
SPM93
MODBUS PROTOCOL
AND REGISTER LIST
V1.3

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1. Communication Protocol

1.1. Introduction

This part describes the Modbus communications protocol employed by the SPM93 and how to pass information into and out of the SPM93 in a Modbus network.

1.1.1 Purpose of the Communication Protocol

The purpose of the SPM93 Modbus communications protocol is to allow setup information and measured data to be efficiently transferred between a Modbus Master Station and a SPM93. This includes:

- 1) Allowing configuration and interrogation of all SPM93 set-up parameters from a Modbus Master Station.
- 2) Allowing interrogation of all data measured by SPM93.

1.1.2 Version of Communication Protocol

The version is proper for all SPM93, which have leaved Pilot. If any change happens later, it will be indicated.

1.2. Detailed Description of SPM93 Modbus Protocol

1.2.1 SPM93 Modbus Protocol Rules

The following rules define the protocol for information transfer between a Modbus Master device and the SPM93 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 "Packet", a packet being simply a serial string of 8-bit bytes. The maximum number of bytes contained within one packet is 128. 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.

1.2.2 Modes of Transmission

Modbus protocol supports ASCII and RTU modes of transmissions. The SPM93 supports only the RTU mode of transmission with **8 data bits, no parity, and 1 stop bit.**

1.2.3 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

1.2.3.1 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. The respond packet of Slave should be its own address.

1. 2.3.2 Function Field

The Function Field is 1-byte long and tells the addressed slave which function to perform. The Modbus functions supported by the SPM93 are listed in below Figure.

Function	Meaning	Action
0x01	Read Relay Output Status	Obtains ON/ OFF information of one or more relay output in SPM93 (0/1)
0x03	Read Registers	Obtains the current value in one or more holding registers of the SPM93.
0x05	Relay control	Write 0xFF00 to close (ON) the relay Write 0x0000 to open (OFF) the relay
0x10	Preset Registers	Places specific binary values into a series of consecutive holding registers of the SPM93

1.2.3.3 Data Field

The Data Field varies in length depending on whether the message is a request or a response packet. This field typically contains information required by the Slave device to perform the command specified in a request packet or data being passed back by the Slave device in a response packet.

In general, registers are transmitted in the order of high-order byte first, low order byte second.

For Example 2.1

One 16-bit register has the content 0x12AB, the register is transmitted:

High order byte = 0x12

Low order byte = 0xAB

1.2.3.4 Error Check Field (Checksum)

This field allows the receiving device to determine if a packet has been corrupted with transmission errors. 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.

2.1 Exception Responses

If a Modbus master device sends a noneffective command to a SPM93 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 Figure describes the exception codes supported by the SPM93 and their possible causes.

Name of Function Code	Meaning
01H	SPM93 only support function code: 01H, 02H, 03H, 05H. This code indicates the Slave device receives noneffective function code, or receives an error command.
02H	Receive a noneffective operation or the length of package exceeds 128 bytes.
03H	The requested data start from an uncompleted address

2.2 Broadcast Packets

The SPM93 supports broadcast commands when communicating in MODBUS mode.

Do write command 0x10 for timing.

3. Packet Communication

Two MODBUS functions are supported by the SPM93. 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 holding register.

Section 3.3 will describe the relay control command

Section 3.4 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→SPM93)		Response Packet (SPM93→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 = output num. ÷ 8, if remainder ≠ 0, then N=N+1.

3.2. Read Holding Registers (Function Code 03H)

This command packet requests that the SPM93 responds all valid registers. The value of reserved registers is 0.

Request Packet (Master→SPM93)		Response Packet (SPM93→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

3.3 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→SPM93)		Response Packet (SPM93→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

3.4Preset Multiple Registers (Function code 10H)

This command packet allows the Master to program the SPM93 setup parameters.

Preset Registers Format (Master→SPM93)		Response Format (SPM93→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: SPM93 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 (ones and zeros). 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. The receiving device performs the same operation on the entire packet

including the checksum. The packet, when divided by the generator polynomial, should give a zero remainder if no transmission errors have occurred. In calculating the CRC, all arithmetic operations (additions and subtractions) are performed using MODULO TWO, or EXCLUSIVE OR operation.

Steps for 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.

Below is an example to calculate CRC checksum for a hexadecimal byte 6403:

Steps	Byte	Operation	Register	Bit#	Shifts
2		Initial value	1111 1111 1111 1111		
	1	Load the first data byte	0000 0000 0110 0100		
3		XOR	1111 1111 1001 1011		
4		Shift 1 bit to right	0111 1111 1100 1101	1	1
5a		XOR generator polynomial	1101 1111 1100 1100		
4		Shift 1 bit to right	0110 1111 1110 0110	2	0
4		Shift 1 bit to right	0011 0111 1111 0011	3	0
4		Shift 1 bit to right	0001 1011 1111 1001	4	1
5a		XOR generator polynomial	1011 1011 1111 1000		
4		Shift 1 bit to right	0101 1101 1111 1100	5	0
4		Shift 1 bit to right	0010 1110 1111 1110	6	0
4		Shift 1 bit to right	0001 0111 0111 1111	7	0
4		Shift 1 bit to right	0000 1011 1011 1111	8	1
5a		XOR generator polynomial	1010 1011 1011 1110		
	2	Load the second data byte	0000 0000 0000 0011		
7		XOR	1010 1011 1011 1101		
4		Shift 1 bit to right	0101 0101 1101 1110	1	1
5a		XOR generator polynomial	1111 0101 1101 1111		
4		Shift 1 bit to right	0111 1010 1110 1111	2	1

5a		XOR generator polynomial	1101 1010 1110 1110		
4		Shift 1 bit to right	0110 1101 0111 0111	3	0
4		Shift 1 bit to right	0011 0110 1011 1011	4	1
5a		XOR generator polynomial	1001 0110 1011 1010		
4		Shift 1 bit to right	0100 1011 0101 1101	5	0
4		Shift 1 bit to right	0010 0101 1010 1110	6	1
5a		XOR generator polynomial	1000 0101 1010 1111		
4		Shift 1 bit to right	0100 0010 1101 0111	7	1
5a		XOR generator polynomial	1110 0010 1101 0110		
4		Shift 1 bit to right	0111 0001 0110 1011	8	0
		CRC-16	0111 0001 0110 1011		

5. SPM93 Register List

All SPM93 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, the MODBUS master reads register **xxxx-1** from the slave. For example register 40011 corresponds to register 10.

Data Type:

Items	Access and Type	Description
-------	-----------------	-------------

1	RO	Read only
2	WO	Write only
3	RW	Read or Write
4	UINT16	Unsigned 16 digits integer
5	INT16	Signed 16 digits integer
6	LUINT32	Unsigned 32 digits integer
7	LINT32	Signed 32 digits integer
8	WORD16	Bit denotation word, applicable to on-off or relay channel. D0 refers to the first on-off or relay channel. D1 refers to the second on-off or relay channel The rest bits may be deduced by analogy Bit 0 refers to "off", and bit 1 refers to "on"

Note: LUINT32 including 2 register address

LINT32 including 2 register address

5.1 Real-time value register list

5.1.1 Common used real time value register

Register No.	Access	Definition	Data Type	Remarks	
40001	RO	Va (ph-N)	UINT16	× 0.01, unit: V	
40002	RO	Vb (ph-N)		× 0.01, unit: V	
40003	RO	Vc (ph-N)		× 0.01, unit: V	
40004	RO	Ia	LUINT32	× 0.001, unit: A	
40005	RO			× 0.001, unit: A	
40006	RO	Ib		× 0.001, unit: A	
40007	RO			× 0.001, unit: A	
40008	RO	Ic		× 0.001, unit: A	
40009				× 0.001, unit: A	
40010	RO	Frequency		UINT16	× 0.01, unit: Hz, Secondary value
40011	RO	Total Power Factor		INT16	× 0.001, Secondary value
40012	RO	Total apparent		LUINT32	× 0.01, Unit:

40013	RO	power		VA, Secondary value		
40014	RO	Total active energy	LUINT32	× 0.1, unit: kWh, primary value		
40015						
40016	RO	Total reactive energy	LUINT32	× 0.1, unit: kvarh, primary value		
40017						
40018	RO	Phase A active power	LINT32	× 0.01, unit: W		
40019						
40020	RO	Phase B active power		LINT32	× 0.01, unit: W	
40021						
40022	RO	Phase C active power			LINT32	× 0.01, unit: W
40023						
40024	RO	Total active power	LINT32			× 0.01, unit: W
40025						
40026	RO	Phase A reactive power	LINT32	× 0.01, unit: var		
40027						
40028	RO	Phase B reactive power	LINT32	× 0.01, unit: var		
40029						
40030	RO	Phase C reactive power	LINT32	× 0.01, unit:		

40031		power		var
40032	RO	Total reactive	LINT32	× 0.01, unit:
40033		power		var

5.1.2 All Real time value register

Register No.	Access	Definition	Data Type	Remarks
40101	RO	Va (ph-N)	UINT16	× 0.01, unit: V
40102	RO	Vb (ph-N)		× 0.01, unit: V
40103	RO	Vc (ph-N)		× 0.01, unit: V
40104	RO	Vab (ph-ph)		× 0.01, unit: V
40105	RO	Vbc (ph-ph)		× 0.01, unit: V
40106	RO	Vca (ph-ph)		× 0.01, unit: V
40107	RO	la	LUINT32	× 0.001, unit: A
40108				
40109	RO	lb		× 0.001, unit: A
40110				
40111	RO	lc		× 0.001, unit: A
40112				
40113	RO	Average current		× 0.001, unit:

40114				A
40115	RO	Phase A active	LINT32	× 0.01, unit: W
40116		power		
40117	RO	Phase B active		× 0.01, unit: W
40118		power		
40119	RO	Phase C active		× 0.01, unit: W
40120		power		
40121	RO	Total active		× 0.01, unit: W
40122		power		
40123	RO	Phase A reactive		× 0.01, unit:
40124		power		var
40125	RO	Phase B reactive	× 0.01, unit:	
40126		power	var	
40127	RO	Phase C reactive	× 0.01, unit:	
40128		power	var	
40129	RO	Total reactive	× 0.01, unit:	
40130		power	var	
40131	RO	Phase A	LUINT32	× 0.01, unit:
40132		apparent power		VA
40133	RO	Phase B		× 0.01, unit:
40134		apparent power	VA	

40135	RO	Phase C apparent power	INT16	× 0.01, unit: VA
40136				
40137	RO	Total apparent power		× 0.01, unit: VA
40138				
40139	RO	Phase A power factor	INT16	× 0.001
40140	RO	Phase B power factor		× 0.001
40141	RO	Phase C power factor		× 0.001
40142	RO	Total power factor		× 0.001
40143	RO	Frequency	UUINT16	× 0.01, unit: Hz
40144	RO	Loaded Timing	LUINT32	Resolution is 0.1 hour
40145				
40146	RO	Over-voltage timing		
40147		Under-voltage timing		

5.2 Energy Data Registers

Register No.	Access	Description	Data Type	Remark
41001	RO	Imp. kWh	LUINT32	× 0.1, unit: kWh
41002				
41003	RO	Exp. kWh		× 0.1, unit: kWh
41004				
41005	RO	Total kWh		× 0.1, unit: kWh
41006				
41007	RO	Imp. kvarh		× 0.1, unit: kvarh
41008				
41009	RO	Exp. kvarh		× 0.1, unit: kvarh
41010				
41011	RO	Total kvarh		× 0.1, unit: kvarh
41012				
41013	RO	Total kWh of tariff 1#		× 0.1, unit: kWh
41014				
41015	RO	Total kWh of tariff 2#		× 0.1, unit: kWh
41016				
41017	RO	Total kWh of tariff 3#		× 0.1, unit: kWh
41018				

41019	RO	Total kWh of tariff 4#	LUINT32	× 0.1, unit: kWh
41020				
41021	RO	Total kvarh of tariff 1#		× 0.1, unit: kvarh
41022				
41023	RO	Total kvarh of tariff 2#		× 0.1, unit: kvarh
41024				
41025	RO	Total kvarh of tariff 3#		× 0.1, unit: kvarh
41026				
41027	RO	Total kvarh of tariff 4#		× 0.1, unit: kvarh
41028				
41029	RO	Reserve		× 0.1, unit: kWh
41030				
41031	RO	Reserve		× 0.1, unit: kvarh
41032				

5.3 Historical Energy Data Registers

5.3.1 Daily Energy Data Registers

Register No.	Access	Description	Remark
41201	RO	Num. of the record	Must read this register alone
41202-41215	RO	Record of last 1st day	Must read this 14 registers

			together
41216-41229	RO	Record of last 2nd day	Must read this 14 registers together
41230-41621	RO
41622-41635	RO	Record of last 31 st day	Must read this 14 registers together

Content of the daily energy data:

Register No.	Access	Description	Data type	Remark
1	RO	Time	LUINT32	Unix time, year, month
2				
3	RO	Total Imp. kWh		× 0.1, unit: kWh
4				
5	RO	Total Exp. kWh		× 0.1, unit: kWh
6				
7	RO	Total kWh		× 0.1, unit: kWh
8				
9	RO	Total Imp. kvarh		× 0.1, unit: kvarh
10				
11	RO	Total Exp. kvarh		× 0.1, unit: kvarh
12				

13	RO	Total kvarh		× 0.1, unit: kvarh
14				

5.3.2 Monthly Energy Data Registers

Register No.	Access	Description	Remark
42001	RO	Num. of the record	Must read this one register alone
42002-42015	RO	Record of last 1st month	Must read this 14 registers together
42016-42029	RO	Record of last 2nd month	Must read this 14 registers together
42030-42155	RO
42156-42169	RO	Record of last 12th month	Must read this 14 registers together

Content of the monthly energy data:

Register No.	Access	Description	Data Type	Remark
1	RO	Time	LUINT32	Unix time, year, month
2				
3	RO	Imp. kWh		× 0.1, unit: kWh
4				
5	RO	Exp. kWh		

6				
7	RO	Total kWh		× 0.1, unit: kWh
8				
9	RO	Imp. kvarh		× 0.1, unit: kvarh
10				
11	RO	Exp. kvarh		× 0.1, unit: kvarh
12				
13	RO	Total kvarh		× 0.1, unit: kvarh
14				

5.3.3 Yearly Energy Data Registers

Register No.	Access	Description	Remark
43001	RO	Num. of the record	Must read this one register alone
43002-43015	RO	Record of last 1st year	Must read this 14 registers together
43016-43029	RO	Record of last 2nd year	Must read this 14 registers together
43030-43127	RO
43128-43141	RO	Record of last 10th year	Must read this 14 registers together

Content of the yearly energy data:

Register No.	Access	Description	Data Type	Remark
1	RO	Time	LUINT32	Unix time, year,
2				month

3	RO	Imp. kWh		× 0.1, unit: kWh
4				
5	RO	Exp. kWh		× 0.1, unit: kWh
6				
7	RO	Total kWh		× 0.1, unit: kWh
8				
9	RO	Imp. kvarh		× 0.1, unit: kvarh
10				
11	RO	Exp. kvarh		× 0.1, unit: kvarh
12				
13	RO	Total kvarh		× 0.1, unit: kvarh
14				

5.3.4 Day Freeze Energy Data Registers

Register No.	Access	Description	Remark
43501	RO	Present day Freezed kWh value	
43502	RO	Time	Unix Time
43503			
43504	RO	Present day 0:00 Total Active	
43505		Energy	
43506	RO	Present day 0:15 Total Active	

43507		Energy	
43508	RO	Present day 0:30 Total Active	
43509		Energy	
43510	RO	Present day 0:45 Total Active	
43511		Energy	
43512	RO	Present day 1:00 Total Active	
43513		Energy	
43514	RO	Present day 1:15 Total Active	
43515		Energy	
43516	RO	Present day 1:30 Total Active	
43517		Energy	
43518	RO	Present day 1:45 Total Active	
43519		Energy	
43520	RO	Present day 2:00 Total Active	
43521		Energy	
43522	RO	Present day 2:15 Total Active	
43523		Energy	
43524	RO	Present day 2:30 Total Active	
43525		Energy	
43526	RO	Present day 2:45 Total Active	

43527		Energy	
43528	RO	Present day 3:00 Total Active	
43529		Energy	
43530	RO	Present day 3:15 Total Active	
43531		Energy	
43532	RO	Present day 3:30 Total Active	
43533		Energy	
43534	RO	Present day 3:45 Total Active	
43535		Energy	
43536	RO	Present day 4:00 Total Active	
43537		Energy	
43538	RO	Present day 4:15 Total Active	
43539		Energy	
43540	RO	Present day 4:30 Total Active	
43541		Energy	
43542	RO	Present day 4:45 Total Active	
43543		Energy	
43544	RO	Present day 5:00 Total Active	
43545		Energy	
43546	RO	Present day 5:15 Total Active	

43547		Energy	
43548	RO	Present day 5:30 Total Active	
43549		Energy	
43550	RO	Present day 5:45 Total Active	
43551		Energy	
43552	RO	Present day 6:00 Total Active	
43553		Energy	
43554	RO	Present day 6:15 Total Active	
43555		Energy	
43556	RO	Present day 6:30 Total Active	
43557		Energy	
43558	RO	Present day 6:45 Total Active	
43559		Energy	
43560	RO	Present day 7:00 Total Active	
43561		Energy	
43562	RO	Present day 7:15 Total Active	
43563		Energy	
43564	RO	Present day 7:30 Total Active	
43565		Energy	
43566	RO	Present day 7:45 Total Active	

43567		Energy	
43568	RO	Present day 8:00 Total Active	
43569		Energy	
43570	RO	Present day 8:15 Total Active	
43571		Energy	
43572	RO	Present day 8:30 Total Active	
43573		Energy	
43574	RO	Present day 8:45 Total Active	
43575		Energy	
43576	RO	Present day 9:00 Total Active	
43577		Energy	
43578	RO	Present day 9:15 Total Active	
43579		Energy	
43580	RO	Present day 9:30 Total Active	
43581		Energy	
43582	RO	Present day 9:45 Total Active	
43583		Energy	
43584	RO	Present day 10:00 Total Active	
43585		Energy	
43586	RO	Present day 10:15 Total Active	

43587		Energy	
43588	RO	Present day 10:30 Total Active	
43589		Energy	
43590	RO	Present day 10:45 Total Active	
43591		Energy	
43592	RO	Present day 11:00 Total Active	
43593		Energy	
43594	RO	Present day 11:15 Total Active	
43595		Energy	
43596	RO	Present day 11:30 Total Active	
43597		Energy	
43598	RO	Present day 11:45 Total Active	
43599		Energy	
43600	RO	Present day 12:00 Total Active	
43601		Energy	
43602	RO	Present day 12:15 Total Active	
43603		Energy	
43604	RO	Present day 12:30 Total Active	
43605		Energy	
43606	RO	Present day 12:45 Total Active	

43607		Energy	
43608	RO	Present day 13:00 Total Active	
43609		Energy	
43610	RO	Present day 13:15 Total Active	
43611		Energy	
43612	RO	Present day 13:30 Total Active	
43613		Energy	
43614	RO	Present day 13:45 Total Active	
43615		Energy	
43616	RO	Present day 14:00 Total Active	
43617		Energy	
43618	RO	Present day 14:15 Total Active	
43619		Energy	
43620	RO	Present day 14:30 Total Active	
43621		Energy	
43622	RO	Present day 14:45 Total Active	
43623		Energy	
43624	RO	Present day 15:00 Total Active	
43625		Energy	
43626	RO	Present day 15:15 Total Active	

43627		Energy	
43628	RO	Present day 15:30 Total Active	
43629		Energy	
43630	RO	Present day 15:45 Total Active	
43631		Energy	
43632	RO	Present day 16:00 Total Active	
43633		Energy	
43634	RO	Present day 16:15 Total Active	
43635		Energy	
43636	RO	Present day 16:30 Total Active	
43637		Energy	
43638	RO	Present day 16:45 Total Active	
43639		Energy	
43640	RO	Present day 17:00 Total Active	
43641		Energy	
43642	RO	Present day 17:15 Total Active	
43643		Energy	
43644	RO	Present day 17:30 Total Active	
43645		Energy	
43646	RO	Present day 17:45 Total Active	

43647		Energy	
43648	RO	Present day 18:00 Total Active	
43649		Energy	
43650	RO	Present day 18:15 Total Active	
43651		Energy	
43652	RO	Present day 18:30 Total Active	
43653		Energy	
43654	RO	Present day 18:45 Total Active	
43655		Energy	
43656	RO	Present day 19:00 Total Active	
43657		Energy	
43658	RO	Present day 19:15 Total Active	
43659		Energy	
43660	RO	Present day 19:30 Total Active	
43661		Energy	
43662	RO	Present day 19:45 Total Active	
43663		Energy	
43664	RO	Present day 20:00 Total Active	
43665		Energy	
43666	RO	Present day 20:15 Total Active	

43667		Energy	
43668	RO	Present day 20:30 Total Active	
43669		Energy	
43670	RO	Present day 20:45 Total Active	
43671		Energy	
43672	RO	Present day 21:00 Total Active	
43673		Energy	
43674	RO	Present day 21:15 Total Active	
43675		Energy	
43676	RO	Present day 21:30 Total Active	
43677		Energy	
43678	RO	Present day 21:45 Total Active	
43679		Energy	
43680	RO	Present day 22:00 Total Active	
43681		Energy	
43682	RO	Present day 22:15 Total Active	
43683		Energy	
43684	RO	Present day 22:30 Total Active	
43685		Energy	
43686	RO	Present day 22:45 Total Active	

43687		Energy	
43688	RO	Present day 23:00 Total Active	
43689		Energy	
43690	RO	Present day 23:15 Total Active	
43691		Energy	
43692	RO	Present day 23:30 Total Active	
43693		Energy	
43694	RO	Present day 23:45 Total Active	
43695		Energy	

note:

1. Present day freeze kWh data will refresh and update day by day, the data will be freeze each 15 mins, register 43502 & 43503 is present data start time.
2. The amount of present day freeze kWh be used to indicate the freezed kWh times.
Each time freeze will add + 1
3. Freeze total active energy is aggregate value

5.3.5 Yesterday Freeze Energy Data Registers

Register No.	Access	Description	Remark
43901	RO	Time	Unix Time
43902			
43903	RO	Yesterday 22:00	

43904		Total Active Energy	
43905	RO	Yesterday 22:15 Total Active Energy	
43906			
43907	RO	Yesterday 22:30 Total Active Energy	
43908			
43909	RO	Yesterday 22:45 Total Active Energy	
43910			
43911	RO	Yesterday 23:00	
43912		Total Active Energy	
43913	RO	Yesterday 23:15 Total Active Energy	
43914			
43915	RO	Yesterday 23:30 Total Active Energy	
43916			
43917	RO	Yesterday 23:45 Total Active Energy	
43918			

note:

1. Yesterday freeze kWh data is yesterday last two hours data saving [register 43901 & 43902]
2. Freeze total active energy is aggregate value

5.4 System parameter registers

Register No.	Access	Description	Data Type	Remark
44001	RO	Wiring mode	UINT16	0--1 0: 3-phase 4-wire 1: 3-phase 3-wire
44002	RW	CT ratio		1~1000
44003	RW	Address		1--247
44004	RW	Baud rate		0--3 0: 2400 1: 4800 2: 9600
44005	RW	Pulse constant		63A:200/400/800(imp/kWh)(imp/kvarh) 5A:3200/6400/12800(imp/kWh)(imp/kvarh) default : 63A:400(imp/kWh)(imp/kvarh) 5A:6400(imp/kWh)(imp/kvarh)
44006	RW	Pulse width		20—80(ms)

44007	RW	Object of pulse output-1		0--1 0: total kWh 1: total kvarh
44008	RW	Object of pulse output-2	UINT16	0--1 0: total kWh 1: total kvarh
44009	RW	Reserve		
44010	RW	Reserve		
44011	RW	Loaded upper limit		Setting value : Secondary side value Default: 4% Calculation factor: 0.001
44012	RW	Voltage upper limit		Setting value : Secondary side value
44013	RW	Voltage lower limit		Setting range of Voltage: 60%Un and 120%Un Unit: V Calculation Factor: 0.01

44014	RW	Multi-tariff mode		<p>0--2, default 1</p> <p>0: Time zone mode (Max. 2 time zone per year)</p> <p>1: Holiday mode1 (Mon.-Fri. Working day, Sat. - Sun. holiday)</p> <p>2: Holiday Mode2 (Sun. - Thu. Working day, Fri. - Sat. holiday)</p>
44015	RW	Start time of Time zone-1: month	UINT16	1--12 (only available when in multi tariff mode)
44016	RW	Start time of Time zone-1: day		1--31 (only available when in multi tariff mode)
44017	RW	Start time of Time zone-2: month		1--12 (only available when in multi tariff mode)
44018	RW	Start time of Time zone-2: day		1--31 (only available when in multi tariff mode)

				mode)
44019	RW	Num. of period for tariff list -1		1--8
44020	RW	The rate at 1st period, tariff list-1		0--3
44021	RW	Start time (hour), 1st period, tariff list-1		0--23
44022	RW	Start time (minute), 1st period, tariff list-1	UINT16	0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44023	RW	The rate at 2nd period, tariff list-1		0--3
44024	RW	Start time (hour), 2nd period, tariff list-1		0--23
44025	RW	Start time (minute), 2nd period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44026	RW	The rate at 3rd period, tariff list-1		0--3
44027	RW	Start time (hour), 3rd		0--23

		period, tariff list-1		
44028	RW	Start time (minute), 3rd period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44029	RW	The rate at 4th period, tariff list-1	UINT16	0--3
44030	RW	Start time (hour), 4th period, tariff list-1		0--23
44031	RW	Start time (minute), 4th period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44032	RW	The rate at 5th period, tariff list-1		0--3
44033	RW	Start time (hour), 5th period, tariff list-1		0--23
44034	RW	Start time (minute), 5th period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44035	RW	The rate at 6th period,	UINT16	0--3

		tariff list-1		
44036	RW	Start time (hour), 6th period, tariff list-1		0--23
44037	RW	Start time (minute), 6th period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44038	RW	The rate at 7th period, tariff list-1		0--3
44039	RW	Start time (hour), 7th period, tariff list-1		0--23
44040	RW	Start time (minute), 7th period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44041	RW	The rate at 8th period, tariff list-1	UJNT16	0--3
44042	RW	Start time (hour), 8th period, tariff list-1		0--23
44043	RW	Start time (minute), 8th period, tariff list-1		0 means 0 min. 1 means 15 min. 2 means 30 min.

				3 means 45 min.
44044	RW	Num. of period for tariff list -2		1--8
44045	RW	The rate at 1st period, tariff list-2		0--3
44046	RW	Start time (hour), 1st period, tariff list-2		0--23
44047	RW	Start time (minute), 1st period, tariff list-2	UINT16	0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44048	RW	The rate at 2nd period, tariff list-2		0--3
44049	RW	Start time (hour), 2nd period, tariff list-2		0--23
44050	RW	Start time (minute), 2nd period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44051	RW	The rate at 3rd period, tariff list-2		0--3
44052	RW	Start time (hour), 3rd		0--23

		period, tariff list-2		
44053	RW	Start time (minute), 3rd period, tariff list-2	UJINT16	0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44054	RW	The rate at 4th period, tariff list-2		0--3
44055	RW	Start time (hour), 4th period, tariff list-2		0--23
44056	RW	Start time (minute), 4th period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44057	RW	The rate at 5th period, tariff list-2		0--3
44058	RW	Start time (hour), 5th period, tariff list-2		0--23
44059	RW	Start time (minute), 5th period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44060	RW	The rate at 6th period,	UJINT16	0--3

		tariff list-2		
44061	RW	Start time (hour), 6th period, tariff list-2		0--23
44062	RW	Start time (minute), 6th period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44063	RW	The rate at 7th period, tariff list-2		0--3
44064	RW	Start time (hour), 7th period, tariff list-2		0--23
44065	RW	Start time (minute), 7th period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min. 3 means 45 min.
44066	RW	The rate at 8th period, tariff list-2	UJINT16	0--3
44067	RW	Start time (hour), 8th period, tariff list-2		0--23
44068	RW	Start time (minute), 8th period, tariff list-2		0 means 0 min. 1 means 15 min. 2 means 30 min.

			3 means 45 min.
44069	RW	kWh refresh to ZERO by Panel Operation	0--1 0: No 1: YES

Note: (1) When multi tariff mode be set as time zone mode, 1st time mode default tariff #1, 2nd time mode default tariff #2

(2) If the starting time of 1st time zone is not January 1st, then default 2nd time zone goes to new year

(3) When multi-tariff mode be set as holiday mode, working day default 1st day's tariff, holiday day default tariff #2

(4) If starting time of tariff #1 is not 0, then default the last tariff will pass 0' o clock.

5.5 Device information registers

Register No.	Access	Description	Data Type	Remark
49001	RW	Model No.	LUINT32	
49002				
49003	RW	S/N		
49004				
49005	RW	Hardware version No.	UINT16	

49006	RO	Software version No. for domestic market		
49007	RO	Reserve		Reserve
49008				
49009				
49010				
49011	RW	Timing	LUINT32	1 The Num. of second from Jan. 1, 1970, Greenwich mean time, support radio command
49012				
49013	RO	Error code	UINT16	
49014	RW	Second		0-59
49015	RW	Minute		0-59
49016	RW	Hour		0-23
49017	RW	Day		1-31
49018	RW	Month		1-12
49019	RW	Year		0-99

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.

5.6 Command data registers

Register No.	Access	Description	Remark
46001	WO	Clean Energy	Write 888
46002	WO	Clean historical energy	Write 888
46003	WO	Reserve	Reserve
46004	WO	Clean Timer	Write 888
46005	WO	Reserve	Reserve
46006	WO	Recover user default parameter	Write 888