Energy storage inverter MODBUS communication protocol

1. Documentation description

This document specifies the requirements of the external 485 communication protocols of the energy storage inverters.The protocol framework is referenced from the Modbus protocol, which actually limits the number of registers that can be read and written once to no more than 32.

2. Serial port communication parameters

The underlying format is fixed at 9600,n,8,1, i.e. baud rate 9600, 8 data bits, no checksum.

Connection method: One master, multiple slaves, star connection, with each slave address set using keyboard in advance. At any time, the inverter supports a universal address, so a new address for the inverter can be set via the universal address (at which point it must be connected one-to-one)。

3.Frame format

Slave address	Functional domain		Data	CRC check
1byte	1byte		Nbyte	2byte
Slave address range: 01H~FEH Master broadcast address: 0 universal address:FFH	03H	Read multi-register	Depend on format of frame	The check range is all data from slave address until the CRC check code. Transimit sequence:the result calculated by CRC is 16-bit data.In the actual transmission, the low bytes should be transmitted first and then the high bytes.
	06H	Write single register		
	10H	Write multi-register		
	other	invalid		

3.1 Frame format of read data

Master send：

Slave address	Functional domain	Data domain				CRC check	
1 byte	1 byte	4 byte				2 byte	
		address of register		Number of register			
Actual address	03H	High byte	Low byte	High byte(00H)	Low byte （N<=32)	CRC_L	CRC_H

Slave returns：

Slave address	Functional domain	Data domain						CRC check	
1 byte	1 byte	（2*N+1）byte						1 byte	
		1 byte	1 byte	1 byte	1 byte	1 byte	…		
Actual address	03H	Number of data returned(byte)	data of returned					CRC_L	CRC_H
			register 1		register 2		…		
			H byte	L byte	H byte	L byte	…		

Return in case of error：

Slave address	Functional domain	Error code	CRC check
1 byte	1 byte	1 byte	2 byte

Actual address	83H	See the error code table.	CRC_L	CRC_H

3.2 Frame formate of write multi-register

Master send:

Slave address	Functional domain	Data domain						CRC check	
1 byte	1 byte	5+2*N byte						2 byte	
		1 byte	1 byte	1 byte	1 byte	1 byte	2*N byte		
Actual address	10H	address of register		number of register		data number	Data of register, High byte send firt,Low byte send after	CRC_L	CRC_H
		H byte	L byte	H byte	L byte	2*N			

Slave returns：

Slave address	Functional domain	Data length				CRC check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 byte	
Actual address	10H	address of register		number of register			
		H byte	L byte	H byte	L byte	CRC_L	CRC_H

Return in case of error:

Slave address	Functional	Error code	CRC check	
1 byte	1 byte	1 byte	2 byte	
Actual address	90H	See the error code table.	CRC_L	CRC_H

3.3 Frame formate of write signal register

Master send：

Slave address	Functional domain	Data domain				CRC check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 byte	
Actual address	06H	address of register		value of register		CRC_L	CRC_H
		H byte	L byte	H byte	L byte		

Slave returns:

Slave address	Functional domain	Data domain				CRC check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 byte	
Actual address	06H	address of register		value of register		CRC_L	CRC_H
		H byte	L byte	H byte	L byte		

Return in case of error:

Slave address	Functional	Error code	CRC check	
1 byte	1 byte	1 byte	2 byte	
Actual address	86H	See the error code table.	CRC_L	CRC_H

3.4 Error code table

Code	Name	Meaning
01H	Illegal command	May be the device is not support this function code
02H	Illegal data address	The request start data address of the master is a unauthorized address, or the end address is over range
03H	Illegal data value	When the received data domain contains an impermissible value. This value indicates an error in the remaining structure in the combined request. Note: It in no way means that the data items being submitted for storage in the register have a value other than what the application expects.

04H	Operation failed	During parameter write operation, the parameter is set to be invalid; for example, the function input terminal cannot be set repeatedly.
05H	Password error	The password written at the password check address is wrong.
06H	Data frame error	When the length of data frame is incorrect or RTU format CRC bits are different from the check calculation number of lower computer in frame information sent by the upper computer.
07H	Parameter is read only	The parameters changed in the upper computer write operation are read-only parameters.
08H	Parameter cannot be changed during running	The parameters changed in the upper computer write operation are the parameters that cannot be changed during running.
09H	Password protection	When the upper computer reads or writes, if user password is set while password is not unlocked, it will report that system is locked.
0AH	Length error	The number of registers required to read during the read process exceeds 32.
0BH	Permission denied	Do not have permission to read or write the register.

4. CRC calculation

The CRC domain detects the entire content of the frame, i.e. all data from the slave address until the CRC check. The slave recalculates the CRC check data and compares it with the check values in the received data stream to determine the validity of the received data. The CRC domain is two-byte 16-bit binary data.

There are three methods to carry out CRC calibration, the results of which are the same and can be freely chosen according to the actual situation.

Method 1：software calculation bit by bit

```
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：Lookup table of 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 bytes*/
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,
};

unsigned int CRC16(unsigned int * puchMsg,unsigned int usDataLen)
{
   unsigned int uchCRCHi = 0xFF ;
   unsigned int uchCRCLo = 0xFF ;
   unsigned int uIndex ;

   while (usDataLen--)
   {
      uIndex = uchCRCLo ^ *puchMsg++ ;
      uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex] ;
      uchCRCHi = auchCRCLo[uIndex] ;
   }
   return (uchCRCHi << 8 | uchCRCLo) ;
```

Method 3：Lookup table by word

```
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,
```

```
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,
};

unsigned int CRC16(unsigned int * puchMsg,unsigned int usDataLen)
{
   unsigned int uchCRCHi = 0xFF ;
   unsigned int uchCRCLo = 0xFF ;
   unsigned int uIndex ;
   unsigned int hi,low;

   while (usDataLen--)
   {
      uIndex = uchCRCLo ^ *puchMsg++ ;
      hi = tblCRC[uIndex] >> 8;
      low = tblCRC[uIndex] & 0xff;
```

4. Unit and multiple ratio description

Physical quantity	Unit	multiple ratio	description
Voltage(DC or AC)	V	10	16 bit unsigned int, range: 0~65535, corresponding: 0V~6553.5V
Current(DC or AC)	A	10	16 bit unsigned int, range: 0~65535, corresponding: 0A~6553.5A 16 bit signed int, range: -32767~32767, corresponding: -3276.7A~3276.7A
Frequnecy	Hz	100	16 bit unsigned int, range: 0~65535, corresponding: 0Hz~655.35Hz
Power(DC or AC)	W	1	16 bit unsigned int, range: 0~65535, corresponding: 0W~65535W
Power factor	/	1000	16 bit signed int, range: -32767~32767。 For example:998 means power factor is 0.998 For example:-900(0xFC7C) means power factor is -0.900
Electric quantity	kWh	10	16 bit unsigned int, range: 0~65535, corresponding: 0kWh~6553.5kWh 32 bit unsigned int, range: 0~4294967295, corresponding: 0kWh~429496729.5kWh For example:1 means 0.1kWh, 10 means 1kWh
Battery capacity	AH	1	16 bit unsigned int, range: 0~65535, corresponding: 0AH~65535AH 32 bit unsigned int, range: 0~4294967295, corresponding: 0AH~4294967295AH
Temperature	℃	10	16 bit signed int,range: -32767~32767, corresponding: -3276.7℃~3276.7℃

Battery setup voltage	V		In this agreement, all battery voltages are set in the same dimension as 12V batteries, that is, all battery voltages are converted to the voltage corresponding to 12V batteries. For example, if the rated battery voltage is 48V and the actual setup voltage is 57.6V, the actually battery voltage is 57.6V/4=14.4V and the value of register is 14.4 x 10=144.

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

Modbus register address of energy storage inverter

Note:

1.The content in gray font is not valid for the inverter

2.Multiplier is the ratio of the actual value to the register value. For example, if the multiplier is 0.1, the actual value = the register value *0.1

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
P00: Product information											
A	1	MaxVoltAndIchargRage	R	1	-	%d	No				Invalid for inverter.
B	1	Machine type code	R	1	-	%d	No				Product type code: 00 (Controller, Home) 01 (Controller, Street lights) 03 (Inverter) 04 (Integrated inverter controller) 05 (Mains frequency off-grid)
C	8	Product type string	R	1	-	%s	No				Invalid for inverter.
14	2	Software version	R	1	-	%d	No				0x0014:CPU1 version, such as 100, indicating V1.00 0x0015:CPU2 version, such as 100, indicating V1.00
16	2	Hardware version	R	1	-	%d	No				0x0016:Control board version, such as 100, indicating V1.00 0x0017:Power board version, such as 100, indicating V1.00
18	2	Product SN	R	1	-	%x	No				Invalid for inverter.
1A	1	RS485 address(read only)	R	1	-	%d	No				Rs485 address(read only)
1B	1	Model code	R	1	-	%d	No				
1C	2	RS485 protocol version	R	1	-	%x	No				0x001C: Protocol version, such as 100, indicating V1.00 0x001D:Reserved
1E	2	Date of manufacture	R	1	-	%x	No				0x001E：高8位：年，低8位：月 0x001F：高8位：日，低8位：时 Invalid
20	1	Production site code	R	1	-	%x	No				0: Shenzhen 1: Dongguan
21	20	software compilation time	R	1	-	%s	No				String format, low 8 bits per register valid, high 8 bits invalid.
35	20	Product SN string	R	1	-	%s	No				String format, low 8 bits per register valid, high 9 bits invalid.
49	1	Reserved	R	1	-	%x	No				
P01: Controller data area											
100	1	Battery level SOC	R	1	-	%d	No				Percentage of remaining battery power
101	1	Battery voltage	R	0.1	V	%.1fV	No				Battery voltage, such as 485, indicating 48.5V
102	1	Battery current	R	0.1	A	%.1fA	Yes				Battery current, such as 500, indicating 50.0A It's charge current if the value is greater the zero,it's discharge current if the value is less then zero
103	1	Device temperature (controller)/battery temperature	R	1	℃	%d	Yes				(High 8 bits) controller temperature (Low 8 bits) battery temperature
104	1	Load (DC) voltage	R	0.1	V	%.1fV	No				
105	1	Load (DC) current	R	0.01	A	%.2fA	No				
106	1	Load (DC) power	R	1	W	%d	No				
107	1	PV panel 1 voltage	R	0.1	V	%.1fV	No				PV panel 1 voltage
108	1	PV panel 1current	R	0.1	A	%.1fA	No				PV panel 1 current
109	1	PV panel 1 power	R	1	W	%d	No				PV panel 1 power
10A	1	DC load on/off command	W	1	-	%d	No				1 for on, 0 for off, controller applicable,invalid for inverter.
10B	1	Charge state	R	1	-	%d	No				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, alarm message	R	1	-	%d	No				Invalid for inverter
10E	1	Charge power	R	1	W	%dW	No				Total charge power, include charge power by mains and pv
10F	1	PV panel 2 voltage	R	0.1	V	%.1fV	No				PV panel 2 voltage
110	1	PV panel 2 current	R	0.1	A	%.1fA	No				PV panel 2 current
111	1	PV panel 2 power	R	1	W	%d	No				PV panel 2 power
P02: Inverter data area											
200	4	Current fault bits	R	1	-	%x	No				Fault bits, each representing one fault, for a total of 64 bits. This register is used by the internal debug tool.

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
204	4	Current fault code	R	1	-	%d	No				Current fault code, with 4 addresses in total, each address storing a fault code corresponding to the current fault. 4 fault codes can be displayed simultaneously. 0 indicates no fault. For example, there are currently two faults, battery under-voltage and inverter overload. Then, the following is shown: 0x204: 01 0x205: 14 0x206: 00 0x207: 00
208	4	Reserved	R	2	-	%x	No				Reserved
20C	3	Current time	RW	1	-	%zdt	No				0x020C: high 8 bits: year, low 8 bits: month 0x020D: high 8 bits: day, low 8 bits: hour 0x020E: high 8 bits: minute, low 8 bits: second
20F	1	Reserved									
210	1	Current state of the machine	R	1	-	%d	No				0: Power-up delay 1: Waiting state 2: Initialization 3: Soft start 4: Mains powered operation 5: Inverter powered operation 6: Inverter to mains 7: Mains to inverter 8: Battery activate 9: Shutdown by user 10: Fault
211	1	Password protection status mark	R	1	-	%d	No				0: No password entered by the user 1: User password has been entered 4: Manufacturer password has been entered
212	1	Bus voltage	R	0.1	V	%.1fV	No				
213	1	Grid voltage phase A	R	0.1	V	%.1fV	No				Mains voltage phase A
214	1	Grid current phase A	R	0.1	A	%.1fA	No				Mains side input current phase A
215	1	Grid frequency	R	0.01	Hz	%.2fHz	No				Mains frequency
216	1	Inverter voltage phase A	R	0.1	V	%.1fV	No				Inverter output voltage phase A
217	1	Inverter current phase A	R	0.1	A	%.1fA	No				Inverter inductive current phase A
218	1	Inverter frequency	R	0.01	Hz	%.2fHz	No				
219	1	Load current phase A	R	0.1	A	%.1fA	No				Load side current phase A
21A	1	Load PF	R	0.01	-	%.2f	Yes				
21B	1	Load active power phase A	R	1	W	%dW	No				
21C	1	Load apparent power phase A	R	1	VA	%dVA	No				
21D	1	Inverter DC component	R	1	mV	%dmV	Yes				
21E	1	Mains charge current	R	0.1	A	%.1fA	No				Battery side current when charging on mains
21F	1	Load ratio phase A	R	1	%	%d%	No				Load percentage phase A
220	1	Heat sink A temperature	R	0.1	℃	%.1f℃	Yes				DC-DC heat sink temperature
221	1	Heat sink B temperature	R	0.1	℃	%.1f℃	Yes				DC-AC heat sink temperature
222	1	Heat sink C temperature	R	0.1	℃	%.1f℃	Yes				Translator heat sink tmperature
223	1	Heat sink D temperature	R	0.1	℃	%.1f℃	Yes				
224	1	PV charge current	R	0.1	A	%.1fA	No				Battery side current by PV charging
225	1	Ibuck2	R	0.1	A	%.1fA	No				invalid
226	1	Inverter fault state	R	1	-	%d	No				Just valid for custom models
227	1	Charge status	R	1	-	%d	No				Just valid for custom models
228	1	PBusVolt	R	0.1	V	%.1fV	无				Just valid for specific machine models
229	1	NBusVolt	R	0.1	V	%.1fV	无				Just valid for specific machine models
22A	1	GridVoltB	R	0.1	V	%.1fV	无				Mains voltage phase B, just valid for specific machine models
22B	1	GridVoltC	R	0.1	V	%.1fV	无				Mains voltage phase C, just valid for specific machine models
22C	1	InvVoltB	R	0.1	V	%.1fV	无				Inverter output voltage phase B, just valid for specific machine models
22D	1	InvVoltC	R	0.1	V	%.1fV	无				Inverter output voltage phase C, just valid for specific machine models
22E	1	InvCurrB	R	0.1	A	%.1fA	无				Inverter inductive current phase B, just valid for specific machine models
22F	1	InvCurrC	R	0.1	A	%.1fA	无				Inverter inductive current phase B, just valid for specific machine models
230	1	LoadCurrB	R	0.1	A	%.1fA	无				Load side current phase B, just valid for specific machine models
231	1	LoadCurrC	R	0.1	A	%.1fA	无				Load side current phase C, just valid for specific machine models
232	1	LoadActivePowerB	R	1	W	%dW	无				Load side active power phase B, just valid for specific machine models

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
233	1	LoadActivePowerC	R	1	W	%dW	无				Load side active power phase C, just valid for specific machine models
234	1	LoadReactivePowerB	R	1	VA	%dVA	无				Load side reactive power phase B, just valid for specific machine models
235	1	LoadReactivePowerC	R	1	VA	%dVA	无				Load side reactive power phase C, just valid for specific machine models
236	1	LoadRatioB	R	1	%	%d%	无				Load percentage phase B, just valid for specific machine models
237	1	LoadRatioC	R	1	%	%d%	无				Load percentage phase C, just valid for specific machine models
P03: Device control area											
DF00	1	Power ON/OFF control	W	1	-	%x	No				0: Power off 1: Power on
DF01	1	Reset control	W	1	-	%x	No				1: Reset Other: no action
DF02	1	Restore to default settings	W	1	-	%x	No				0xAA: Restore Other: No action Restore to default settings to clear all accumulated information and restore parameters to default state, restart to take effect
DF03	1	Clear current alarm	W	1	-	%x	No				1: Clear Other: no action
DF04	1	Clear statistics	W	1	-	%x	No				1: Clear Other: no action
DF05	1	Clear history	W	1	-	%x	No				1: Clear Other: no action
DF06	2	Firmware upgrade command	W	1	-	%x	No				Firmware upgrade command
DF08	1	Sleep control/activation command	W	1	-	%x	No				5A5A:sleep A5A5:run
DF09	3	Manual light up switch	W	1	-	%x	No				1:Switch 1 on;0 off 2:Light-up power 0~100% 3:Light-up time 0~ 54000S
DF0C	1	Generator switch command	W	1	-	%x	No				0: No action 1: Switch to power supply by generator
DF0D	1	Immediate equalizing charge command	W	1		%d	No				0:Disable 1:Enable
P05: Battery-related parameters settings area											
E000	1	Reserved	RW	1	-	%d	No	0	1	0	
E001	1	Pv charge current setup	RW	0.1	A	%dA	No	0	100	60	PV charge current limit
E002	1	Nominal battery capacity	RW	1	AH	%dAH	No	0	400	100	
E003	1	System voltage rate(read only)	RW	1	V	%dV	No	12	255	48	12：12V 24：24V 36：36V
E004	1	Battery type	RW	1	-	%d	No	0	14	3	0 : User define 1 : SLD 2 : FLD
E005	1	Over voltage	RW	0.1	V	%.1fV	No	9	15.5	15.5	Battery overcharge protection, fast protection
E006	1	Limited charge voltage	RW	0.1	V	%.1fV	No	9	15.5	14.4	Overcharge protection voltage
E007	1	Equalizing charge voltage	RW	0.1	V	%.1fV	No	9	15.5	14.4	
E008	1	Boost charge voltage/overcharge voltage	RW	0.1	V	%.1fV	No	9	15.5	14.4	Boost charge for lead acid battery, overcharge voltage for lithium battery
E009	1	Floating charge voltage/overcharge return charge	RW	0.1	V	%.1fV	No	9	15.5	14	The overcharge return voltage is for the lithium battery, and after charging stops due to overcharge, when the battery voltage is below the judgment point, charging starts again.
E00A	1	Boost charge return voltage	RW	0.1	V	%.1fV	No	9	15.5	13.2	After the battery enters floating charge, the battery voltage is again below the judgment point and the battery enters the boost charge again.
E00B	1	Over discharge return voltage	RW	0.1	V	%.1fV	No	9	15.5	12.6	After the battery enters under-voltage protection due to over discharge, return discharge state voltage
E00C	1	Under-voltage warning voltage	RW	0.1	V	%.1fV	No	9	15.5	11	Low battery voltage alarm, load not cut off
E00D	1	Over discharge voltage	RW	0.1	V	%.1fV	No	9	15.5	12.2	Low battery voltage alarm, load cut off
E00E	1	Limited discharge voltage	RW	0.1	V	%.1fV	No	9	15.5	11.2	During the battery over-discharge delay, the battery voltage is lower than the judgment point and the load is immediately turned off.
E00F	1	Charge cut-off SOC, discharge cut-off SOC	RW	1	-	%d%	No	0	100	5	(high 8 bits) charge cutoff SOC (low 8 bits) discharge cutoff SOC
E010	1	Over discharge delay time	RW	1	S	%dS	No	0	120	60	
E011	1	Equalizing charge time	RW	1	Min	%dmin	No	0	600	120	Step +10
E012	1	Boost charge time	RW	1	Min	%dmin	No	10	600	120	Step +10

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
E013	1	Equalizing charge interval	RW	1	day	%dDay	No	0	255	30	
E014	1	Temperature compensation coefficient	RW	1	mV/℃/2V	%d	Yes	0	10	5	invalid
E015	1	Charge upper limit temperature	RW	1	℃	%d	Yes	-40	100	60	invalid
E016	1	Charge lower limit temperature	RW	1	℃	%d	Yes	-40	100	-30	invalid
E017	1	Discharge upper limit temperature	RW	1	℃	%d	Yes	-40	100	60	invalid
E018	1	DisChgMinTemper	RW	1	℃	%d	Yes	-40	100	-30	invalid
E019	1	HeatBatStartTemper	RW	1	℃	%d	Yes	-40	100	0	invalid
E01A	1	HeatBatStopTemper	RW	1	℃	%d	Yes	-40	100	5	invalid
E01B	1	Mains switching voltage	RW	0.1	V	%.1fV	No	9	15.5	11.5	Load is switched to mains when the battery voltage is below the judgment point
E01C	1	Stop charging current	RW	0.1	A	%.1fV	No	0	40	0	Only valid for the lithium battery, when the current in the constant voltage charging state is lower than this value, charging is stopped
E01D	1	DC load working mode	RW	1	-	%d	No	0	0	0	Invalid
E01E	1	Light control delay time (household: minutes)	RW	1	Min	%d	No	0	60	0	Invalid
E01F	1	Light control voltage	RW	1	V	%d	No	1	40	5	Invalid
E020	1	Number of batteries connected in series	RW	1	-	%d	No	1	200	4	Invalid
E021	1	Special power control	RW	1	-	%d	No				Invalid
E022	1	Inverter switching voltage	RW	0.1	V	%.1fV	No	9	15.5	14	Switch back to inverter when the battery voltage is higher than the judgment point
E023	1	Equalizing charge timeout time	RW	1	min	%dmin	No	5	900	240	Step +5
E024	1	Lithium battery activation current	RW	0.1	A	%.1fA	No	0	10	2.5	
E025	1	Reserved	R	1		%d	No				
E026	1	1-section start charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E027	1	1-section stop charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E028	1	2-section start charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E029	1	2-section stop charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E02A	1	3-section start charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E02B	1	3-section stop charging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E02C	1	Sectional charging function enable	RW	1	-	%d	无	0	1	0	0:Disable 1:Enable
E02D	1	1-section start discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E02E	1	1-section stop discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E02F	1	2-section start discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E030	1	2-section stop discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E031	1	3-section start discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E032	1	3-section stop discharging time	RW	1	h/m	%d	无	0	5947	0	hour and minute: 23*256+59==5947
E033	1	Sectional discharging function enable	RW	1	-	%d	无	0	1	0	0:Disable 1:Enable
E034	3	current time setup	RW	1	-	%d	无	0	-	0	E034 - year and month: 99*256+12==25356 E035 -day and hour: 31*256+23==7959 E036 -minute and second: 59*256+59==15163
E037	1	PV grid-connected power generation enable	RW	1	-	%d	无	0	1	0	0:Disable 1:Enable
E038	1	GFCI Enable	RW	1	-	%d	无	0	1	0	0:Disable 1:Enable
E039	1	P5 Reserved	R	1		%d	无				
		P07 Inverter parameters settings area by user									
E200	1	Inverter 485 address setup	RW	1	-	%d	No	1	254	1	Integers, range: 1~254
E201	1	Inverter parallel mode setup	RW	1	-	%d	No	0	7	0	0: Stand alone 1: Parallel in single phase 2: Parallel in two phase and phase is 0° 3: Parallel in two phase and phase is 120° 4: Parallel in two phase and phase is 180° 5: Parallel in three phase and phase is A 6: Parallel in three phase and phase is B 7: Parallel in three phase and phase is C
E202	1	User password set value	W	1	-	%d	No	0	65535	0	The password is a 4-bit decimal number. No password when it is 0. Keyboard password can be changed via keyboard and communication
E203	1	Password input	W	1	-	%d	No	0	65535	0	

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
E204	1	Output priority	RW	1	-	%d	No	0	2	1	Output priority: 0: solar 1: line 2: sbu
E205	1	Mains charge current limit	RW	0.1	A	%.1fA	No	0	100	80	Maximum mains charge current limit
E206	1	Equalizing charge enable	RW	1	V	%d	No	0	1	0	
E207	1	Power save level	RW	1	W	%dW	No	0	1000	25	
E208	1	Output voltage	RW	0.1	V	%.1fV	No	100	264	120	
E209	1	Output frequency	RW	0.01	Hz	%.2fHz	No	45	65	50	
E20A	1	Maximum charge current	RW	0.1	A	%.1fA	No	0	150	80	
E20B	1	AC input range	RW	1		%d	No	0	1	1	0:wide range(APL) 1:narrow range(UPS)
E20C	1	Eco mode	RW	1		%d	No	0	1	0	0:Disable 1:Enable
E20D	1	Overload auto restart	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E20E	1	Over temperature auto restart	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E20F	1	Charge priority	RW	1		%d	No	0	3	2	0:PV preferred, only start mains charging when PV is not available 1:Mains preferred, only start PV charging when mains is not available 2: Hybrid mode, mains and PV charging at the same time, PV is preferred. 3: PV only, mains does not charge.
E210	1	Alarm control	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E211	1	Alarm enable when input source is interrupted	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E212	1	Overload bypass enable	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E213	1	Record fault code	RW	1		%d	No	0	1	1	0:Disable 1:Enable
E214	1	Split-phase transformer	RW	1		%d	No	0	1	0	0:Disable 1:Enable
E215	1	BMS communication enable	RW	1		%d	No	0	1	0	0:Disable 1:Enable
E216	1	Start charge time setup	RW	1		%d	No	0	23	0	Just valid for some custom model
E217	1	Start discharge time setup	RW	1		%d	No	0	23	12	Just valid for some custom model
E218	1	Reserved	RW	1		%d	No	0	1	0	
E219	2	UniqueIDcode	R	1		%d	No	0	65535	0	Just valid for some custom model
E21B	1	BMS protocol	RW	1		%d	No	0	30	0	
P08: Power statistics historical data											
F000	7	Last 7 days historical data of PV power generation	R	1	AH	%d	No				
F007	7	Last 7 days historical data of battery charge level	R	1	AH	%d	No				The electric quantity data occupies one register every day. For example, today is September 27th, then the PV energy yield data of the last 7 days are as follows: F000: On September 26th F001: On September 25th F002: On September 24th F003: On September 23th F004: On September 22th F005: On September 21th F006: On September 20th
F00E	7	Last 7 days historical data of battery discharge level	R	1	AH	%d	No				
F015	7	Last 7 days historical data of mains charge level	R	1	AH	%d	No				
F01C	7	Last 7 days historical data of power consumption by load	R	0.1	kwh	%.1fkWh	No				
F023	7	Last 7 days historical data of power consumption by load from mains	R	0.1	kwh	%.1fkWh	No				
F02A	3	Reserved	R	0.1	kwh	%.1fkWh	No				
F02D	1	Battery charge AH of the day	R	1	AH	%d	No				The total battery charge level (AH) of the day, applicable to the 2nd generation machines.
F02E	1	Battery discharge AH of the day	R	1	AH	%d	No				The total battery discharge level (AH) of the day, applicable to the 2nd generation machines.
F02F	1	PV power generation of the day	R	0.1	kWh	%.1fkWh	No				The total PV power generation of the day, applicable to the 2nd generation machines.
F030	1	Load power consumption of the day	R	0.1	kWh	%.1fkWh	No				The total power consumption by load of the day, applicable to the 2nd generation machines.
F031	1	Total running days	R	1	day	%d	No				
F032	1	Total number of battery overdischarge	R	1	-	%d	No				

Address	Length	Name	WR	Multiplier	Unit	Display format	Symbol	Min	Max	Default	Remarks
F033	1	Total number of battery full charge	R	1	-	%d	No				
F034	2	Accumulated battery charge AH	R	1	AH	%d	No				
F036	2	Accumulated battery discharge AH	R	1	AH	%d	No				
F038	2	Accumulated PV power generation	R	0.1	kWh	%.1fkWh	No				
F03A	2	Accumulated power consumption of load	R	0.1	kWh	%.1fkWh	No				
F03C	1	Mains charge level of today	R	1	AH	%d	No				Mains charge level AH of the day
F03D	1	Power consumption by load from mains of today	R	0.1	kWh	%.1fkWh	No				Power consumption by load from mains of the day
F03E	1	Inverter working hours of today	R	1	min	%dmin	No				
F03F	1	Bypass working hours of today	R	1	min	%dmin	No				
F040	3	Power on time	R	1		%d	No				
F043	3	Last equalizing charge completion time	R	1		%d	No				
F046	2	Accumulated charge level by mains	R	0.1	kWh	%.1fkWh	No				
F048	2	Accumulated power consumption by load from mains	R	0.1	kWh	%.1fkWh	No				
F04A	1	Accumulated working hours of inverter	R	1	h	%dh	No				
F04B	1	Accumulated working hours of bypass	R	1	h	%dh	No				
F04C	1	Reserved	R	1		%d	No				
F04D	1	Reserved	R	1		%d	No				
P09:Fault history record											
F800	16	FaultHistoryRecord00	RW	1		%d	No				Each fault record takes up 16 addresses, a total of 16 fault records are stored. Fault record internal data format definition: (defined by internal offset address) 0x00: Fault code, specific definition of the fault code can be found in the instruction manual. A value of 0 for the fault code indicates that this fault record is invalid. 0x01~0x03: The time when the fault code occurred (there is no time for the 1st generation machines). 0x04~0x0F: Data packets captured at the moment of a fault, 12 data in total.
F810	16	FaultHistoryRecord01	RW	1		%d	No				
F820	16	FaultHistoryRecord02	RW	1		%d	No				
F830	16	FaultHistoryRecord03	RW	1		%d	No				
F840	16	FaultHistoryRecord04	RW	1		%d	No				
F850	16	FaultHistoryRecord05	RW	1		%d	No				
F860	16	FaultHistoryRecord06	RW	1		%d	No				
F870	16	FaultHistoryRecord07	RW	1		%d	No				
F880	16	FaultHistoryRecord08	RW	1		%d	No				
F890	16	FaultHistoryRecord09	RW	1		%d	No				
F8A0	16	FaultHistoryRecord10	RW	1		%d	No				
F8B0	16	FaultHistoryRecord11	RW	1		%d	No				
F8C0	16	FaultHistoryRecord12	RW	1		%d	No				
F8D0	16	FaultHistoryRecord13	RW	1		%d	No				
F8E0	16	FaultHistoryRecord14	RW	1		%d	No				
F8F0	16	FaultHistoryRecord15	RW	1		%d	No				
F900	1	RecordReserved0	R	1		%d	No				
F901	1	RecordReserved1	R	1		%d	No				
END											

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