MODBUS Protocol for Energy Storage Inverter

Revision Record

S/N	Revision Content	Revised by	Revised on	Ver. No.
1	1. Two registers (with inverter fault state, charging state, and unique ID) defined by RGSC are increased. 2. Units of minimum, maximum, and default values are removed (for protocol conversion code). 3. The BMS enable register and BMS protocol register are increased. 4. The charging time and discharging time registers are increased (to achieve timed charging and discharging). 5. The state register is removed (not available and memory occupied). 6. The protocol structure is modified (refer to the controller protocol).	zhengkk	July 14, 2021	V1.4
2	1. The definition of the current state value (8: battery activation, 9: manual shutdown, 10: fault) of the machine is modified. 2. The default values of some loop parameters are set to 4096. When used in the program, 4096 is used as the default value. 3. The battery type is GEL (3) by default. If there is a difference in the program, it may be customized according to the customer ID. 4. The original Baud rate is changed to Parallel Mode. 5. The output priority is 2 (SBU) by default. If there is a difference in the program, it may be customized according to the customer ID.	zhengkk	September 16, 2021	V1.5
3	The Modbus protocol format specification and the register address table are merged into a single file. Note: 1. If the version No. on the page is incorrect, you only need to modify the table name. The title and version No. at the header are automatically updated without manual modification. 2. When releasing the version with neutral packing, you need to replace the company name at the page of the two files with "protocol", and do not delete the original characters; otherwise, the format will change when the company name is added next time.	zhengkk	September 24, 2021	V1.5
4	1. The protocol is revised, and the register is increased to supports single split-phase machine, two-way PV input and three-way AC power input, and three-way inverter output data transmission. 2. E218 register address is added to set the derated power of the machine.	wangqt	June 14, 2022	V1.6
5	1. The time of segmental charging and discharging and their enable settings are increased. 2. The settings of grid-connected generation and leakage detection are increased.	wangzw	June 1, 2022	V1.7
6	1. The single split-phase machine borrows the adjustment parameter addresses of the PLL, DF43 and DF44, to adjust the iteration control parameters; and the data type is changed to the signed number, and the default value is changed. 2. The maximum value of boost charge time E102 is changed to 900, consistent with the range set on the display. 3. The E21F address is added to set the grid-connected PF value. 4. The data annotation error in the E004 battery type and address (12-L13 and 13-L14) is fixed. 5. The error cumulative charging unit and mismatch of proportion and actual quantity of AC power are fixed, and the cumulative charging unit is changed to the same as the charging unit on the day, which is AH. 6. The 0×214 address is changed back to the AC power phase-A current (generation-3 parallel machine also	wangqt	July 28, 2022	V1.7
7	1. EOOF is used for discharge cutoff SOC setting and is valid in BMS communication. 2. E01C is used to set the current for the lithium battery to stop charging. 3. E01D is used to set the SOC for the lithium battery to stop charging. 4. E01E is used to set the low SOC capacity alarm and is valid for BMS communication. 5. E01F is used to change the SOC capacity setting of the AC power in SBU mode and is valid for BMS communication. 6. E020 is used to change the SOC capacity setting of the inverter in SBU mode and is valid for BMS communication.	zhengkk	August 2, 2022	V1.7
8	1. E207 is changed to enable the N wire grounding, which is available only for some models. 2. The number of historical fault records is increased to 32.	zhengkk	November 11, 2022	V1.80
9	1. The register for grid-connected voltage protection is increased. 2. Grid-connected active, reactive, and PF registers are increased. 3. Grid-connected power register is increased. 4. The insulation impedance detection enable and threshold setting registers are increased. 5. The grid-connected current F02C on the day is increased.	zhengkk	February 13, 2023	V1.90
10	1. The PV output priority is increased. 2. Grid-connected parameters are independently placed in group 08.	zhengkk	March 7, 2023	V1.91
11	1. The DC load switch is increased.	zhengkk	March 8, 2023	V1.92

12	1. Diesel engine operating mode and diesel engine charging current setting parameters are increased. 2. The function settings of battery participating in grid connection are increased. 3. The grid-connected active power is changed to the actual power. 4. Diesel engine voltage calibration coefficient is increased.	zhengkk	August 4, 2023	V1.93
13	1. The battery temperature register 0×0103 is increased. 2. 0×E037 register is changed to an operating mode register. 3. 0×E03A is modified to enable battery temperature compensation. 4. The SOC value corresponding to the charge and discharge period (0×E03B−0×E040) is added. 5. 0×E204 is changed to bms communication fault stop register. 6. Diesel engine rated power setting 0×E221 is increased. 7. The CT ratio register 0×E42B is increased. 8. Anti-reverse and anti-error power setting register 0×E42C is increased.	zhengkk	October 8, 2023	V1.94
14	1. A/B/C phase home load register is increased. 2. The battery voltage determination register for the timed charging and discharging period is increased. 3. The maximum power register for timed discharging is increased. 4. The normal network latency register is increased. 5. The register for normal/reconnected power rise rate is increased. 6. The register for network voltage frequency range is increased.	zhengkk	January 4, 2024	V1.95
15	1. The maximum power register for timed charging is increased. 2. The register for timed charging source selection is increased.	zhengkk	January 11, 2024	V1.96
16	1. The calibration of the power limit parameter for timed charge and discharge is changed to 1	zhengkk	February 21, 2024	V1.97
17	1. Add arc fault clearing instruction register; 2. Add CT automatic detection and manual setting register; 3. Add the minor load power register; 4. Add the battery SOH, rated capacity, and remaining capacity registers;	zhengkk	March 14,2024	V1.98
18	1. E021 Set the maximum battery discharge current; 2. E110-E112 is modified as the minor load current coefficient calibration register 3. Add DC component control register E110-E112 4. Add bms battery voltage, current, temperature, charge/discharge limit, flag bit register (112-11B)	zhengkk	April 01,2024	V1.99
19	1.Added the kWh statistics of the accumulated charge and discharge amount of the battery on the same day（F04D-F052) 2.Add the DRMS enable register(E43B)	zhengkk	2024.05.08	V2.00
20	1.Add the apparent power and current registers of secondary loads 2.Add PV secondary load enable and mains secondary load enable registers 3.Add the week set register 4.Add DRMS enable register, three-stage undervoltage point register 5.The power consumption statistics register of the refueling machine 6.Add parallel system total power register 7.Add the whole machine load rate register 8.Add the number of parallel machines display register 9.Add the total power of the parallel system UPS, the total power of the HOMEload, the total power of the grid, the total power of the oil port display register 10.Add timed charge week to enable 11.Add the meter enable register	zhengkk	2024.12.05	V2.04

Format Specification of the MODBUS Protocol for Energy Storage Inverter

1. Document Description

This document defines the content of RS485 communication protocol for the Company's energy storage inverters, including RS485 communication frame format, Modbus register address definition, quantity calibration, etc. The protocol follows the Modubus-RTU protocol and supports 03, 06, and 10 function codes. The maximum number of read-write registers at a time is 32.

2. Serial Communication Parameters

"9,600, n, 8, 1" indicates a baud rate of 9,600, with 8 data bits, and no parity check.
There are one host and multiple slaves in RS485 connection mode. The default address of the inverter is 1, which can be set. It supports 255 universal address. When a host and an inverter are connected one to one, 255 can be used to communicate with the inverter. The address that the inverter responds to is the actual address.

3. Data Format

Slave IP Address	Function Code		Data Length or Content	CRC Check
1 byte	1 byte		N bytes	2 bytes
Slave IP address range: 01H to FEH Host IP broadcast address: 0 Universal address: FFH	03H	Reading multiple registers	Command related	Check range: all data from the slave IP address to the CRC check; Transmission order: The CRC calculates the result as 16-bit data. In actual transmission, the low byte is passed first, and the high byte is passed later.
	06H	Writing a single register		
	10H	Writing multiple registers		
	Miscellaneous	Invalid		

3.1 Reading the data frame format

Frame format sent by the host:

Slave IP Address	Function Code	Data Field				CRC Check	
1 byte	1 byte	4 bytes				2 bytes	
Actual address	03H	High byte of register address	Low byte of register address	N high bytes of registers, usually 00H	N low bytes of registers (N<=32)	CRC_L	CRC_H
1	3	02H	00H	00H	20H	45H	AAH

Data frame format returned from the slave IP:

Slave IP Address	Function Code	Data Field						CRC Check	
1 byte	1 byte	(2*N+1) bytes						2 bytes	
		1 byte	1 byte	1 byte	1 byte	1 byte	…		
Actual address	03H	Byte length of the returned data	Returned data					CRC_L	CRC_H
			Register 1 value		Register 2 value		…		
			High byte	Low byte	High byte	Low byte	…		

Error frame format returned from the slave IP:

Slave IP Address	Function Code	Error Code	CRC Check	
1 byte	1 byte	1 byte	2 bytes	
Actual address	83H	See the error code table.	CRC_L	CRC_H

3.2 Writing multiple data frame formats

Frame format sent by the host:

Slave IP Address	Function Code	Data Field						CRC Check	
1 byte	1 byte	5+2*N bytes						2 bytes	
		1 byte	1 byte	1 byte	1 byte	1 byte	2*N bytes		
Actual address	10H	Register address		Register count		Data Length	For the value of N registers, the high byte precedes the low byte.	CRC_L	CRC_H
		High byte	Low byte	High byte	Low byte	2*N			

Response frame format returned from the slave IP:

Slave IP Address	Function Code	Data length				CRC Check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	
Actual address	10H	Register address		Register count			
		High byte	Low byte	High byte	Low byte	CRC_L	CRC_H

Error frame format returned from the slave IP:

Slave IP Address	Function Code	Error Code	CRC Check	
1 byte	1 byte	1 byte	2 bytes	
Actual address	90H	See the error code table.	CRC_L	CRC_H

3.3 Writing a single data frame format

Frame format sent by the host:

Slave IP Address	Function Code	Data Field				CRC Check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	
Actual address	06H	Register address		Register value		CRC_L	CRC_H
		High byte	Low byte	High byte	Low byte		

Response frame format returned from the slave IP:

Slave IP Address	Function Code	Data Field				CRC Check	
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	
Actual address	06H	Register address		Register value		CRC_L	CRC_H
		High byte	Low byte	High byte	Low byte		

Error frame format returned from the slave IP:

Slave IP Address	Function Code	Error Code	CRC Check	
1 byte	1 byte	1 byte	2 bytes	
Actual address	86H	See the error code table.	CRC_L	CRC_H

3.4 Error code table

Code	Name	Meaning
01H	Illegal command	The slave may not support this command.
02H	Illegal data address	The register address requested by the host is out of the legal register address range defined by the slave.
03H	Illegal data value	The register value requested by the host is out of the register value range defined by the slave.
04H	Operation failure	The parameter write operation is invalid for the parameter setting, or the slave does not support the
05H	Password error	The password is error for the address validation.
06H	Data frame error	The length of the data frame sent by the host is incorrect, and the CRC check bit in RTU format is
07H	Parameter read-only	Parameters changed during the host write operation are read-only.
08H	Parameters cannot be	The parameters that are modified during the host write operation are the those that cannot be changed
09H	Password protection	When the host is reading or writing, the system is reported to be locked if the password is set and locked.
0AH	Length error	The number of read/write registers exceeds the upper limit 32.
0BH	Permission denied	There is no permission to perform this operation

4. CRC Check Computation

The CRC domain verifies the content of the entire frame, that is, all data from the slave IP address to the CRC check. The slave retests the CRC check data and compares it with the check value in the received data stream to determine the validity of the received data. The CRC domain consists of two-byte and 16-bit binary value data. In actual transmission, the low byte is passed first, and the high byte is passed later.
There are three methods to calculate the CRC check value. If the results of the three methods are the same, you can choose them freely according to the actual situation.

Method 1: cycle computation 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: byte lookup table

```
/*CRC value of the 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 the 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,
};

/*function returns CRC as an unsigned short*/
 /*parameter puchMsg: the 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 ; /*high byte initialization of CRC*/
   unsigned int uchCRCLo = 0xFF ; /*low byte initialization of CRC*/
   unsigned int uIndex ; /*CRC lookup table index*/
   while (usDataLen--)    /*complete the entire message buffer*/
   {
      uIndex = uchCRCLo ^ *puchMsg++ ; /*CalcCRC*/
      uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex] ;
      uchCRCHi = auchCRCLo[uIndex] ;
   }
   return (uchCRCHi << 8 | uchCRCLo) ;
}
```

Method 3: word lookup table

```
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,
};
/*function returns CRC as an unsigned short*/
/*parameter puchMsg: the 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 ; /*high byte initialization of CRC*/
   unsigned int uchCRCLo = 0xFF ; /*low byte initialization of CRC*/
   unsigned int uIndex ; /*CRC lookup table index*/
   unsigned int hi,low;
   while (usDataLen--)    /*complete the entire message buffer*/
   {
      uIndex = uchCRCLo ^ *puchMsg++ ; /*CalcCRC*/
      hi = tblCRC[uIndex] >> 8;
      low = tblCRC[uIndex] & 0xff;
      uchCRCLo = uchCRCHi ^ hi;
      uchCRCHi = low;
   }
   return (uchCRCHi << 8 | uchCRCLo) ;
}
```

4. Unit and Dimension Description

Physical Quantity	Unit	Magnification	Description
Voltage (including AC and DC)	V	10	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 V to 6,553.5 V
Current (including AC and DC)	A	10	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 A to 6,553.5 A 16-bit signed integer ranging from -32,767 to 32,767, corresponding to -3,276.7 A to 3,276.7 A
Frequency	Hz	100	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 Hz to 655.35 Hz
Power (including AC and DC)	W	1	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 W to 65,535 W
Power factor	/	1000	16-bit signed integer ranging from -32,767 to 32,767 (e.g., 998 indicates a power factor of 0.998; and -900 (0×FC7C) indicates a power factor of -0.900.)
AC side capacity	kWh	10	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 kWh to 6,553.5 kWh; 32-bit unsigned integer ranging from 0 to 4,294,967,295, corresponding to 0 kWh to 429,496,729.5 kWh; (e.g., 1 indicates 0.1 kWh and 10 indicates 1 KWH)
Battery side capacity	AH	1	16-bit unsigned integer ranging from 0 to 65,535, corresponding to 0 AH to 65,535 AH; 32-bit unsigned integer ranging from 0 to 4,294,967,295, corresponding to 0 AH to 4,294,967,295 AH
Temperature	°C	10	16-bit signed integer ranging from -32,767 to 32,767, corresponding to -3,276.7°C to 3,276.7°C
Battery set voltage	V	10	All battery set voltages in this protocol are in the unified dimension of 12 V batteries, that is, all battery set voltages are converted to the corresponding voltage of 12 V. If the rated voltage of the battery is 48 V and the actual set voltage is 57.6 V, the set value is 57.6 V/4=14.4 V, and the value converted for the register is 14.4*10=144.

Note: When 32-bit data occupies two registers, the data is stored in the register in small-endian mode, that is, the low bytes of data are in the low address of the register, and the high bytes are in the high address of the register. If the 32-bit data 0×12345678 is stored at 0×0001 and 0×0002, the order in the register table is 0×0001=0×5678 and 0×0002=0×1234.

MODBUS Protocol for Energy Storage Inverter - Register Address Table

Note:

1. The register displayed in gray font is invalid for the energy storage inverter.
2. Magnification refers to the multiple of the actual value than the register value. If the magnification is 0.1, the actual value is the register value multiplied by 0.1.

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
P00 Product Information Area											
A	1	MinorVersion	R	1	-	%d	Unsigned				Reserved
B	1	MachType	R	1	-	%d	Unsigned				Product type 00 (domestic controller) 01 (controller for street light) 03 (grid-connected inverter) 04 (all-in-one solar charger inverter) 05 (power frequency off-grid)
C	8	ProductInfoReversed01	R	1	-	%s	Unsigned				Reserved
14	2	SoftWareVersion	R	1	-	%d	Unsigned				0×0014: APP version (e.g.,100 for V1.00) 0×0015: BOOTLOADER version (e.g.,100 for V1.00), reserved
16	2	HardWareVersion	R	1	-	%d	Unsigned				0×0016: control panel version (e.g.,100 for V1.00) 0×0017: power amplifier board version (e.g.,100 for V1.00), reserved
18	2	ProductInfoReversed02	R	1	-	%x	Unsigned				Reserved
1A	1	Rs485Addr	R	1	-	%d	Unsigned				Rs485 address, which is read-only
1B	1	MachModelNum2	R	1	-	%d	Unsigned				
1C	2	RS485Version	R	1	-	%x	Unsigned				0×001C: protocol version (e.g.,100 for V1.00) 0×001D: reserved
1E	2	ManufactureDate	R	1	-	%x	Unsigned				0×001E: high byte: year, low byte: month 0×001F: high byte: day, low byte: hour
20	1	ProductAreaCode	R	1	-	%x	Unsigned				0: Shenzhen 1: Dongguan
21	20	CpuBuidTime	R	1	-	%s	Unsigned				String format, with the low bytes of each register valid and the high bytes invalid
35	20	ProductSNStr	R	1	-	%s	Unsigned				String format, with the low bytes of each register valid and the high bytes invalid
49	1	ProductInfoReversed03	R	1	-	%x	Unsigned				
P01 DC Data Area											
100	1	BatSoc	R	1	-	%d	Unsigned				Percentage of remaining battery power
101	1	BatVolt	R	0.1	V	%.1fV	Unsigned				Battery voltage (e.g., 485 for 48.5 V)
102	1	ChargeCurr	R	0.1	A	%.1fA	Signed				Battery current (e.g., 500 for 50.0A) Current greater than 0 indicates discharging; and current less than 0 indicates charging.
103	1	DeviceBatTemper	R	0.1	℃	%.1f℃	Signed				Battery temperature
104	1	Battery SOH	R	1		%d%	Unsigned				
105	1	Battery rated capacity	R	1	AH	%d	Unsigned				
106	1	Battery remain capacity	R	1	AH	%d	Unsigned				
107	1	Pv1Volt	R	0.1	V	%.1fV	Unsigned				Voltage of PV panel 1
108	1	Pv1Curr	R	0.1	A	%.1fA	Unsigned				Current of PV panel 1
109	1	Pv1ChargePower	R	1	W	%d	Unsigned				Power of PV panel 1
10A	1	PvTotalPower	R	1	-	%d	Unsigned				Total PV power
10B	1	ChargeState	R	1	-	%d	Unsigned				0×0000: Charge off 0×0001: Quick charge 0×0002: Const voltage charge 0×0004: Float charge 0×0005: Reserved 0×0006: Li battery activate 0×0008: Full
10C	1	BatteryCycleCount	R	1	-	%d	Unsigned				
10D	1	DcDataRevserved04	R	1	-	%d	Unsigned				Reserved
10E	1	ChargePower	R	1	W	%dW	Unsigned				PV charging power + AC charging power
10F	1	Pv2Volt	R	0.1	V	%.1fV	Unsigned				Voltage of PV panel 2
110	1	Pv2Curr	R	0.1	A	%.1fA	Unsigned				Current of PV panel 2
111	1	Pv2ChargePower	R	1	W	%d	Unsigned				Power of PV panel 2
112	1	BatBmsVolt	R	0.1	V	%.1fV	无				
113	1	BatBmsCurr	R	0.1	A	%.1fA	无				
114	1	BatBmsTemp	R	0.1	℃	%.1f℃	有				
115	1	BatBmsChgLimitVolt	R	0.1	V	%.1fV	无				
116	1	BatBmsChgLimitCurr	R	0.1	A	%.1fA	无				
117	1	BatBmsDchgLimitCurr	R	0.1	A	%.1fA	无				
118	1	BmsAlarmH	R	1	-	%x	无				
119	1	BmsAlarmL	R	1	-	%x	无				
11A	1	BmsProtectH	R	1	-	%x	无				
11B	1	BmsProtectL	R	1	-	%x	无				
P02 Inverter Data Area											
200	4	CurrErrReg	R	1	-	%x	Unsigned				Each fault bit represents a fault, with a total of 64 bits. This register is used by the internal debugging.
204	4	CurrFcode	R	1	-	%d	Unsigned				There are four addresses. Each address stores a fault code corresponding to the current fault. Four fault codes can be displayed at the same time. 0 indicates no fault. If there are two faults, battery under-voltage and inverter overload, the following information is displayed: 0×204: 01 0×205: 14 0×206: 00 0×207: 00
208	3	ReservedInvData0	R	2	-	%x	Unsigned				Reserved
20B	1	Powerflowflag	R	1	-		Unsigned				
20C	3	SysDateTime	RW	1	-	%zdt	Unsigned				0×020C: high byte: year, low byte: month 0×020D: high byte: day, low byte: hour 0×020E: high byte: minute, low byte: second The register can be set to adjust the RTC clock.
20F	1	GridOnRemainTime	R	1	s	%d	Unsigned				

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
210	1	MachineState	R	1	-	%d	Unsigned				0: Power-on delay 1: Standby state 2: Initialization 3: Soft start 4: AC power operation 5: Inverter operation 6: Inverter to AC power 7: AC power to inverter 8: Battery activation 9: Manual shutdown 10: Fault Split-phase all-in-one machines and European standard single-phase 8-12K machines are as follows: 0: Initialization 1: Standby state 2: AC power operation 3: Inverter operation
211	1	PriorityFlag	R	1	-	%d	Unsigned				0: Users have not entered password 1: The password of users is entered 4: The password of the manufacturer is entered
212	1	BusVoltSum	R	0.1	V	%.1fV	Unsigned				
213	1	GridVoltA	R	0.1	V	%.1fV	Unsigned				AC power phase-A voltage
214	1	GridCurrA	R	0.1	A	%.1fA	Unsigned				AC power phase-A current
215	1	GridFreq	R	0.01	Hz	%.2fHz	Unsigned				AC power frequency
216	1	InvVoltA	R	0.1	V	%.1fV	Unsigned				Inverter phase-A output voltage
217	1	InvCurrA	R	0.1	A	%.1fA	Unsigned				Inverter phase-A inductive current
218	1	InvFreq	R	0.01	Hz	%.2fHz	Unsigned				
219	1	LoadCurrA	R	0.1	A	%.1fA	Unsigned				Load side phase-A current
21A	1	LoadPF	R	0.01	-	%.2f	Signed				Unused
21B	1	LoadActivePowerA	R	1	W	%dW	Unsigned				Phase-A load active power
21C	1	LoadApparentPowerA	R	1	VA	%dVA	Unsigned				Phase-A load apparent power
21D	1	InvDcVolt	R	1	mV	%dmV	Signed				Unused
21E	1	LineChgCurr	R	0.1	A	%.1fA	Unsigned				Charging current from the AC power on the battery side
21F	1	LoadRatioA	R	1	%	%d%	Unsigned				Phase-A load ratio
220	1	Tempera	R	0.1	°C	%.1f°C	Signed				Cooling-fin DC-DC temperature
221	1	Temperb	R	0.1	°C	%.1f°C	Signed				Cooling-fin DC-AC temperature
222	1	Temperc	R	0.1	°C	%.1f°C	Signed				Transformer temperature
223	1	Temperd	R	0.1	°C	%.1f°C	Signed				Ambient temperature
224	1	Ibuck1	R	0.1	A	%.1fA	Unsigned				Charging current from the PV power on the battery side
225	1	ParallCurrRms	R	0.1	A	%.1fA	Unsigned				High-pressure parallel use
226	1	Invfaultstate	R	1	-	%d	Unsigned				Available for customized models only
227	1	ChargeStatus	R	1	-	%d	Unsigned				Available for customized models only
228	1	PBusVolt	R	0.1	V	%.1fV	Unsigned				Suitable for the split-phase all-in-one machine and European standard machine of 10 kW
229	1	NBusVolt	R	0.1	V	%.1fV	Unsigned				Suitable for the split-phase all-in-one machine and European standard machine of 10 kW
22A	1	GridVoltB	R	0.1	V	%.1fV	Unsigned				AC power phase-B voltage
22B	1	GridVoltC	R	0.1	V	%.1fV	Unsigned				AC power phase-C voltage
22C	1	InvVoltB	R	0.1	V	%.1fV	Unsigned				Inverter phase-B output voltage
22D	1	InvVoltC	R	0.1	V	%.1fV	Unsigned				Inverter phase-C output voltage
22E	1	InvCurrB	R	0.1	A	%.1fA	Unsigned				Inverter phase-B inductive current
22F	1	InvCurrC	R	0.1	A	%.1fA	Unsigned				Inverter phase-C inductive current
230	1	LoadCurrB	R	0.1	A	%.1fA	Unsigned				Load side phase-B current
231	1	LoadCurrC	R	0.1	A	%.1fA	Unsigned				Load side phase-C current
232	1	LoadActivePowerB	R	1	W	%dW	Unsigned				
233	1	LoadActivePowerC	R	1	W	%dW	Unsigned				
234	1	LoadReactivePowerB	R	1	VA	%dVA	Unsigned				
235	1	LoadReactivePowerC	R	1	VA	%dVA	Unsigned				
236	1	LoadRatioB	R	1	%	%d%	Unsigned				Phase-B load ratio
237	1	LoadRatioC	R	1	%	%d%	Unsigned				Phase-C load ratio
238	1	GridCurrB	R	0.1	A	%.1fA	Unsigned				AC power phase-B current
239	1	GridCurrC	R	0.1	A	%.1fA	Unsigned				AC power phase-C current
23A	1	GridActivePowerA	R	1	A	%dW	Signed				**Greater than 0 for power of grid connection; Less than 0 for power of grid consumption**
23B	1	GridActivePowerB	R	1	A	%dW	Signed				**Greater than 0 for power of grid connection; Less than 0 for power of grid consumption**
23C	1	GridActivePowerC	R	1	A	%dW	Signed				**Greater than 0 for power of grid connection; Less than 0 for power of grid consumption**
23D	1	GridApparentPowerA	R	1	VA	%dVA	Unsigned				
23E	1	GridApparentPowerB	R	1	VA	%dVA	Unsigned				
23F	1	GridApparentPowerC	R	1	VA	%dVA	Unsigned				
240	1	HomeLoadActivePowerA	R	1	W	%dW	Unsigned				
241	1	HomeLoadActivePowerB	R	1	W	%dW	Unsigned				
242	1	HomeLoadActivePowerC	R	1	W	%dW	Unsigned				
243	1	SecondLoadActivePowerA	R	1	W	%dW	Unsigned				Active power of A/L1 phase second load (for HESP120SH3/HESP48120SH3)
244	1	SecondLoadActivePowerB	R	1	W	%dW	Unsigned				Active power of B/L2 phase second load (for HESP120SH3/HESP48120SH3)
245	1	SecondLoadActivePowerC	R	1	W	%dW	Unsigned				Active power of C/L3 phase second load (for HESP120SH3/HESP48120SH3)
246	1	SecondLoadAppPowerA	R	1	VA	%dVA	Unsigned				Apparent power of A/L1 phase second load (for HESP120SH3/HESP48120SH3)
247	1	SecondLoadAppPowerB	R	1	VA	%dVA	Unsigned				Apparent power of B/L2 phase second load (for HESP120SH3/HESP48120SH3)
248	1	SecondLoadAppPowerC	R	1	VA	%dVA	Unsigned				Apparent power of C/L3 phase second load (for HESP120SH3/HESP48120SH3)
249	1	SecondLoadCurrA	R	0.1	A	%.1fA	Unsigned				Current RMS of A/L1 phase second load (for HESP120SH3/HESP48120SH3)
24A	1	SecondLoadCurrB	R	0.1	A	%.1fA	Unsigned				Current RMS of B/L2 phase second load (for HESP120SH3/HESP48120SH3)
24B	1	SecondLoadCurrC	R	0.1	A	%.1fA	Unsigned				Current RMS of C/L3 phase second load (for HESP120SH3/HESP48120SH3)
24C	1	LoadRatioSum	R	1	W	%d	Unsigned				Load rate of the total load (for HESP120SH3/HESP48120SH3)
24D	1	ParallelNum	R	1	W	%d	Unsigned				Number of parallel device
24E	2	ParaUpsLoadPowersum	R	1	W	%d	Signed				Sum of active power of three-phase UPS load
250	2	ParaHomeLoadPowerSum	R	1	W	%d	Signed				Sum of active power of three-phase home load
252	2	ParaGridPowerSum	R	1	W	%d	Signed				Sum of active power of three-phase grid
254	2	ParaGenPortPowerSum	R	1	W	%d	Signed				Sum of active power of three-phase generator
P03 Device Control Area											
DF00	1	CmdPowerOnOff	W	1	-	%x	Unsigned				0: Off 1: on Others: no action
DF01	1	CmdMachineReset	W	1	-	%x	Unsigned				1. Reset Others: no action
DF02	1	CmdRestoreFactorySetting	W	1	-	%x	Unsigned				0×AA: restoring 0×BB: clear the statistics (power statistics) 0×CC: clearing the fault history Others: no action Restore factory set values to clear all cumulative data and restore parameters to the default state, and restart to take effect.
DF03	1	Arc fault clear	W	1	-	%x	Unsigned				0：Ignore 1：clear
P05 Setting Area for Battery-related Parameters											
E000	1	BatParmReserved0	RW	1	-	%d	Unsigned	0	1	0	
E001	1	PvChgCurrSet	RW	0.1	A	%dA	Unsigned	0	150	80	PV charging current limit. Generation-1 machine: 50 A, generation-2 machine: 60 A, and generation-3 machine: 80 A-100 A
E002	1	BatRateCap	RW	1	AH	%dAH	Unsigned	0	400	100	

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
E003	1	BatRateVolt	RW	1	V	%dV	Unsigned	12	255	48	12: 12 V 24: 24 V 36: 36 V 48: 48 V
E004	1	BatTypeSet	RW	1	-	%d	Unsigned	0	14	6	0: User define 1: SLD 2: FLD 3: GEL 4: Lithium iron phosphate x 14 5: Lithium iron phosphate x 15 6: Lithium iron phosphate x 16 7: Lithium iron phosphate x 7 8: Lithium iron phosphate x 8 9: Lithium iron phosphate x 9 10: Ternary lithium x 7 11: Ternary lithium x 8 12: Ternary lithium x 13 13: Ternary lithium x 14
E005	1	BatOverVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	15.5	Battery charging over-voltage protection point (converted to the voltage corresponding to 12 V, followed by the same battery voltage)
E006	1	BatChgLimitVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	14.4	Over-charging protection voltage
E007	1	BatConstChgVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	14.4	Equalizing charging voltage
E008	1	BatImprovChgVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	14.4	Lead-acid battery is prohibited from boost charge, and lithium battery is prohibited from over-charging voltage.
E009	1	BatFloatChgVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	14	For lead-acid battery
E00A	1	BatImprovChgBackVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	13.2	After the battery enters floating charging, the battery voltage is lower than the judged point again, and the battery enters boost charge again.
E00B	1	BatOverDischgBackVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	12.6	After the battery is protected from over-discharge and under-voltage, it is returned to the discharged state.
E00C	1	BatUnderVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	11	Alarming of low battery voltage without load cut-off
E00D	1	BatOverDischgVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	12.2	Alarming of low battery voltage with load cut-off
E00E	1	BatDischgLimitVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	11.2	During the battery over-discharge delay, the battery voltage is lower than the judged point, and then the load is off at once.
E00F	1	BatStopSOC	RW	1	-	%d%	Unsigned	0	100	5	Discharge cut-off SOC
E010	1	BatOverDischgDelayTime	RW	1	S	%dS	Unsigned	0	120	60	
E011	1	BatConstChgTime	RW	1	Min	%dmin	Unsigned	0	900	120	
E012	1	BatImprovChgTime	RW	1	Min	%dmin	Unsigned	10	900	120	
E013	1	BatConstChgGapTime	RW	1	day	%dDay	Unsigned	0	255	30	
E014	1	CoeffTemperCompen	RW	1	mV/°C/2V	%d	Signed	0	10	5	Invalid
E015	1	ChgMaxTemper	RW	1	°C	%d	Signed	-40	100	60	Invalid
E016	1	ChgMinTemper	RW	1	°C	%d	Signed	-40	100	-30	Invalid
E017	1	DisChgMaxTemper	RW	1	°C	%d	Signed	-40	100	60	Invalid
E018	1	DisChgMinTemper	RW	1	°C	%d	Signed	-40	100	-30	Invalid
E019	1	HeatBatStartTemper	RW	1	°C	%d	Signed	-40	100	0	Invalid
E01A	1	HeatBatStopTemper	RW	1	°C	%d	Signed	-40	100	5	Invalid
E01B	1	BatSwitchDcVolt	RW	0.1	V	%.1fV	Unsigned	9	15.5	11.5	The load is switched to the AC power when the battery voltage falls below this judged point.
E01C	1	StopChgCurrSet	RW	0.1	A	%.1fA	Unsigned	0	10	2	Only the lithium battery is effective, and when the current of constant-voltage charging state is lower than this value, the charging is stopped.
E01D	1	StopChgSocSet	RW	1	%	%d	Unsigned	0	100	100	When the SOC capacity is greater than or equal to this value, charging is stopped, and it is valid for BMS communication.
E01E	1	BatSocLowAlarm	RW	1	%	%d	Unsigned	0	100	15	With the alarming of low SOC capacity, it is valid for BMS communication.
E01F	1	BatSocSwToLine	RW	1	%	%d	Unsigned	0	100	10	In SBU mode, the AC power is applied when the SOC capacity is less than or equal to the value.
E020	1	BatSocSwToBatt	RW	1	%	%d	Unsigned	1	100	100	In SBU mode, the inverter is applied when the SOC capacity is greater than or equal to the value.
E021	1	BatDischgMaxCurrSet	RW	1	A	%.1fA	Unsigned	0	200	100	
E022	1	BattVoltSwToInv	RW	0.1	V	%.1fV	Unsigned	9	15.5	14	When the battery voltage is higher than the judged point, the inverter is switched back.
E023	1	BattEqualChgTimeout	RW	1	min	%dmin	Unsigned	5	900	240	Increment+5
E024	1	LiBattActiveCurrSet	RW	0.1	A	%.1fA	Unsigned	0	20	8	
E025	1	BMSChgLCMode	RW	1		%d	Unsigned	0	2	1	
E026	**1**	ChargeStartTime1	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E027	**1**	ChargeEndTime1	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E028	**1**	ChargeStartTime2	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E029	**1**	ChargeEndTime2	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E02A	**1**	ChargeStartTime3	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E02B	**1**	ChargeEndTime3	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E02C	**1**	OnTimeChargeEn	RW	1	-	%d	Unsigned	0	1	0	0: disabled; 1: enabled
E02D	**1**	DischgStartTime1	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E02E	**1**	DischgEndTime1	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E02F	**1**	DischgStartTime2	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E030	**1**	DischgEndTime2	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E031	**1**	DischgStartTime3	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E032	**1**	DischgEndTime3	RW	1	h/m	%d	Unsigned	0	5947	0	Hours and minutes: 23*256+59=5,947
E033	**1**	OnTimeDischgEn	RW	1	-	%d	Unsigned	0	1	0	0: disabled; 1: enabled
E034	**3**	BatParmReserved2	RW	1	-	%d	Unsigned	0	-	0	
E037	1	InvToGridEn	RW	1	-	%d	Unsigned	0	3	0	0: off-grid mode (banned) 1: grid-connected mode 2: ACout anti-reverse flow 3: ACin anti-reverse flow
E038	**1**	LeakageCurrDtcEn	RW	1	-	%d	Unsigned	0	1	0	0: disabled; 1: enabled
E039	**1**	PvPowerPrioritySet	RW	1		%d	Unsigned	0	2	0	0: charging priority 1: load priority
E03A	1	BattTemperCompEn	RW	1	-	%d	Unsigned	0	1	0	0: disabled 1: enabled
E03B	1	TimedChg1StopSOC	RW	1	%	%d	Unsigned	0	100	100	During charging period, the charging is stopped when SOC is greater than the specified value.
E03C	1	TimedChg2StopSOC	RW	1	%	%d	Unsigned	0	100	100	
E03D	1	TimedChg3StopSOC	RW	1	%	%d	Unsigned	0	100	100	
E03E	1	TimedDchg1StopSOC	RW	1	%	%d	Unsigned	0	100	80	During discharging period, the discharging is stopped when SOC is less than the specified value.
E03F	1	TimedDchg2StopSOC	RW	1	%	%d	Unsigned	0	100	60	
E040	1	TimedDchg3StopSOC	RW	1	%	%d	Unsigned	0	100	10	
E041	1	TimedChg1StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	57.6	
E042	1	TimedChg2StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	57.6	
E043	1	TimedChg3StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	57.6	
E044	1	TimedDchg1StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	42	
E045	1	TimedDchg2StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	42	
E046	1	TimedDchg3StopVolt	RW	0.1	W	%.1fV	Unsigned	40	59.5	42	
E047	1	TimedDchg1MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E048	1	TimedDchg2MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E049	1	TimedDchg3MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E04A	1	TimedChg1MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E04B	1	TimedChg2MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E04C	1	TimedChg3MaxPower	RW	1	W	%d	Unsigned	0	12000	6000	
E04D	1	TimedChgSource	RW	1		%d	Unsigned	0	7	0	Bit00: AC power during the charging period 1, 0: disabled, 1: enabled Bit01: electric generator during the charging period 1, 0: disabled, 1: enabled Bit02: AC power during the charging period 2, 0: disabled, 1: enabled Bit03: electric generator during the charging period 2, 0: disabled, 1: enabled Bit04: AC power during the charging period 3, 0: disabled, 1: enabled Bit05: electric generator during the charging period 3, 0: disabled, 1: enabled
E04E	1	OnGridDchgSocBalanceEn	RW	1		%d	Unsigned	0	1	0	Only for HESP120SH3

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
E04F	1	OnGridChgSocBalanceEn	RW	1		%d	Unsigned	0	1	0	Only for HESP120SH3
E050	1	SocBalanceRatio	RW	1		%d	Unsigned	0	10	0	Only for HESP120SH3
E051	1	reserved	RW	1		%d	Unsigned	0	1	0	Only for HESP120SH3
P07 User Setting Area for Inverter Parameters											
E200	1	Rs485AddrSet	RW	1	-	%d	Unsigned	1	254	1	Integer (1 to 254)
E201	1	ParallMode	RW	1	-	%d	Unsigned	0	7	0	0: single machine 1: single-phase parallel 2: two-phase parallel 3: two-phase parallel 120 4: two-phase parallel 180 5: three-phase A 6: three-phase B 7: three-phase C
E202	1	PassWordSet	W	1	-	%d	Unsigned	0	65535	0	The password consists of four decimal digits. If the parameter is 0, there is no password. Keyboard passwords can be changed by keyboard and communication.
E203	1	PassWordInput	W	1	-	%d	Unsigned	0	65535	0	
E204	1	OutputPriority	RW	1	-	%d	Unsigned	0	2	1	0: solar 1: line 2: sbu
E205	1	IbattLineChgLimit	RW	0.1	A	%.1fA	Unsigned	0	200	60	Maximum charging current limit for AC power charging
E206	1	BattEqualChgEnable	RW	1	V	%d	Unsigned	0	1	0	
E207	1	N_G_FuncEn	RW	1		%d	Unsigned	0	1	0	N and PE ground cable short circuit enabled (only available on some models)
E208	1	OutputVoltSet	RW	0.1	V	%.1fV	Unsigned	100	264	120	
E209	1	OutputFreqSet	RW	0.01	Hz	%.2fHz	Unsigned	45	65	50	
E20A	1	MaxChgCurr	RW	0.1	A	%.1fA	Unsigned	0	200	80	
E20B	1	AcVoltRange	RW	1		%d	Unsigned	0	1	1	0: wide band (APL) 1: narrow band (UPS)
E20C	1	PowerSavingMode	RW	1		%d	Unsigned	0	1	0	0: disabled 1: enabled
E20D	1	AutoRestartOvLoad	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E20E	1	AutoRestartOvTemper	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E20F	1	ChgSourcePriority	RW	1		%d	Unsigned	0	3	2	0: PV priority (AC power charging available when PV fails) 1: AC power priority (PV charging available when AC power fails) 2: hybrid mode (AC power and PV charging at the same time, with PV priority) 3: PV only
E210	1	AlarmEnable	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E211	1	AlarmEnWhenSourceLoss	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E212	1	BypEnableWhenOvLoad	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E213	1	RecordFaultEnable	RW	1		%d	Unsigned	0	1	1	0: disabled 1: enabled
E214	1	BmsErrStopEnable	RW	1		%d	Unsigned	0	1	0	0: disabled 1: enabled
E215	1	BmsCommEnable	RW	1		%d	Unsigned	0	2	0	0: disabled 1: 485-BMS enabled 2: CAN-BMS enabled
E216	1	DcLoadSwitch	RW	1		%d	Unsigned	0	1	0	0: off, 1: on
E217	1	InvParamSetReserved01	RW	1		%d	Unsigned	0	0	0	Reserved
E218	1	DeratePower	RW	1		%.001fW	Unsigned	1000	15000	0	Reduction of machine power rating
E219	1	InvParamSetReserved02	R	1		%d	Unsigned	0	1	0	
E21A	**1**	**GeneratorChgDisable**	**R**	**1**		**%d**	**Unsigned**	**0**	**1**	**0**	**Generator charging by default (can be disabled)**
E21B	1	Rs485BmsProtocol	RW	1		%d	Unsigned	0	30	7	
E21C	1	MaxLineCurrent	RW	0.1		%.1fA	Unsigned	0	100	40	Only for some custom models (ancient style ship of RGSC)
E21D	**1**	**MaxLinePower**	**RW**	**1**		**%d**	**Unsigned**	**0**	**65535**	**50**	**Peak clipping power of grid** **50: 500 W**
E21E	1	OutputPhaseSet	RW	1		%d	Unsigned	0	2	0	Only for single split-phase machine; 0: single-phase connection, 1: three-phase connection, 2: split-phase connection
E21F	1	GenWorkMode	RW	1		%d	Unsigned	0	1	0	
E220	1	GenChgMaxCurr	RW	0.1	A	%.1fA	Unsigned	0	100	40	
E221	**1**	**GenRatePower**	**RW**	**1**		**%d**	**Unsigned**	**0**	**65535**	**6000**	
E222	1	PvToSmartLoadEn	RW	1		%d	无	0	1	0	**reserved**
E223	**1**	GridToSmartLoadEn	RW	1		%d	无	0	1	0	**The enabling setup of the grid supply to the secondary load**
E224	**1**	WeekSet	RW	1		%d	无	1	7	1	**Week setting**
E225	**1**	WeekToOnTimeEn	RW	1		%d	无	1	7	1	**bit00：Start a timed charge on Monday** **bit01：Start scheduled charging on Tuesday** **...**
P08 Setting Area for Inverter Grid-connection Parameters											
E400	1	GridActivePowerSet	RW	1	W	%d	Unsigned	0	65000	0	
E401	1	GridPfSet	RW	0.001		%.3f	Signed	-1	1	1	Only suitable for models supporting grid-connection, with the adjustment range of -80~100 and 80~100
E402	1	GridQset	RW	0.1	%	%d	Signed	-100	100	0	Grid-connection reactive power setting
E403	1	GridStandard	RW	1		%d	Signed	0	100	100	Grid-connection standard setting
E404	1	GridUVLevel1	RW	0.1	V	%.1f	Unsigned	0	270	184	
E405	1	GridUVTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E406	1	GridUVResumLevel1	RW	0.1	V	%.1f	Unsigned	0	270	198	
E407	1	GridUVResumTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E408	1	GridUVLevel2	RW	0.1	V	%.1f	Unsigned	0	270	184	
E409	1	GridUVTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E40A	1	GridUVResumLevel2	RW	0.1	V	%.1f	Unsigned	0	270	198	
E40B	1	GridUVResumTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E40C	1	GridOVLevel1	RW	0.1	V	%.1f	Unsigned	0	270	280	
E40D	1	GridOVTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E40E	1	GridOVResumLevel1	RW	0.1	V	%.1f	Unsigned	0	320	270	
E40F	1	GridOVResumTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E410	1	GridOVLevel2	RW	0.1	V	%.1f	Unsigned	0	320	280	
E411	1	GridOVTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E412	1	GridOVResumLevel2	RW	0.1	V	%.1f	Unsigned	0	320	270	
E413	1	GridOVResumTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E414	1	GridUFLevel1	RW	0.01	Hz	%.2f	Unsigned	0	65	47	
E415	1	GridUFTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E416	1	GridUFResumLevel1	RW	0.01	Hz	%.2f	Unsigned	0	65	48	
E417	1	GridUFResumTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E418	1	GridUFLevel2	RW	0.01	Hz	%.2f	Unsigned	0	65	47	
E419	1	GridUFTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E41A	1	GridUFResumLevel2	RW	0.01	Hz	%.2f	Unsigned	0	65	48	
E41B	1	GridUFResumTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E41C	1	GridOFLevel1	RW	0.01	Hz	%.2f	Unsigned	0	65	52.5	
E41D	1	GridOFTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E41E	1	GridOFResumLevel1	RW	0.01	Hz	%.2f	Unsigned	0	65	51	
E41F	1	GridOFResumTime1	RW	20	mS	%d	Unsigned	20	600000	120	
E420	1	GridOFLevel2	RW	0.01	Hz	%.2f	Unsigned	0	65	52.5	
E421	1	GridOFTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E422	1	GridOFResumLevel2	RW	0.01	Hz	%.2f	Unsigned	0	65	51	

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
E423	1	GridOFResumTime2	RW	20	mS	%d	Unsigned	20	600000	120	
E424	1	ReConnectGridTime	RW	1	S	%d	Unsigned	0	600	60	
E425	1	IsoCheckEn	RW	1		%d	Unsigned	0	1	1	
E426	1	IsoProtectPoint	RW	1		%d	Unsigned	10	65535	15	
E427	1	GridFuncEnable	RW	1		%d	Unsigned	0	65535	0	
E428	1	GridStandUserMode	RW	1		%d	Unsigned	0	1	0	
E429	1	Cei021AutoTestStep	RW	1		%d	Unsigned	0	65535	0	
E42A	1	BattForGridPowerEn	RW	1		%d	Unsigned	0	3	0	0: Battery is not discharged. 1: Battery discharges to UPS loads. 2: Battery discharges to home loads. 3: Grid connection participates in electricity sales.
E42B	1	ExCtRatio	RW	1		%d	Unsigned	0	5000	1000	
E42C	1	ZeroExportPower	RW	1	W	%d	Unsigned	0	500	20	When it is in the anti-reverse current function, the input target power is set for the grid.
E42D	1	ReConnPowerRamp	RW	1	S	%d	Unsigned	0	1000	60	Rising rate of reconnection power
E42E	1	WattPFCurveEnable	RW	1		%d	Unsigned	0	1	0	
E42F	1	HLVRTEnable	RW	1		%d	Unsigned	0	1	0	
E430	1	Cei021AutoTestStart	RW	1		%d	Unsigned	0	1	0	
E431	1	AfciEnable	RW	1		%d	Unsigned	0	1	0	
E432	1	NormalConnDlyTsec	RW	1	S	%d	Signed	0	1000	30	
E433	1	NormalConnPwrRampTsec	RW	1	S	%d	Unsigned	0	1000	30	
E434	1	ConnVoltLow	RW	0.1	V	%.1f	Unsigned	0	320	110	
E435	1	ConnVoltHigh	RW	0.1	V	%.1f	Unsigned	0	320	140	
E436	1	ConnFreqLow	RW	0.01	Hz	%.2f	Unsigned	40	70	60	
E437	1	ConnFreqHigh	RW	0.01	Hz	%.2f	Unsigned	40	70	60	
E438	1	CT auto detect enable	RW	1		%d	Unsigned	0	1	0	
E439	1	CT manual setting	RW	1		%d	Unsigned	0	2	0	
E43A	1	GridFuncEnable1	RW	1		%d	Unsigned	0	65535	0	
E43B	1	DRMS_Enable	RW	1		%d	Unsigned	0	1	0	0:disable 1:enable
E43C	1	GridUVLevel3	RW	0.1	V	%.1f	Unsigned				Power grid three-level undervoltage protection point
E43D	1	GridUVTime3	RW	20	ms	%d	Unsigned				Power grid three-level undervoltage protection time
E43E	1	SmartMeterEn	RW	1		%d	Unsigned				0:disable 1：Single phase meter 2：Three phase meter
E43F	1	reserved	RW	1		%d	Unsigned				
P09 Power Statistics Historical Data											
F000	7	PVEnergyLast7day	R	0.1	kWh	%.1fkWh	Unsigned				The power data for each day occupies one register, so for example, if today is September 27, the PV power generation data for the last 7 days is as follows: F000: power generation on September 26 (yesterday) F001: power generation on September 25 (two days ago) F002: power generation on September 24 ..... F006: power generation on September 20
F007	7	BatChgEnergyLast7day	R	1	AH	%dAH	Unsigned				
F00E	7	BatDisChgEnergyLast7day	R	1	AH	%dAH	Unsigned				
F015	7	LineChgEnergyLast7day	R	1	AH	%dAH	Unsigned				
F01C	7	LoadConsumLast7day	R	0.1	kWh	%.1fkWh	Unsigned				
F023	7	LoadConsumFromLineLast7day	R	0.1	kWh	%.1fkWh	Unsigned				
F02A	2	EnergyStatisticsDay	R	0.1	kWh	%.1fkWh	Unsigned				
F02C	1	GeneratEnergyToGridToday	R	0.1	kWh	%.1fkWh	Unsigned				
F02D	1	BatChgAHToday	R	1	AH	%d	Unsigned				The amount of battery charge today (AH)
F02E	1	BatDischgAHToday	R	1	AH	%d	Unsigned				The amount of battery discharge today (AH)
F02F	1	GeneratEnergyToday	R	0.1	kWh	%.1fkWh	Unsigned				The amount of PV power generation today
F030	1	UsedEnergyToday	R	0.1	kWh	%.1fkWh	Unsigned				The energy consumed by the load today
F031	1	WorkDaysTotal	R	1	d	%d	Unsigned				
F032	2	GridEnergyTotal	R	0.1	kWh	%.1fkWh	Unsigned				Cumulative value of power generated to the grid
F034	2	BatChgAHTotal	R	1	AH	%d	Unsigned				
F036	2	BatDischgAHTotal	R	1	AH	%d	Unsigned				
F038	2	GeneratEnergyTotal	R	0.1	kWh	%.1fkWh	Unsigned				
F03A	2	UsedEnergyTotal	R	0.1	kWh	%.1fkWh	Unsigned				
F03C	1	LineChgEnergyTday	R	1	AH	%d	Unsigned				AC charging power (AH) for the day
F03D	1	LoadConsumLineTday	R	0.1	kWh	%.1fkWh	Unsigned				
F03E	1	InvWorkTimeToday	R	1	min	%dmin	Unsigned				
F03F	1	LineWorkTimeTodya	R	1	min	%dmin	Unsigned				
F040	3	PowerOnTime	R	1		%d	Unsigned				Refer to the time register for the current time format.
F043	3	LastEquaChgTime	R	1		%d	Unsigned				Refer to the time register for the current time format.
F046	2	LineChgEnergyTotal	R	1	AH	%d	Unsigned				
F048	2	LoadConsumLineTotal	R	0.1	kWh	%.1fkWh	Unsigned				Cumulative load power consumed from the battery side
F04A	1	InvWorkTimeTotal	R	1	h	%dh	Unsigned				
F04B	1	LineWorkTimeTotal	R	1	h	%dh	Unsigned				
F04C	1	LineChgKwHTday	R	1		%d	Unsigned				
F04D	1	BatChgkWhToday	R	0.1	kWh	%.1fkWh	Unsigned				The energy of battery charge today (kWh)
F04E	1	BatDischgkWhToday	R	0.1	kWh	%.1fkWh	Unsigned				The energy of battery discharge today (kWh)
F04F	1	EnergyReserved3	R	1		%d	Unsigned				
F050	2	BatChgkWhTotal	R	0.1	kWh	%.1fkWh	Unsigned				The energy of battery charge total (kWh)
F052	2	BatDischgkWhTotal	R	0.1	kWh	%.1fkWh	Unsigned				The energy of battery discharge total (kWh)
F054	2	LineChgkWhTotal	R	0.1	kWh	%.1fkWh	Unsigned				
F056	1	GenLoadConsumToday	R	0.1	kWh	%.1f	Unsigned				The amount of electricity consumed by the generator with load today
F057	1	GenChgkWhToday	R	0.1	kWh	%.1f	Unsigned				The amount of electricity consumed by the generator charging today
F058	2	GenLoadConsumTotal	R	0.1	kWh	%.1f	Unsigned				The amount of electricity consumed by the generator with load total
F05A	2	GenChgkWhTotal	R	0.1	kWh	%.1f	Unsigned				The amount of electricity consumed by the generator charging total
F05C	1	GenWorkTimeToday	R	1	h	%d	Unsigned				Generator working hours of the day
F05D	1	GenWorkTimeTotal	R	1	h	%d	Unsigned				Cumulative working time of generator
P10 Fault Record											
F800	16	FaultHistoryRecord00	RW	1		%d	Unsigned				
F810	16	FaultHistoryRecord01	RW	1		%d	Unsigned				
F820	16	FaultHistoryRecord02	RW	1		%d	Unsigned				
F830	16	FaultHistoryRecord03	RW	1		%d	Unsigned				
F840	16	FaultHistoryRecord04	RW	1		%d	Unsigned				
F850	16	FaultHistoryRecord05	RW	1		%d	Unsigned				Each fault record occupies 16 addresses, storing a total of 16 fault records.
F860	16	FaultHistoryRecord06	RW	1		%d	Unsigned				Internal data format definition for fault record: (defined by internal offset address)
F870	16	FaultHistoryRecord07	RW	1		%d	Unsigned				**0x00:** Fault code**;** see the instruction **m**anual for specific definition of fault code. If the fault
F880	16	FaultHistoryRecord08	RW	1		%d	Unsigned				code is 0, it means that the fault record is invalid.
F890	16	FaultHistoryRecord09	RW	1		%d	Unsigned				**0x01–0x03:** The time when the fault code occurs (there is no time for generation-1 machines).
F8A0	16	FaultHistoryRecord10	RW	1		%d	Unsigned				**0x04–0x0F:** Data packets captured when a fault occurs, with a total of 12 data.
F8B0	16	FaultHistoryRecord11	RW	1		%d	Unsigned				
F8C0	16	FaultHistoryRecord12	RW	1		%d	Unsigned				
F8D0	16	FaultHistoryRecord13	RW	1		%d	Unsigned				
F8E0	16	FaultHistoryRecord14	RW	1		%d	Unsigned				
F8F0	16	FaultHistoryRecord15	RW	1		%d	Unsigned				
F900	16	FaultHistoryRecord16	RW	1		%d	Unsigned				
F910	16	FaultHistoryRecord17	RW	1		%d	Unsigned				
F920	16	FaultHistoryRecord18	RW	1		%d	Unsigned				
F930	16	FaultHistoryRecord19	RW	1		%d	Unsigned				
F940	16	FaultHistoryRecord20	RW	1		%d	Unsigned				
F950	16	FaultHistoryRecord21	RW	1		%d	Unsigned				
F960	16	FaultHistoryRecord22	RW	1		%d	Unsigned				
F970	16	FaultHistoryRecord23	RW	1		%d	Unsigned				
F980	16	FaultHistoryRecord24	RW	1		%d	Unsigned				
F990	16	FaultHistoryRecord25	RW	1		%d	Unsigned				
F9A0	16	FaultHistoryRecord26	RW	1		%d	Unsigned				
F9B0	16	FaultHistoryRecord27	RW	1		%d	Unsigned				
F9C0	16	FaultHistoryRecord28	RW	1		%d	Unsigned				
F9D0	16	FaultHistoryRecord29	RW	1		%d	Unsigned				
F9E0	16	FaultHistoryRecord30	RW	1		%d	Unsigned				
F9F0	16	FaultHistoryRecord31	RW	1		%d	Unsigned				

Address	Length	English Name	R/W	Magnification	Unit	Display Format	Signed/Unsigned	Minimum	Maximum	Default	Remark
FA00	16	AutoTestRecord	RW	1		%d	Unsigned				
FA10	1	RecordReserved0	R	1		%d	Unsigned				
FA11	1	RecordReserved1	R	1		%d	Unsigned				
END											

Note: The 0×0438-0×439 is the online upgrade command entry address.