Energiespeicher-Wechselrichter MODBUS-Überwachungskommunikationsprotokoll V1.5

1. Dokumentbeschreibung

Dieses Dokument definiert den Inhalt des RS485-Überwachungskommunikationsprotokolls unserer Produkte der Energiespeicher-Wechselrichterserie, einschließlich RS485-Kommunikationsrahmenformat, Definition der Modbus-Registeradresse,
Mengenkalibrierung usw. Das Protokoll folgt dem Modbus-RTU-Kommunikationsprotokoll, unterstützt die Funktionscodes 03, 06 und 10, und die Anzahl der Lese- und Schreibregister überschreitet 32 gleichzeitig nicht.

2. Serielle Kommunikationsparameter

9600,n,8,1, also Baudrate 9600, 8 Datenbits, keine Parität.
Der RS485-Verbindungsmodus ist ein Master und mehrere Slaves, und die Standardadresse des Wechselrichters ist 1, die eingestellt werden kann. Unterstützt 255 universelle Adressen, im Falle einer Eins-zu-Eins-Verbindung zwischen dem Host und dem Wechselrichter ist dies möglich Kommunikationszugriff auf den Wechselrichter über 255, die Adresse, auf die der Wechselrichter antwortet, ist die tatsächliche Adresse.

3. Data Format

slave address	function code	Data length or data content	CRC check
1 Byte	1 Byte	N Byte	2 Byte
Slave address range: 01H-FEH host broadcast address: 0 universal address: FFH	03H read multiple registers 06H write a single register 10H write multiple registers other invalid	related to the order	Check range: from the address of the slave to all before the CRC check data. Transmission sequence: The result calculated by CRC is 16-bit data, When actually transmitting, the low-order byte should be transmitted first, and the high-order byte should be transmitted later. are transmitted in section order.

3.1 Read data frame format

Host send frame format:

slave address	function code	data field				CRC check
1 Byte	1 Byte	4 Byte				2 Byte
physical address	03H	register high address byte	register low address byte	The number of registers N, high byte, usually 00H	The number of registers N, low byte, (N<=32)	CRC_L CRC_H

Slave returns data frame format:

slave address	function code	data field						CRC check
1 Byte	1 Byte	(2*N+1) bytes						2 Byte
		1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	. . .	
physical address	03H	bytes of returned data length	returned data					
			value of register 1		value of register 2			
			high byte	low byte	high byte	low byte		CRC_L CRC_H

Slave returns error frame format:

slave address	function code	error code	CRC check
1 Byte	1 Byte	1 Byte	2 Byte
physical address	83H	see error code table	CRC_L CRC_H

3.2 Write multiple dataframe formats

Host send frame format:

slave address	function code	data field						CRC check
1 Byte	1 Byte	5+2*N bytes						2 Byte
		1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2*N Byte	
physical address	10H	register address		number of registers		data length	The value of N registers high byte first low byte after	CRC_L CRC_H
		high byte	low byte	high byte	low byte	2*N		

Slave returns response frame format

slave address	function code	data field				CRC check
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte
physical address	10H	register address		number of registers		CRC_L CRC_H
		high byte	low byte	high byte	low byte	

Slave returns error frame format

slave address	function code	error code	CRC check
1 Byte	1 Byte	1 Byte	2 Byte
physical address	90H	see error code table	CRC_L CRC_H

3.3 Write a single dataframe format

Host send frame format:

slave address	function code	data field				CRC check
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte
physical address	06H	register address		register value		CRC_L CRC_H
		high byte	low byte	high byte	low byte	

Slave returns response frame format

slave address	function code	data field				CRC check
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte
physical address	06H	register address		register value		CRC_L CRC_H
		high byte	low byte	high byte	low byte	

Slave returns error frame format

slave address	function code	error code	CRC check
1 Byte	1 Byte	1 Byte	2 Byte
physical address	86H	see error code table	CRC_L CRC_H

3.4 Error code table

Code	Name	Meaning
01H	illegal order	The slave may not support the command
02H	illegal data address	The register address requested by the master exceeds the legal register address range defined by the slave
03H	invalid data value	The value of the register requested by the master is outside the range defined by the slave
04H	operation failed	The parameter is set to an invalid setting in the parameter write operation, or the current state of the slave does not support the execution of the command
05H	wrong password	The password written in the password verification address is wrong
06H	data frame error	In the frame information sent by the host, the length of the data frame is incorrect, and the CRC check digit in the RTU format is different from the check calculation number of the lower computer.
07H	parameter is read-only	Parameters changed during host write operations are read-only parameters
08H	parameters cannot be changed during operation	The parameters changed in the host write operation are parameters that cannot be changed during operation
09H	password protection	When the host reads or writes, if the user password is set and the password is not locked and unlocked, it will report that the system is locked
0AH	wrong length	The number of read and write registers exceeds the maximum supported number of 32
0BH	Insufficient permissions	Insufficient permission for this operation

4. CRC check calculation

The CRC field checks the content of the entire frame, that is, all the data from the slave address to the CRC check, the slave recalculates the CRC check data and compares it with the check value in the received data stream to judge the reception Data Validity. The CRC field is two-byte 16-bit binary value data, and the transmission sequence is to transmit the low-order byte first, and then transmit the high-order byte.
There are three ways to calculate the CRC check value. The calculation results of the three ways are the same, and you can choose freely according to the actual situation.

Method 1: Bitwise cycle calculation method

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char
data_length)
{
int i;
unsigned int crc_value=0xffff;
while(data_length--)
{
crc_value^=*data_value++;
for(i=0;i<8;i++)
{
if(crc_value&0x0001)
crc_value=(crc_value>>1)^0xa001;
else
crc_value=crc_value>>1;
}
}
return(crc_value);
}
```

Method 2: byte lookup table method

```
/* CRC value of high byte */
static unsigned int auchCRCHi[] =
{
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
```

```
0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40,
}

/* CRC value of low byte */
static unsigned int auchCRCLo[] =
{
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7,
0x05, 0xC5, 0xC4, 0x04,
0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B,
0xC9, 0x09, 0x08, 0xC8,
0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F,
0xDD, 0x1D, 0x1C, 0xDC,
0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
0x11, 0xD1, 0xD0, 0x10,
0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37,
0xF5, 0x35, 0x34, 0xF4,
0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A, 0x3B, 0xFB,
0x39, 0xF9, 0xF8, 0x38,
0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF,
0x2D, 0xED, 0xEC, 0x2C,
0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26, 0x22, 0xE2, 0xE3, 0x23,
0xE1, 0x21, 0x20, 0xE0,
0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67,
0xA5, 0x65, 0x64, 0xA4,
0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F, 0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB,
0x69, 0xA9, 0xA8, 0x68,
0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF,
0x7D, 0xBD, 0xBC, 0x7C,
0xB4, 0x74, 0x75, 0xB5, 0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73,
0xB1, 0x71, 0x70, 0xB0,
0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97,
0x55, 0x95, 0x94, 0x54,
0x9C, 0x5C, 0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B,
0x99, 0x59, 0x58, 0x98,
0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F,
0x8D, 0x4D, 0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83,
0x41, 0x81, 0x80, 0x40,
};

/* The function returns CRC as unsigned short */
/* Parameter puchMsg : message used to calculate CRC */
/* Parameter usDataLen: the number of bytes in the message */
unsigned int CRC16(unsigned int * puchMsg,unsigned int usDataLen)
{
     unsigned int uchCRCHi = 0xFF ;  /* CRC high byte initialization */
     unsigned int uchCRCLo = 0xFF ;  /* CRC low byte initialization */
     unsigned int uIndex ;           /* CRC lookup table index */
     while (usDataLen--) /* complete the entire message buffer */
     {
          uIndex = uchCRCLo ^ *puchMsg++ ; /* calculate CRC */
          uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex];
          uchCRCHi = auchCRCLo[uIndex];
     }
```

```
    return (uchCRCHi << 8 | uchCRCLo) ;
}
```

Method 3: word look-up table method

```
Static unsigned int tblCRC[] =
{
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,
0x01C6,0xC006,0x8007,0x41C7,0x0005,0xC1C5,0x81C4,0x4004,
0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,0x81CE,0x400E,
0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,
0x01D8,0xC018,0x8019,0x41D9,0x001B,0xC1DB,0x81DA,0x401A,
0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,
0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,
0x01D2,0xC012,0x8013,0x41D3,0x0011,0xC1D1,0x81D0,0x4010,
0x01F0,0xC030,0x8031,0x41F1,0x0033,0xC1F3,0x81F2,0x4032,
0x0036,0xC1F6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41F4,
0x003C,0xC1FC,0x81FD,0x403D,0x01FF,0xC03F,0x803E,0x41FE,
0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,
0x0028,0xC1E8,0x81E9,0x4029,0x01EB,0xC02B,0x802A,0x41EA,
0x01EE,0xC02E,0x802F,0x41EF,0x002D,0xC1ED,0x81EC,0x402C,
0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,
0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,
0x01A0,0xC060,0x8061,0x41A1,0x0063,0xC1A3,0x81A2,0x4062,
0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,0x41A4,
0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,
0x01AA,0xC06A,0x806B,0x41AB,0x0069,0xC1A9,0x81A8,0x4068,
0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,
0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,
0x01B4,0xC074,0x8075,0x41B5,0x0077,0xC1B7,0x81B6,0x4076,
0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071,0x8070,0x41B0,
0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192,
0x0196,0xC056,0x8057,0x4197,0x0055,0xC195,0x8194,0x4054,
0x019C,0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,
0x005A,0xC19A,0x819B,0x405B,0x0199,0xC059,0x8058,0x4198,
0x0188,0xC048,0x8049,0x4189,0x004B,0xC18B,0x818A,0x404A,
0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,
0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,
0x0182,0xC042,0x8043,0x4183,0x0041,0xC181,0x8180,0x4040,
};
/* The function returns CRC as unsigned short */
/* Parameter puchMsg: message used to calculate CRC*/
/* Parameter usDataLen: the number of bytes in the message */
unsigned int CRC16(unsigned int * puchMsg, unsigned int usDataLen)
{
    unsigned int uchCRCHi = 0xFF ; /* CRC high byte initialization */
    unsigned int uchCRCLo = 0xFF ; /* CRC low byte initialization */
    unsigned int uIndex ; /* CRC lookup table index */
    unsigned int hi,low;
    while (usDataLen--) /* complete the entire message buffer */
    {
        uIndex = uchCRCLo ^ *puchMsg++ ; /* Calculate CRC */
        hi = tblCRC[uIndex] >> 8;
        low = tblCRC[uIndex] & 0xff;
        uchCRCLo = uchCRCHi ^ hi;
```

```
            uchCRCHi = low;
        }
        return (uchCRCHi << 8 | uchCRCLo) ;
    }
```

5. Description of units and dimensions

Physical quantity	Unit	Magnification	Illustrate
Voltage (including AC and DC)	V	10	16-bit unsigned integer, range 0~65535, corresponding to 0V~6553.5V
Current (including AC and DC)	A	10	16-bit unsigned integer, range 0~65535, corresponding to 0A~6553.5A 16-bit signed integer, range -32767~32767, corresponding to -3276.7A~3276.7A
Frequency	HZ	100	16-bit unsigned integer, range 0~65535, corresponding to 0Hz~655.35Hz
Power (including AC and DC)	W	1	16-bit unsigned integer, range 0~65535, corresponding to 0W~65535W
power factor	/	1000	16-bit signed integer, range -32767~32767. For example: 998 means the power factor is 0.998 For example: -900 (0xFC7C) means that the power factor is -0.900
electricity	kWh	10	16-bit unsigned integer, range 0~65535, corresponding to 0kWh~6553.5kWh 32-bit unsigned integer, range 0~4294967295, corresponding to 0kWh~429496729.5kWh For example: 1 means 0.1kWh, 10 means 1kWh
battery capacity	Ah	1	16-bit unsigned integer, range 0~65535, corresponding to 0AH~65535Ah 32-bit unsigned integer, range 0~4294967295, corresponding to 0AH~4294967295Ah
temperature	°C	10	16-bit signed integer, range -32767~32767, corresponding to -3276.7°C~3276.7°C
Battery voltage setting value	V		All battery setting voltages in this agreement take 12V batteries as the unified dimension, that is, all battery setting voltage values are converted to the corresponding voltage of 12V. For example, the rated voltage of the battery is 48V, and the actual set voltage is 57.6V, then the set value is 57.6V/4=14.4V, and the value converted into the register is 14.4*10=144.

Note: When 32-bit data occupies two registers, the data is stored in the register using the little-endian mode, that is, the lower 16 bits of the data are in the lower address of the register, and the higher 16 bits of the data are in the higher address of the register. For example, the 32-bit data 0x12345678 is stored in two addresses 0x0001 and 0x0002, and the arrangement order in the register table is address 0x0001=0x5678, address 0x0002=0x1234.

Energy storage inverter MODBUS monitoring protocol register address table

illustrate:

1. Gray fonts indicate registers that are invalid for energy storage inverters

2. The magnification refers to the multiple of the actual value compared to the register value. For example, if the magnification is 0.1, the actual value is the value of the register * 0.1

Address	Length	Name	R / W	Magnification	Unit	Display Format	w/wo sign	Min. Value	Max. Vlue	Def. Value	Remark
P00 Product information area											
A	1	System maximum support voltage and rated charging current	R	1	-	%d	none				Not valid for inverters
B	1	product type	R	1	-	%d	none				product type 00 (controller, household) 01 (controller, street light) 03(Inverter) 04 (Control and inverter all-in-one machine) 05 (power frequency off-grid)
C	8	Product number	R	1	-	%s	none				Not valid for inverters
14	2	Software version	R	1	-	%d	none				0x0014: CPU1 version, such as 100, means V1.00 0x0015: CPU2 version, such as 100, means V1.00, reserved
16	2	hardware version	R	1	-	%d	none				0x0016: Control board version, such as 100, means V1.00 0x0017: power board version, such as 100, means V1.00, reserved
18	2	Product Serial Number	R	1	-	%x	none				Controller applies. Not valid for inverters
1A	1	Controller, device address	R	1	-	%d	none				Rs485 address, the address is read-only
1B	1	model code	R	1	-	%d	none				
1C	2	RS485 protocol version	R	1	-	%x	none				0x001C: protocol version, such as 100, means V1.00 0x001D: Reserved
1E	2	Production Date	R	1	-	%x	none				0x001E: high 8 bits: year, low 8 bits: month 0x001F: high 8 bits: day, low 8 bits: hour
20	1	Origin code	R	1	-	%x	none				0: Shenzhen 1: Dongguan
21	20	software compile time	R	1	-	%s	none				String format, the lower 8 bits of each register are valid, and the upper 8 bits are invalid
35	20	product serial number string	R	1	-	%s	none				String format, the lower 8 bits of each register are valid, and the upper 8 bits are invalid
49	1	reserve	R	1	-	%x	none				
P01 controller data area											
100	1	Battery power SOC	R	1	-	%d	none				Battery Remaining Percentage
101	1	battery voltage	R	0.1	V	%.1fV	none				Battery voltage, such as 485, means 48.5V
102	1	battery current	R	0.1	A	%.1fA	have				Battery current, such as 500, means 50.0A; A current greater than 0 means discharging; a current less than 0 means charging

103	1	Device temperature (controller)/battery temperature	R	1	°C	%d	have				(high 8 bits) controller temperature (lower 8 bits) battery temperature
104	1	Load (DC) voltage	R	0.1	V	%.1fV	none				
105	1	Load (DC) current	R	0.01	A	%.2fA	none				
106	1	Load (DC) power	R	1	W	%d	none				
107	1	Solar panel voltage	R	0.1	V	%.1fV	none				PV panel voltage
108	1	solar panel current	R	0.1	A	%.1fA	none				PV current
109	1	Solar panel power	R	1	W	%d	none				PV power
10A	1	DC load on/off command	W	1	-	%d	none				1 is to turn on the light, 0 is to turn off the light, the controller applies
10B	1	Load status and charging status	R	1	-	%d	none				0x0000: Chgarge off 0x0001: Quik charge 0x0002: Const voltage charge 0x0004: Float charge 0x0005: Reserved 0x0006: Li battery acitvate 0x0007: Reserved
10C	2	Controller failure and warning information	R	1	-	%d	none				Only the controller is valid, see 200~20B B31 Reserved for inverse control fault information
10E	1	charging power	R	1	W	%dW	none				Total charging power
10F	1	reserve	R	1		%d	none				reserve
P02 Inverter data area											
200	4	current fault bit	R	1		%x	none				Fault bits, each representing a fault, a total of 64 bits. This register is used by internal debug tools.
204	4	current fault code	R	1		%d	none				The current fault code has 4 addresses in total, and each address stores a fault code corresponding to the current fault, and can display 4 fault codes at the same time. 0 means no failure. For example, there are currently two faults: battery undervoltage and inverter overload. Then display as follows: 0x204: 01 0x205: 14 0x206: 00 0x207: 00
208	4	reserve	R	2		%x	none				reserve
20C	3	current time	R W	1		%zdt	none				0x020C: high 8 bits: year, low 8 bits: month 0x020D: high 8 bits: day, low 8 bits: hour 0x020E: high 8 bits: minutes, low 8 bits: seconds
20F	1	reserve									
210	1	machine current status	R	1		%d	none				0: power-on delay 1: waiting state 2: Initialize 3: Soft start 4: Mains running 5: inverter operation 6: Inverter to mains 7: Mains to inverter 8: Battery activated 9: Manual shutdown 10: failure
211	1	Password protection status flag	R	1	-	%d	none				0: The user has not entered a password 1: User password has been entered 4: The factory password has been entered
212	1	bus voltage	R	0.1	V	%.1fV	none				

213	1	power voltage	R	0.1	V	%.1fV	none				mains voltage
214	1	grid current	R	0.1	A	%.1fA	none				The input current of the mains side is applicable to the 2nd generation machine.
215	1	grid frequency	R	0.01	Hz	%2fHz	none				Mains frequency
216	1	inverter voltage	R	0.1	V	%.1fV	none				Inverter output voltage
217	1	inverter current	R	0.1	A	%.1fA	none				Inverter inductor current
218	1	inverter frequency	R	0.01	Hz	%2fHz	none				
219	1	load current	R	0.1	A	%.1fA	none				load side current
21A	1	Load PF	R	0.01	-	%.2f	have				
21B	1	load active power	R	1	W	%dW	none				
21C	1	load apparent power	R	1	W	%dW	none				
21D	1	Inverted DC component	R	1	mV	%dmV	have				
21E	1	Mains charging current	R	0.1	A	%.1fA	none				When the mains is charging, the battery side current.
21F	1	load factor	R	1	%	%d%	none				load percentage
220	1	Heat sink A temperature	R	0.1	°C	%.1f°C	have				DC-DC heat sink temperature
221	1	Heat sink B temperature	R	0.1	°C	%.1f°C	have				DC-AC radiator temperature
222	1	Heat sink C temperature	R	0.1	°C	%.1f°C	have				Transformer temperature
223	1	ambient temperature	R	0.1	°C	%.1f°C	have				
224	1	PV charging current	R	0.1	A	%.1fA	none				PV charging current
225	1	buck current 2	R	0.1	A	%.1fA	none				Applicable to the 1st generation machine, but not to the 2nd generation machine.
226	1	Inverter Fault Status (RV)	R	1		%d	none				Applies to custom models only
227	1	State of charge (RV)	R	1		%d	none				Applies to custom models only
P03 Equipment control area											
DF00	1	Switch control	W	1	-	%x	none				0: shutdown 1: boot Others: no action
DF01	1	reset control	W	1	-	%x	none				1: reset Others: no action
DF02	1	restore factory defaults	W	1	-	%x	none				0xAA: restore Others: no action Restoring factory defaults clears all accumulative information and restores the parameters to the default state. New launch takes effect
DF03	1	clear current alarm	W	1	-	%x	none				1: Clear Others: no action
DF04	1	clear statistics	W	1	-	%x	none				1: Clear Others: no action
DF05	1	clear history	W	1	-	%x	none				1: Clear Others: no action
DF06	2	Firmware upgrade command	W	1	-	%x	none				Firmware upgrade command
DF08	1	Sleep Control / Activation Command	W	1	-	%x	none				5A5A:sleep A5A5:run
DF09	3	manual light switch	W	1	-	%x	none				1: switch 1 on; 0 off 2: Lighting power 0~100% 3: Lighting time 0~ 54000S
DF0C	1	Generator switch command	W	1	-	%x	none				0: no action 1: switch to generator power supply
DF0D	1	Immediate equalization charge command	W	1		%d	none				0: disabled 1: enable

P04 Debug data area											
P05 Battery related parameter setting area											
E000	1	reserve	R W	1	-	%d	none	0	1	0	
E001	1	Photovoltaic maximum charging current setting	R W	0.1	A	%dA	none	0	100	60	PV charging current limit. 1st generation machine 50A, 2nd generation machine 60A.
E002	1	Battery nominal capacity	R W	1	Ah	%dAH	none	0	400	100	
E003	1	Battery rated voltage (read only)	R W	1	V	%dV	none	12	255	48	12 : 12V 24 : 24V 36 : 36V 48 : 48V
E004	1	battery type	R W	1	-	%d	none	0	14	3	0 : User define 1 : SLD 2 : FLD 3 : GEL 4: Lithinum iron phosphate x 14 5: Lithinum iron phosphate x 15 6: Lithinum iron phosphate x 16 7: Lithinum iron phosphate x 7 8: Lithinum iron phosphate x 8 9: Lithinum iron phosphate x 9 10: Ternary lithium x 7 11: Ternary lithium x 8 13: Ternary lithium x 13 14: Ternary lithium x 14
E005	1	Overvoltage	R W	0.1	V	%.1fV	none	9	15.5	15.5	Battery charging overvoltage protection point
E006	1	Charge limit voltage	R W	0.1	V	%.1fV	none	9	15.5	14.4	Overcharge protection voltage
E007	1	Balanced charging voltage	R W	0.1	V	%.1fV	none	9	15.5	14.4	
E008	1	Boost charging voltage / overcharge voltage	R W	0.1	V	%.1fV	none	9	15.5	14.4	Lead-acid batteries are called boost charging, and lithium batteries are called overcharge voltage.
E009	1	Float charge voltage / over charge return voltage	R W	0.1	V	%.1fV	none	9	15.5	14	The overshoot return voltage is for lithium batteries. After the overcharge stops charging, if the ground battery is lower than the judgment point, it will restart charging.
E00A	1	Boost charge return voltage	R W	0.1	V	%.1fV	none	9	15.5	13.2	After the battery enters the floating charge, the battery voltage is lower than the judgment point again, and the battery enters the boost charge again.
E00B	1	Over-discharge return voltage	R W	0.1	V	%.1fV	none	9	15.5	12.6	After the battery is over-discharged and under-voltage protected, it returns to the voltage of the discharged state
E00C	1	Undervoltage warning voltage	R W	0.1	V	%.1fV	none	9	15.5	11	Low battery voltage alarm, load does not cut off
E00D	1	Over-discharge voltage	R W	0.1	V	%.1fV	none	9	15.5	12.2	Low battery voltage alarm, cut off the load
E00E	1	discharge limiting voltage	R W	0.1	V	%.1fV	none	9	15.5	11.2	During the battery over-discharge delay process, if the battery voltage is lower than the judgment point, the load will be turned off immediately
E00F	1	Charge cut-off SOC, discharge cut-off SOC	R W	1	-	%d%	none	0	100	5	(higher 8 bits) charge cut-off SOC (lower 8 bits) discharge cut-off SOC
E010	1	Over-discharge delay time	R W	1	S	%dS	none	0	120	60	
E011	1	Equalization charging time	R W	1	Min	%dmin	none	0	600	120	Step +10

E012	1	Improve charging time	R W	1	Min	%dmin	none	0	600	120	Step +10
E013	1	Equalization charge interval	R W	1	day	%dDay	none	10	255	30	
E014	1	temperature compensation coefficient	R W	1	mV/°C /2V	%d	have	0	10	5	Only lead-acid batteries are valid
E015	1	Charging upper limit temperature	R W	1	°C	%d	have	-40	100	60	
E016	1	Charging lower limit temperature	R W	1	°C	%d	have	-40	100	-30	
E017	1	Discharge upper limit temperature	R W	1	°C	%d	have	-40	100	60	
E018	1	Discharge lower limit temperature	R W	1	°C	%d	have	-40	100	-30	
E019	1	Heating start temperature	R W	1	°C	%d	have	-40	100	0	Only lithium battery is effective, heating at low temperature
E01A	1	Heating stop temperature	R W	1	°C	%d	have	-40	100	5	Only lithium battery is effective, heating at low temperature
E01B	1	Mains switching voltage	R W	0.1	V	%.1fV	none	9	15.5	11.5	When the battery voltage is lower than the judgment point, the load is switched to the mains
E01C	1	stop charging current	R W	0.1	A	%.1fV	none	0	40	0	Only lithium battery is valid, when the constant voltage charging state current is lower than this value, stop charging
E01D	1	DC load working mode	R W	1	-	%d	none	0	0	0	Only the controller works. 00H Pure light control, light control on/off load
E01E	1	Light control delay time (household: minutes)	R W	1	Min	%d	none	0	60	0	only available on the controller
E01F	1	Photovoltaic	R W	1	V	%d	none	1	40	5	only available on the controller
E020	1	Number of batteries in series	R W	1	-	%d	none	1	200	4	Number of lithium batteries in series
E021	1	special power control	R W	1	-	%d	none				Only the controller works. b10-b15 not used
E022	1	Inverter switching voltage	R W	0.1	V	%.1fV	none	9	15.5	14	Switch back to the inverter when the battery voltage is higher than the judgment point
E023	1	Balanced charging timeout	R W	1	Min	%dmin	none	5	900	240	Step +5
E024	1	Lithium battery activation current	R W	0.1	A	%.1fA	none	0	10	2.5	
E025	1	reserve	R	1		%d	none				
P06 Inverter parameter factory setting area											
P07 Inverter parameter user setting area											
E200	1	Inverter 485 address setting	R W	1	-	%d	none	1	254	1	Integer, range 1~254
E201	1	parallel mode	R W	1	-	%d	none	0	7	0	0: stand-alone 1: Single-phase parallel operation 2: Two-phase parallel operation 3: Two-phase parallel machine 120 4: Two-phase parallel machine 180 5: Three-phase A 6: Three-phase B 7: Three-phase C
E202	1	User password setting value	W	1	-	%d	none	0	65535	0	The password is a 4-digit decimal number. When it is 0, there is no password. The keyboard password can be modified through the keyboard and communication
E203	1	password input	W	1	-	%d	none	0	65535	0	
E204	1	output priority	R W	1	-	%d	none	0	2	1	0：solar 1：line 2：sbu

E205	1	Mains charging current limit	R W	0.1	A	%.1fA	none	0	100	80	Mains charging maximum charging current limit
E206	1	Balanced charging enable	R W	1	V	%d	none	0	1	0	
E207	1	Energy Saving Threshold	R W	1	W	%dW	none	0	1000	25	
E208	1	Output voltage (default 220V)	R W	0.1	V	%.1fV	none	100	264	120	
E209	1	Output frequency (default 50Hz)	R W	0.01	Hz	%.2fHz	none	45	65	50	
E20A	1	Maximum charging current	R W	0.1	A	%.1fA	none	0	150	80	
E20B	1	AC input range	R W	1		%d	none	0	1	1	0: wide range (APL) 1: narrow range (UPS)
E20C	1	energy saving mode	R W	1		%d	none	0	1	0	0: disabled 1: enable
E20D	1	Overload automatic restart	R W	1		%d	none	0	1	1	0: disabled 1: enable
E20E	1	Over temperature automatic restart	R W	1		%d	none	0	1	1	0: disabled 1: enable
E20F	1	charging priority	R W	1		%d	none	0	3	2	0: Photovoltaic priority, only when the photovoltaic is invalid, the mains charging will be started 1: Mains power priority, photovoltaic charging will only be started when the mains power is invalid 2: Hybrid mode, charging with mains power and photovoltaics at the same time, giving priority to photovoltaics. 3: Photovoltaic only, no mains charging.
E210	1	Alarm control	R W	1		%d	none	0	1	1	0: disabled 1: enable
E211	1	Alarm enable when input source is interrupted	R W	1		%d	none	0	1	1	0: disabled 1: enable
E212	1	Overload bypass enable	R W	1		%d	none	0	1	1	0: disabled 1: enable
E213	1	record fault code	R W	1		%d	none	0	1	1	0: disabled 1: enable
E214	1	split phase transformer	R W	1		%d	none	0	1	0	0: disabled 1: enable
E215	1	BMS enabled	R W	1		%d	none	0	1	0	0: disabled 1: enable
E216	1	start charging time	R W	1		%d	none	0	23	0	Only applicable to some customized models
E217	1	Start discharge time	R W	1		%d	none	0	23	12	Only applicable to some customized models
E218	1	reserve	R W	1		%d	none	0	1	0	
E219	2	unique code	R	1		%d	none	0	65535	0	Only applicable to some customized models
E21B	1	BMS protocol	R W	1		%d	none	0	30	0	
P08 Historical data of electricity statistics											
F000	7	Historical data of PV power generation in the last 7 days	R	0.1	kWh	%.1fkWh	none				The daily power data occupies one register. For example, today is September 27, and the PV power generation data for the last 7 days are as follows: F000: power generation on September 26 (yesterday) F001: Power generation on September 25 (the day before yesterday)
F007	7	Historical data of battery charging capacity in the last 7 days	R	1	Ah	%dAh	none				
F00E	7	Historical data of battery discharge capacity in the last 7 days	R	1	Ah	%dAh	none				

F015	7	The historical data of the last 7 days of mains charging power	R	1	Ah	%dAh	none				F002: Power generation on September 24 F003: Power generation on September 23 F004: Power generation on September 22 F005: Power generation on September 21 F006: Power generation on September 20
F01C	7	Historical data of load power consumption in the last 7 days	R	0.1	kWh	%.1fkWh	none				
F023	7	The historical data of the load's power consumption from the mains for the last 7 days	R	0.1	kWh	%.1fkWh	none				
F02A	3	reserve	R	0.1	kWh	%.1fkWh	none				
F02D	1	Battery charging hours per day	R	1	Ah	%d	none				The total charge capacity (AH) of the battery on the current day.
F02E	1	Ampere-hours of battery discharge per day	R	1	Ah	%d	none				The total battery discharge capacity (AH) of the day.
F02F	1	PV power generation of the day	R	0.1	kWh	%.1fkWh	none				The total PV power generation of the day.
F030	1	Load consumption of the day	R	0.1	kWh	%.1fkWh	none				The total power consumed by the load on the day.
F031	1	total running days	R	1	d	%d	none				
F032	1	Total battery over-discharge times	R	1	-	%d	none				
F033	1	The total number of times the battery is fully charged	R	1	-	%d	none				
F034	2	Battery accumulative charging hours	R	1	Ah	%d	none				
F036	2	Cumulative battery discharge ampere hours	R	1	Ah	%d	none				
F038	2	PV accumulative power generation	R	0.1	kWh	%.1fkWh	none				
F03A	2	load accumulative power consumption	R	0.1	kWh	%.1fkWh	none				
F03C	1	Charging power of the day	R	1	Ah	%d	none				Charging capacity of mains electricity of the day AH
F03D	1	The load consumes electricity from the mains on the day	R	0.1	kWh	%.1fkWh	none				
F03E	1	Invert working hours of the day	R	1	min	%dmin	none				
F03F	1	Bypass business hours of the day	R	1	min	%dmin	none				
F040	3	boot time	R	1			none				The time format refers to the current time register
F043	3	Last equalization charging completion time	R	1			none				The time format refers to the current time register
F046	2	Cumulative battery charge	R	0.1	kWh	%.1fkWh	none				
F048	2	The load accumulatively consumes power from the mains	R	0.1	kWh	%.1fkWh	none				The load accumulates the power consumption from the battery side.
F04A	1	Inverter accumulative working time	R	1	H	%dh	none				
F04B	1	Bypass cumulative working time	R	1	H	%dh	none				
F04C	1	reserve	R	1		%d	none				
F04D	1	reserve	R	1		%d	none				

P09 Fault history record											
F800	16	Fault record 0	R W	1		%d	none				Each fault record occupies 16 addresses, and a total of 16 fault records are stored. Definition of internal data format of fault record: (defined by internal offset address) 0x00: fault code, see the instruction manual for the specific definition of the fault code. The value of the fault code is 0, indicating that the fault record is invalid. 0x01~0x03: The time when the fault code occurred (the 1st generation machine has no time). 0x04~0x0F: The data packets captured at the moment of fault occurrence, 12 data in total.
F810	16	Fault record 1	R W	1		%d	none				
F820	16	Fault record 2	R W	1		%d	none				
F830	16	Fault record 3	R W	1		%d	none				
F840	16	Fault record 4	R W	1		%d	none				
F850	16	Fault record 5	R W	1		%d	none				
F860	16	Fault record 6	R W	1		%d	none				
F870	16	Fault record 7	R W	1		%d	none				
F880	16	Fault record 8	R W	1		%d	none				
F890	16	Fault record 9	R W	1		%d	none				
F8A0	16	Fault record 10	R W	1		%d	none				
F8B0	16	Fault record 11	R W	1		%d	none				
F8C0	16	Fault record 12	R W	1		%d	none				
F8D0	16	Fault record 13	R W	1		%d	none				
F8E0	16	Fault record 14	R W	1		%d	none				
F8F0	16	Fault record 15	R W	1		%d	none				
F900	1	reserve	R	1		%d	none				
F901	1	reserve	R	1		%d	none				
End											

Note: 0x0438~0x439 is the online upgrade command entry address.