO	U32	...		
42333	RO	U32	Import kWh of previous 31 st day		× 0.1, unit: kWh
42334					
42335	RO	U32	Export kWh of previous 31 st day		
42336					
42337	RO	U32	Import kvarh of previous 31 st day	× 0.1, unit: kvarh	
42338					
42339	RO	U32	Export kvarh of previous 31 st day		
42340					
42341	RO	U32	Time		
42342					
42343	RO	U32	Import kWh of tariff 1# in previous 1 st month		× 0.1, unit: kWh
42344					
42345	RO	U32	Export kWh of tariff 1# in		

42346			previous 1 st month	
42347	RO	U32	Import kvarh of tariff 1# in	× 0.1, unit: kvarh
42348			previous 1 st month	
42349	RO	U32	Export kvarh of tariff 1# in	× 0.1, unit: kvarh
42350			previous 1 st month	
42351	RO	U32	Import kWh of tariff 2# in	× 0.1, unit: kWh
42352			previous 1 st month	
42353	RO	U32	Export kWh of tariff 2# in	× 0.1, unit: kWh
42354			previous 1 st month	
42355	RO	U32	Import kvarh of tariff 2# in	× 0.1, unit: kvarh
42356			previous 1 st month	
42357	RO	U32	Export kvarh of tariff 2# in	× 0.1, unit: kvarh
42358			previous 1 st month	
42359	RO	U32	Import kWh of tariff 3# in	× 0.1, unit: kWh
42360			previous 1 st month	
42361	RO	U32	Export kWh of tariff 3# in	× 0.1, unit: kWh
42362			previous 1 st month	
42363	RO	U32	Import kvarh of tariff 3# in	× 0.1, unit: kvarh
42364			previous 1 st month	
42365	RO	U32	Export kvarh of tariff 3# in	× 0.1, unit: kvarh
42366			previous 1 st month	
42367	RO	U32	Import kWh of tariff 4# in	× 0.1, unit: kWh
42368			previous 1 st month	
42369	RO	U32	Export kWh of tariff 4# in	× 0.1, unit: kWh
42370			previous 1 st month	
42371	RO	U32	Import kvarh of tariff 4# in	× 0.1, unit: kvarh
42372			previous 1 st month	
42373	RO	U32	Export kvarh of tariff 4# in	× 0.1, unit: kvarh
42374			previous 1 st month	
42375	RO	U32	Time	
42376				
42377	RO	U32	Import kWh of tariff 1# in	× 0.1, unit: kWh
42378			previous 2 nd month	
42379	RO	U32	Export kWh of tariff 1# in	× 0.1, unit: kWh
42380			previous 2 nd month	
42381	RO	U32	Import kvarh of tariff 1# in	× 0.1, unit: kvarh
42382			previous 2 nd month	
42383	RO	U32	Export kvarh of tariff 1# in	

42384			previous 2 nd month	
42385	RO	U32	Import kWh of tariff 2# in	× 0.1, unit: kWh
42386			previous 2 nd month	
42387	RO	U32	Export kWh of tariff 2# in	
42388			previous 2 nd month	
42389	RO	U32	Import kvarh of tariff 2# in	× 0.1, unit: kvarh
42390			previous 2 nd month	
42391	RO	U32	Export kvarh of tariff 2# in	
42392			previous 2 nd month	
42393	RO	U32	Import kWh of tariff 3# in	× 0.1, unit: kWh
42394			previous 2 nd month	
42395	RO	U32	Export kWh of tariff 3# in	
42396			previous 2 nd month	
42397	RO	U32	Import kvarh of tariff 3# in	× 0.1, unit: kvarh
42398			previous 2 nd month	
42399	RO	U32	Export kvarh of tariff 3# in	
42400			previous 2 nd month	
42401	RO	U32	Import kWh of tariff 4# in	× 0.1, unit: kWh
42402			previous 2 nd month	
42403	RO	U32	Export kWh of tariff 4# in	
42404			previous 2 nd month	
42405	RO	U32	Import kvarh of tariff 4# in	× 0.1, unit: kvarh
42406			previous 2 nd month	
42407	RO	U32	Export kvarh of tariff 4# in	
42408			previous 2 nd month	
42409	RO	U32	Time	
42410				
42411-42716	RO	U32	...	
42717	RO	U32	Import kWh of tariff 1# in	× 0.1, unit: kWh
42718			previous 12 th month	
42719	RO	U32	Export kWh of tariff 1# in	
42720			previous 12 th month	
42721	RO	U32	Import kvarh of tariff 1# in	× 0.1, unit: kvarh
42722			previous 12 th month	
42723	RO	U32	Export kvarh of tariff 1# in	
42724			previous 12 th month	
42725	RO	U32	Import kWh of tariff 2# in	× 0.1, unit: kWh
42726			previous 12 th month	

42727	RO	U32	Export kWh of tariff 2# in	
42728			previous 12 th month	
42729	RO	U32	Import kvarh of tariff 2# in	× 0.1, unit: kvarh
42730			previous 12 th month	
42731	RO	U32	Export kvarh of tariff 2# in	
42732			previous 12 th month	
42733	RO	U32	Import kWh of tariff 3# in	× 0.1, unit: kWh
42734			previous 12 th month	
42735	RO	U32	Export kWh of tariff 3# in	
42736			previous 12 th month	
42737	RO	U32	Import kvarh of tariff 3# in	× 0.1, unit: kvarh
42738			previous 12 th month	
42739	RO	U32	Export kvarh of tariff 3# in	
42740			previous 12 th month	
42741	RO	U32	Import kWh of tariff 4# in	× 0.1, unit: kWh
42742			previous 12 th month	
42743	RO	U32	Export kWh of tariff 4# in	
42744			previous 12 th month	
42745	RO	U32	Import kvarh of tariff 4# in	× 0.1, unit: kvarh
42746			previous 12 th month	
42747	RO	U32	Export kvarh of tariff 4# in	
42748			previous 12 th month	
42749	RO	U32	Time	
42750				

5.8 Frequency Deviation Record Register List

Register Address	Access	Type	Description	Remark
43001	RO	U16	Over limit event Num. of frequency deviation	Read independently
43002-43006	RO		No. 1 event log	Read simultaneously
43007-43011	RO		No. 2 event log	Read simultaneously
43012-43146	RO		...	
43147-43151	RO		No. 30 event log	Read simultaneously

The content of the 5 registers for frequency deviation

Register Address	Access	Type	Description	Remark
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1	RO	U16	1 st word for frequency deviation event	Frequency deviation value, × 0.01, unit: Hz
2	RO	U16	2 nd word for frequency deviation event	Event occurs time, seconds, UNIX system time, low word
3	RO	U16	3 rd word for frequency deviation event	Event occurs time, seconds, UNIX system time, high word
4	RO	U16	4 th word for frequency deviation event	Event end time, seconds, UNIX system time, low word
5	RO	U16	5 th word for frequency deviation event	Event end time, seconds, UNIX system time, high word

5.9 Voltage Deviation Record Register List

Register Address	Access	Type	Description	Remark
43201	RO	U16	Over limit event Num. of voltage deviation	Read independently
43202-43207	RO		No. 1 event log	Read simultaneously
43208--43213	RO		No. 2 event log	Read simultaneously
43214-43346	RO		...	
43376-43381	RO		No. 30 event log	Read simultaneously

The content of the 6 registers for frequency deviation

Register Address	Access	Type	Description	Remark
1	RO	U16	1 st word for voltage deviation event	Phase voltage deviation, 0—Va 1—Vb 2—Vc
2	RO	U16	2 nd word for voltage deviation event	Voltage deviation value, × 0.01, unit: %
3	RO	U16	3 rd word for voltage deviation event	Event occurs time, seconds, UNIX system time, low word
4	RO	U16	4 th word for voltage deviation event	Event occurs time, seconds, UNIX system time, high word
5	RO	U16	5 th word for voltage deviation event	Event end time, seconds, UNIX system time, low word
6	RO	U16	6 th word for voltage deviation event	Event end time, seconds, UNIX system time, high word

5.10 Voltage Unbalance Record Register List

Register	Access	Type	Description	Remark
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Address				
43401	RO	U16	Num. of over limit event in present day	
43402	RO	U16	Num. of over limit event in present month	
43403	RO	U16	Total Num. of over limit event	
43404-43408	RO		Max. voltage unbalance event in present month	
43409-43413	RO		Max. voltage unbalance event in history	
43414-43418	RO		No. 1 event	Read simultaneously
43419-43423	RO		No. 2 event	Read simultaneously
43424-43558	RO		...	
43559-43563	RO		No. 30 event	Read simultaneously

The content of the 5 registers for voltage unbalance

Register Address	Access	Type	Description	Remark
1	RO	U16	1 st word for voltage unbalance event	Voltage unbalance rate, × 0.01, unit: %
2	RO	U16	2 nd word for voltage unbalance event	Event occurs time, seconds, UNIX system time, low word
3	RO	U16	3 rd word for voltage unbalance event	Event occurs time, seconds, UNIX system time, high word
4	RO	U16	4 th word for voltage unbalance event	Event end time, seconds, UNIX system time, low word
5	RO	U16	5 th word for voltage unbalance event	Event end time, seconds, UNIX system time, high word

5.11 SOE (Event Log) Register List

Register Address	Access	Type	Description	Remark
44001	RO	U16	Num. of event (SOE)	Read independently
44002-44007	RO		No. 1 event	Read simultaneously
44008-44013	RO		No. 2 event	Read simultaneously
44014-44595	RO		...	
44596-44601	RO		No. 100 event	Read simultaneously

The content of the 6 registers for SOE

Register Address	Access	Type	Description	Remark
1	RO	U16	1 st word for SOE	Type of event
2	RO	U16	2 nd word for SOE	Value, low word

3	RO	U16	3 rd word for SOE	Value, high word
4	RO	U16	4 th word for SOE	Event occurs time, millisecond
5	RO	U16	5 th word for SOE	Event occurs time, seconds, UNIX system time, low word
6	RO	U16	6 th word for SOE	Event occurs time, seconds, UNIX system time, high word

5.12 System Parameter Register List

Register Address	Access	Type	Description	Remark
45001	RW	U16	CT primary	1 to 9999 (× 1A)
45002	RW	U16	Connection mode	0 to 1 0--3-phase 4-wire 1--3-pase 3-wire
45003	RW	U16	PT primary	1 to 650 (× 0.1kV)
45004	RW	U16	Address of RS485 COM 1	1 to 247
45005	RW	U16	Baudrate of RS485 COM 1	0 to 4 0--2400 1--4800 2--9600 3--19200 4--38400
45006	RW	U16	Parity check of RS485 COM 1	0 to 2 0—No parity 1—Odd 2--Even
45007	RW	U16	Stop bit of RS485 COM 1	1 to 2 1—1 bit stop 2—2 bit stop
45008	RW	U16	Address of RS485 COM 2	1 to 247
45009	RW	U16	Baudrate of RS485 COM 2	0 to 4 0--2400 1--4800 2--9600 3--19200 4--38400
45010	RW	U16	Parity check of RS485 COM 2	0 to 2 0—No parity

				1—Odd 2--Even
45011	RW	U16	Stop bit of RS485 COM 2	1 to 2 1—1 bit stop 2—2 bit stop
45012	RW	U16	Profibus address	1 to 127
45013	RW	U16	Demand calculation mode	0 to 1 0—Fixed block 1—Rolling block
45014	RW	U16	Demand interval	0 to 4 0--5min 1--10min 2--15min 3--30min 4--60min
45015	RW	U16	Subinterval	0 to 3 0--1min 1--2min 2--3min 3--5min
45016	RW	U16	Multi-tariff mode	0 to 1 0—Time zone mode 1—Holiday mode
45017	RW	U16	Starting time, 1 st time zone	257 to 4657 High 8 bit --Month Low 8 bit--Day
45018	RW	U16	Starting time , 2 nd time zone ,	257 to 4657 High 8 bit --Month Low 8 bit--Day
45019	RW	U16	Num. of period for tariff list -1	1 to 8
45020	RW	U16	The rate at 1 st period, tariff list-1	0 to 3
45021	RW	U16	Starting time, 1 st period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45022	RW	U16	The rate at 2 nd period, tariff list-1	0 to 3
45023	RW	U16	Starting time, 2 nd period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45024	RW	U16	The rate at 3 rd period, tariff list-1	0 to 3
45025	RW	U16	Starting time, 3 rd period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute

45026	RW	U16	The rate at 4 th period, tariff list-1	0 to 3
45027	RW	U16	Starting time, 4 th period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45028	RW	U16	The rate at 5 th period, tariff list-1	0 to 3
45029	RW	U16	Starting time, 5 th period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45030	RW	U16	The rate at 6 th period, tariff list-1	0 to 3
45031	RW	U16	Starting time, 6 th period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45032	RW	U16	The rate at 7 th period, tariff list-1	0 to 3
45033	RW	U16	Starting time, 7 th period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45034	RW	U16	The rate at 8 th period, tariff list-1	0 to 3
45035	RW	U16	Starting time, 8 th period, tariff list-1,	0 to 9029 High 8 bit – Hour Low 8 bit— Minute
45036	RW	U16	Num. of period for tariff list -2	Same as tariff list-1
45037	RW	U16	The rate at 1 st period, tariff list-2	Same as tariff list-1
45038	RW	U16	Starting time, 1 st period, tariff list-2	Same as tariff list-1
45039	RW	U16	The rate at 2 nd period, tariff list-2	Same as tariff list-1
45040	RW	U16	Starting time, 2 nd period, tariff list-2,	Same as tariff list-1
45041	RW	U16	The rate at 3 rd period, tariff list-2	Same as tariff list-1
45042	RW	U16	Starting time, 3 rd period, tariff list-2,	Same as tariff list-1
45043	RW	U16	The rate at 4 th period, tariff list-2	Same as tariff list-1
45044	RW	U16	Starting time, 4 th period, tariff list-2,	Same as tariff list-1
45045	RW	U16	The rate at 5 th period, tariff list-2	Same as tariff list-1
45046	RW	U16	Starting time, 5 th period, tariff list-2	Same as tariff list-1
45047	RW	U16	The rate at 6 th period, tariff list-2	Same as tariff list-1
45048	RW	U16	Starting time, 6 th period, tariff list-2	Same as tariff list-1
45049	RW	U16	The rate at 7 th period, tariff list-2	Same as tariff list-1
45050	RW	U16	Starting time, 7 th period, tariff list-2,	Same as tariff list-1
45051	RW	U16	The rate at 8 th period, tariff list-2	Same as tariff list-1
45052	RW	U16	Starting time, 8 th period, tariff list-2,	Same as tariff list-1
45053	RW	U16	Pulse constant, pulse output -1	1000 to 9999
45054	RW	U16	Object, pulse output-1	0
45055	RW	U16	Pulse width, pulse output-1	60 to 100, unit: ms

45056	RW	U16	Pulse constant, pulse output -2	1000 to 9999
45057	RW	U16	Object, pulse output-2	1
45058	RW	U16	Pulse width, pulse output-2	60 to 100, unit: ms
45059	RW	U16	Object, analog output-1	0 to 13, 0-- Null 1-- Va 2--Vb 3--Vc 4--Vab 5--Vbc 6--Vca 7--Ia 8--Ib 9--Ic 10--Ptot 11--Qtot 12--PFtot 13--Frequency
45060	RW	U16	Magnification factor, analog output-1	
45061	RW	U16	Object, analog output-2	Same as analog output-1
45062	RW	U16	Magnification factor, analog output-2	Same as analog output-1
45063	RW	U16	Control mode, relay-1	0 to 1 0-- Local 1-- Remote
45064	RW	U16	Object, relay-1	0 to 26 0--Null 1--Frequency 2--Va 3--Vb 4--Vc 5--Neutral voltage 6--Average Vph-N 7--Vab 8--Vbc 9--Vca 10--Average Vph-ph 11--Ia 12--Ib 13--Ic 14--Neutral current 15--Average current 16--PFa 17--PFb

				18--PFc 19--PFtot 20—Voltage unbalance 21—THD for Va 22—THD for Vb 23—THD for Vc 24—THD for Ia 25—THD for Ib 26—THD for Ic
45065	RW	U16	Upper limit, relay-1	0—120, unit: %
45066	RW	U16	Lower limit, relay-1	0—120, unit: %
45067	RW	U16	Delay time, relay-1	0—99, unit: second
45068	RW	U16	Release time, relay-1	0—99, unit: second
45069	RW	U16	Control mode, relay-2	Same as relay-1
45070	RW	U16	Object, relay-2	Same as relay-1
45071	RW	U16	Upper limit, relay-2	Same as relay-1
45072	RW	U16	Lower limit, relay-2	Same as relay-1
45073	RW	U16	Delay time, relay-2	Same as relay-1
45074	RW	U16	Release time, relay-2	Same as relay-1
45075	RW	U16	Control mode, relay-3	Same as relay-1
45076	RW	U16	Object, relay-3	Same as relay-1
45077	RW	U16	Upper limit, relay-3	Same as relay-1
45078	RW	U16	Lower limit, relay-3	Same as relay-1
45079	RW	U16	Delay time, relay-3	Same as relay-1
45080	RW	U16	Release time, relay-3	Same as relay-1
45081	RW	U16	Control mode, relay-4	Same as relay-1
45082	RW	U16	Object, relay-4	Same as relay-1
45083	RW	U16	Upper limit, relay-4	Same as relay-1
45084	RW	U16	Lower limit, relay-4	Same as relay-1
45085	RW	U16	Delay time, relay-4	Same as relay-1
45086	RW	U16	Release time, relay-4	Same as relay-1
45087	RW	U16	Frequency deviation limit	0 to 1000 ($\times 0.01\text{Hz}$)
45088	RW	U16	Voltage deviation limit	0 to 10000 ($\times 0.01\%$)
45089	RW	U16	Voltage unbalance limit	0 to 10000 ($\times 0.01\%$)

5.13 Command Data Register List

Register address	Access	Type	Description	Remark
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45201	WO	U16	Clear energy data (kWh & kvarh)	Write 888
45202	WO	U16	Clear SOE event log	Write 888
45203	WO	U16	Clear Max./ Min. data	Write 888
45204	WO	U16	Clear voltage unbalance event at present day	Write 888
45205	WO	U16	Clear voltage unbalance event at present month	Write 888
45206	WO	U16	Clear voltage unbalance event in history	Write 888
45207	WO	U16	Clear voltage deviation event	Write 888
45208	WO	U16	Clear frequency deviation event	Write 888
45209	WO	U16	Clear Max. demand data	Write 888
45210	WO	U16	Reset to factory default setting	Write 888

5.14 Memory Storage Register List

Note:

Use function code 10H to send the retrieval command:

Steps for reading the data from Memory Storage

1. Do the data retrieval before read the data from memory. Firstly send retrieval command (i.e. retrieval data string), write the retrieval command string to register address: 47001 ~ 47006 (write this 6 registers simultaneously, otherwise, the data retrieval will not success), then read the data from register: 47007~47033. One time can retrieve 4 history data record.

For example: If we need to read the 2nd string of data on March 28, 2012, firstly write “0, 12, 3, 28, 2, 4” to register 47001 ~ 47006, then read the 4 history data record from the register 47007~47033. Every data record must have the time point.

2. The procedure to read data from memory: Firstly write to register 47001~47006, secondly read register 47007~47108..

For example: If we need to read the 2nd string of data on March 28, 2012, firstly write “0, 12, 3, 28, 2, 1” to register 47001 ~ 47006, then read the register 47007~47108.

For example: If user get the data from Register 47009 is 38190, then the actual value = 38190 × calculation factor= 38190 ×0.01= 381.90, so the actual Vab = 381.90V

3. If read the invalid file, invalid time point, or file of future time, the meter will respond ERROR “ER” 0x4552

4. The register 47005 (time point), 1 point means 5 mins. The meter calculates the point from the time when the meter is powered ON of that day. In case the meter is power off during the day, it will calculate the point continuously.

For example:

Status of Power Meter	Time	Time point
Power ON	00: 00 ~01:00	1 to 12 Point 1—00:05

		Point 2—00:10 Point 3—00:15 ... Point 11—00:55 Point 12—01:00
Power OFF	01:00 ~02:00	(no data, no record)
Power ON	02:00 ~24:00	13 to 24 Point 13—02:05 Point 14—02:10 Point 15—02: 15 ... Point 274—23:50 Point 275—23:55 Point 276—24:00

Register address	Access	Type	Description	Remark
47001	WO	U16	Reserved	Write 0
47002	WO	U16	Year	0 to 99
47003	WO	U16	Month	1 to 12
47004	WO	U16	Day	1 to 31
47005	WO	U16	Time point	1 to 288 Refer to above Note-4
47006	WO	U16	Data record num.	1 to 4
47007	RO	U16	UNIX system time of the first time point, low word	
47008	RO	U16	UNIX system time of the first time point, high word	
47009	RO	U16	Vab, time point 1	× 0.01
47010	RO	U16	Vbc, time point 1	× 0.01
47011	RO	U16	Vca, time point 1	× 0.01
47012	RO	U16	Va, time point 1	× 0.01
47013	RO	U16	Vb, time point 1	× 0.01
47014	RO	U16	Vc, time point 1	× 0.01
47015	RO	U16	Ia, time point 1	× 0.0001
47016	RO	U16	Ib, time point 1	× 0.0001
47017	RO	U16	Ic, time point 1	× 0.0001
47018	RO	U16	Frequency, time point 1	× 0.01
47019	RO	U16	Voltage unbalance, time point 1	× 0.01

47020	RO	S16	PFa, time point 1	× 0.001
47021	RO	S16	PFb, time point 1	× 0.001
47022	RO	S16	PFc, time point 1	× 0.001
47023	RO	U16	THD for Va, time point 1	× 0.001
47024	RO	U16	THD for Vb, time point 1	× 0.001
47025	RO	U16	THD for Vc, time point 1	× 0.001
47026	RO	U16	Demand for Ia, time point 1	× 0.0001
47027	RO	U16	Demand for Ib, time point 1	× 0.0001
47028	RO	U16	Demand for Ic, time point 1	× 0.0001
47029~47030	RO	S32	Demand for Ptot, time point 1	× 0.1
47031~47032	RO	S32	Demand for Qtot, time point 1	× 0.1
47033	RO	U16	Demand for Stot, time point 1	× 0.1
47034~47060	RO		Data of time point 2	
47061~47087	RO		Data of time point 3	
47088~47114	RO		Data of time point 4	

5.15. Devise Information Register List

Register address	Access	Type	Description	Remark
49001	RW	U32	Device ID	
49002				
49003	RW	U32	Manufacturing No.	
49004				
49005	RW	U16	Hardware version	
49006	RO	U16	Software version	-
49007-49010	-		Reserved	-
49011	RW	U32	Timing, low word	The Num. of second from Jan. 1, 1970, Greenwich mean time, support radio command
49012			Timing, high word	
49013	RO	U16	Error code	
49014	RW	U16	Second	0 to 59
49015	RW	U16	Minute	0 to 59
49016	RW	U16	Hour	0 to 23
49017	RW	U16	Day	1 to 31
49018	RW	U16	Month	1 to 12
49019	RW	U16	Year	0 to 99

Note:

1. The UNIX system time register 49011~49012 must write simultaneously.

2. The Clock register 49014~49019 must read/ write simultaneously. Time of origin: Jan 1, 2000.