

# **JXNT MODBUS Interface Definition**

## **Description**



Issue: 1

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Renac Technologies Co., Ltd

## Revision record

| Date       | Revision Version | Change Description               | Modifier  |
|------------|------------------|----------------------------------|-----------|
| 2017-12-27 | 1                | initial version                  | Zhang Yao |
| 2019-02-21 | 1                | Add "Renac Protocol Query Frame" | Zhang Yao |
|            |                  |                                  |           |
|            |                  |                                  |           |
|            |                  |                                  |           |
|            |                  |                                  |           |
|            |                  |                                  |           |

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## Renac protocol query frame

After the communication module is automatically connected to the server, the server first identifies the "network communication module query frame", and then obtains the "Renac protocol query frame" of the device. After confirming the protocol, the server continues data query and analysis;

| Packet header          | Source address | Destination address | Control command character | Function command character | Data length |
|------------------------|----------------|---------------------|---------------------------|----------------------------|-------------|
| 2 Bytes<br>(0xAA 0x55) | 2 Bytes        | 2 Bytes             | 1 Byte                    | 1 Byte                     | 1 Byte (N)  |

| Data0  | Data1  | ...    | DataN-1 | Checksum |
|--------|--------|--------|---------|----------|
| 1 Byte | 1 Byte | 1 Byte | 1 Byte  | Bytes    |

- Server request frame:

0xAA 0x55 0x01 0x00 0x00 0xFE 0xEE 0x00 0x00 0x02 0xEC

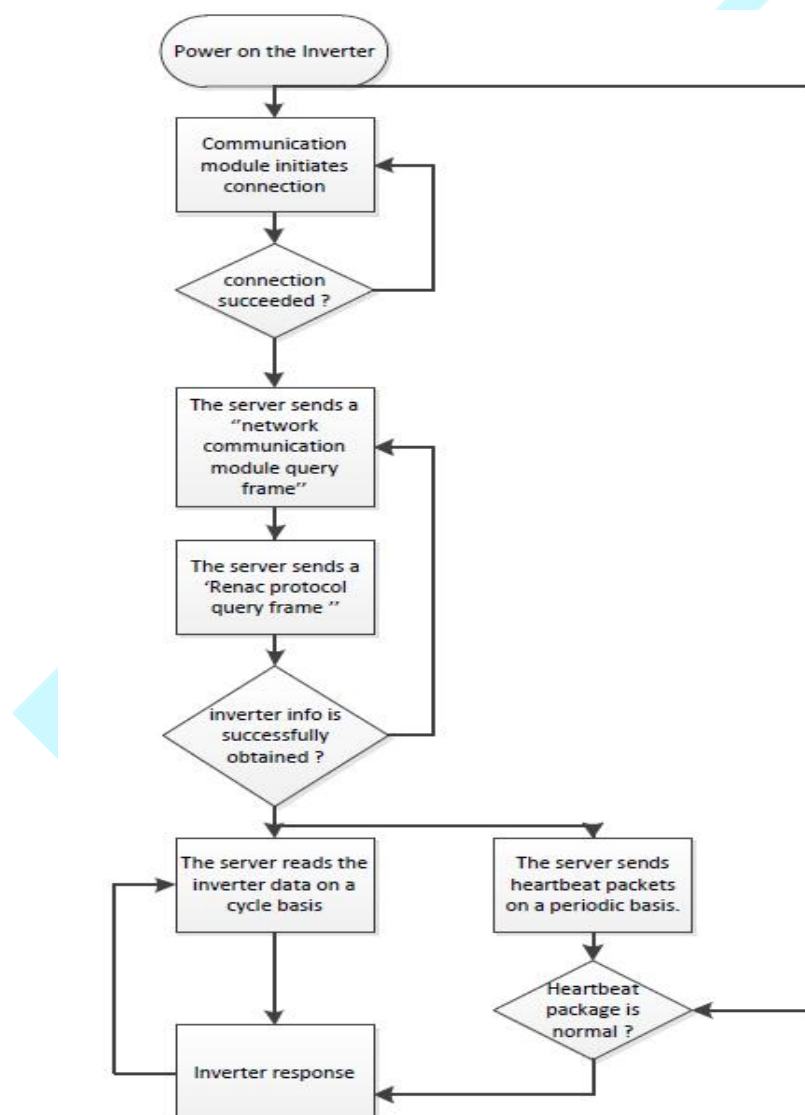
- Client return format: a total of 45 (34 + 11) bytes returned

| Control command character<br>CtrlCmd | Function command character<br>FunCmd | Direction | Length L | Implication                | Remark                            |
|--------------------------------------|--------------------------------------|-----------|----------|----------------------------|-----------------------------------|
| 0xEE                                 | 0x00                                 | PC→INV    | 0x00     | Request module information |                                   |
|                                      | 0x80                                 | INV→ PC   | 0x22     | Module feedback            | ASCII code, as defined in Table 1 |

| Data serial number | Chinese meaning | Description  |
|--------------------|-----------------|--|
| 0-31               | serial number   | Device serial number 16 bits, reserved 16, ascii code  |
| 32                 | protocol type   | 0x01: NAC1-3KW-SS<br>《KSTN external communication data format definition》<br>0x02: NAC4-8KW-DS&NAC6-80K<br>《JXNT MODBUS Interface Definition |

|    |                         |   |
|----|-------------------------|---|
|    |                         | Description<br>》<br>0x03: ESC3-6KW-DS<br>《JXNT_ESC3-6KW-DS Protocol》<br>0x04: |
| 33 | Protocol version number | Defined according to the Protocol   |
|    |                         |   |

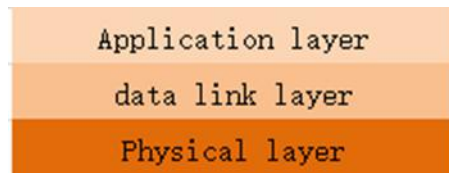
## Connection flow chart



- The heartbeat packet identification is judged by the network communication module. For example, the WIFI is judged by the WIFI module, and the Ethernet is judged by the Ethernet module;
- RS485 or RS232 only needs to reply to the “protocol query frame”;

# 1 Communication protocol overview

The ModBus communication protocol is divided into the following layers and described in layers. :



- 1.1 Physical layer
- 1.2 data link layer
- 1.3 Application layer
- 1.4 Physical layer
- 1.5 data link layer
- 1.6 Application layer

## 1.1 Physical layer

interface:

- Baud rate is 9600.
- Transmission by RTU, asynchronous mode
- 1 start bit
- 8 data bits
- No verification.
- 1 stop bit

Description:

- The maximum frame length is no more than 256 bytes.
- The low byte of the CRC check code is first and the high byte is after.
- The definition of all frame structures in this article contains only the function code and data part.

## 1.2 Data link layer

### 1.2.1 Addressing mode

The protocol supports unicast and broadcast modes. The address allocation rules are as follows:



Table 1-1 Address allocation principles

| Broadcast address | Slave node address | Reserved |
|-------------------|--------------------|----------|
| 0                 | 1--247             | 248--255 |

## 1.2.2 Frame structure

Table 1-2 frame structure

| Address | Function code | Data     | CRC check |
|---------|---------------|----------|-----------|
| 1byte   | 1byte         | 2xN byte | 2 byte    |

## 1.2.3 Data encoding

- MODBUS uses a 'big-Endian' to represent addresses and data items. This means that when multiple bytes are sent, the most significant bit is sent first.

For example:

Table 5-3 Examples of data encoding formats

| Register size | Data   |
|---------------|--------|
| 16 bits       | 0x1234 |

The first byte sent is 0x12 and then 0x34

- String transfer rules: characters from left to right

## 1.2.4 Interaction process

1. In any way, the communication process is initiated by the master node, and the slave node does not initiate communication.
2. In the unicast mode, the slave node responds to the command of the master node in a question-and-answer manner. If the master node does not receive a response from the slave node within 5Sec, it considers that the communication has timed out.
3. In the broadcast mode, the slave node only receives the command sent by the master node, and does not respond to the command frame sent by the master node.

## 1.2.5 CRC check

The CRC check range is the check of all bytes before the CRC field, using a 16-bit CRC check. The implementation reference code is as follows:

```
static unsigned char 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
    };

```

```
/* Low byte CRC value */
```

```

static char 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 short CRC16 ( puchMsg, usDataLen ) /\* The function returns the CRC as a unsigned short type \*/

```

    unsigned char *puchMsg ; /* message to calculate CRC upon */
    unsigned short usDataLen ; /* quantity of bytes in message */
    {
        unsigned char uchCRCHi = 0xFF ; /* high byte of CRC initialized */
        unsigned char uchCRCLo = 0xFF ; /* low byte of CRC initialized */
        unsigned uIndex ; /* will index into CRC lookup table */
        while (usDataLen--) /* pass through message buffer */
        {
            uIndex = uchCRCLo ^ *puchMsg++ ; /* calculate the CRC */
            uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex] ;
            uchCRCHi = auchCRCLo[uIndex] ;
        }
        return (uchCRCHi << 8 | uchCRCLo) ;
    }

```

}

Code source: 《MODBUS over Serial Line Specification and Implementation Guide V1.02》

## 1.3 Application layer

### 1.3.1 Table 1-4 Function code list

Table 1-4 Function code list

| Function code | Implication                     | Remarks  |
|---------------|---------------------------------|--|
| 0x03          | Read register                   | Support single and multiple registers for continuous reading         |
| 0x06          | Write a single register         | Support single register write action                                 |
| 0x10          | Write multiple registers        | Support multiple register continuous write actions                   |
| 0x2B          | Read device identification code | Get device type and version number                                   |
| 0x65          | Read multi-segment register     | Register data of different segment intervals can be read at one time |
| 0x42          | Write multi-segment register    | Register data for different segment intervals at a time              |

### 1.3.2 Exception code list

For each NE type, you need to ensure that the exception code of the product is unique, and the name and description are provided in a unified manner (you need to provide Chinese and English description information in the NE interface document). Multiple versions of the same network element type must be forward compatible, and the used code cannot be used for other purposes.

Table 1-5 Abnormal code summary table (0x00-0x8F is a common exception code segment)

| Code | Name                  | Implication  |
|------|-----------------------|--|
| 0x01 | Illegal function code | The function code received in the inquiry is not allowed to operate. |
| 0x02 | Illegal data address  | The data address in the inquiry is not allowed to operate.           |
| 0x03 | Illegal data value    | The data in the query is an impermissible value                      |
| 0x04 | Data save failed      |  |
| 0x06 | Slave device busy     |  |
| 0x08 | Storage parity error  |  |

### 1.3.3 Read register (0x03)

#### 1.3.3.1 Master node request frame format

Table 1-6 Master node request frame format

| Data field             | Length | Description   |
|------------------------|--------|---------------|
| Slave node address     | 1byte  | 1~247         |
| function code          | 1 byte | 0x03          |
| Register start address | 2 byte | 0x0000~0xFFFF |
| Number of registers    | 2 byte | 1~125         |
| CRC                    | 2 byte | N/A           |

#### 1.3.3.2 Slave node normal response frame format

Table 1-7 Master node request frame format

| Data field         | Length   | Description |
|--------------------|----------|-------------|
| Slave node address | 1byte    | 1~247       |
| function code      | 1 byte   | 0x03        |
| Number of bytes    | 1 byte   | 2N          |
| Register value     | 2xN byte | N/A         |

|     |        |     |
|-----|--------|-----|
| CRC | 2 byte | N/A |
|-----|--------|-----|

Note: N is the number of registers

### 1.3.3.3 Slave exception response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1byte  | 1~247                         |
| function code      | 1 byte | 0x83                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

## 1.3.4 Write a single register (0x06)

### 1.3.4.1 Master node request frame format

| Data field         | Length | Description   |
|--------------------|--------|---------------|
| Slave node address | 1byte  | 1~247         |
| function code      | 1 byte | 0x06          |
| Register address   | 2 byte | 0x0000~0xFFFF |
| Register value     | 2 byte | 0x0000~0xFFFF |
| CRC                | 2 byte | N/A           |

### 1.3.4.2 Slave node normal response frame format

| Data field         | Length | Description   |
|--------------------|--------|---------------|
| Slave node address | 1byte  | 1~247         |
| function code      | 1 byte | 0x06          |
| Register address   | 2 byte | 0x0000~0xFFFF |

|                |        |               |
|----------------|--------|---------------|
| Register value | 2byte  | 0x0000~0xFFFF |
| CRC            | 2 byte | N/A           |

### 1.3.4.3 Slave exception response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1byte  | 1~247                         |
| function code      | 1 byte | 0x86                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

## 1.3.5 Write multiple registers (0x10)

### 1.3.5.1 Master node request frame format

| Data field             | Length  | Description      |
|------------------------|---------|------------------|
| Slave node address     | 1byte   | 1~247            |
| function code          | 1 byte  | 0x10             |
| Register start address | 2 byte  | 0x0000~0xFFFF    |
| Number of registers    | 2 byte  | 0x0000~0x007b(N) |
| Number of bytes        | 1byte   | 2xN              |
| Register value         | 2N byte | Value            |
| CRC                    | 2 byte  | N/A              |

### 1.3.5.2 Slave node normal response frame format

| Data field         | Length | Description |
|--------------------|--------|-------------|
| Slave node address | 1byte  | 1~247       |
| function code      | 1 byte | 0x10        |

|                     |        |               |
|---------------------|--------|---------------|
| Register address    | 2 byte | 0x0000~0xFFFF |
| Number of registers | 2 byte | 0x0000~0xFFFF |
| CRC                 | 2 byte | N/A           |

### 1.3.5.3 Slave exception response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1byte  | 1~247                         |
| function code      | 1 byte | 0x90                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

### 1.3.6 Read device identification code (0x2B)

This function code allows reading of the identification code and additional messages associated with the physical description and functional description of the remote device. The read device identifier interface is modeled as an address space consisting of a set of addressable data elements. The data element is the object being read, and the object Id determines this data element. The data element consists of three types of objects:

ReadDevId code:

| Device ID | Description  |
|-----------|--|
| 01        | Basic device identifier. All such objects are mandatory: vendor name, product code, and revision number.   |
| 02        | Normal device identification code. In addition to the basic data objects, the device provides additional and selectable identification codes as well as data object descriptions. All kinds of objects are defined by standard, but the execution of such objects is optional. |
| 03        | Expand the device ID. In addition to normal data objects, the device provides additional and optional identification codes as well as dedicated data descriptions. All of this data is device dependent.   |
| 04        | Request for a specific device ID   |

Connection mark

When the device ID code is 01/02 or (stream access): 00: no subsequent objects; FF: subsequent objects

When the device ID code is 04: it must be set to 00.

Read device identification code



| Object Id | Object name/description | Types        | M/O       | kind      |
|-----------|-------------------------|--------------|-----------|-----------|
| 0x00      | Trade Names             | ASCII string | Mandatory | basic     |
| 0x01      | Product Code            | ASCII string | Mandatory |           |
| 0x02      | Major revision          | ASCII string | Mandatory |           |
| 0x03—0x7f |                         |              |           | normal    |
| 0x80—0xff |                         |              |           | Expansion |

## Consistency level

| Consistency level | Description   |
|-------------------|---|
| 0x01              | Basic identification (flow direction only)                |
| 0x02              | Regular identification (flow direction only)              |
| 0x03              | Extended identifier (flow direction only)                 |
| 0x81              | Basic identity (flow direction and single access)         |
| 0x82              | Regular identification (flow direction and single access) |
| 0x83              | Extended identity (flow direction and single access)      |

### 1.3.6.1 Query device identification information command

## Read device identification request

| Data field         | Length | Description |
|--------------------|--------|-------------|
| Slave node address | 1 byte | 1-247       |
| function code      | 1 byte | 0x2B        |
| MEI type           | 1 byte | 0x0E        |
| ReadDevId code     | 1 byte | 01          |
| Object ID          | 1 byte | 0x00        |
| CRC                | 2 byte | N/A         |

## Read device indication request response

| Data field         | Length | Description                     |
|--------------------|--------|---------------------------------|
| Slave node address | 1 byte | 1-247                           |
| function code      | 1 byte | 0x2B                            |
| MEI type           | 1 byte | 0x0E                            |
| ReadDevId code     | 1 byte | 01                              |
| Consistency level  | 1 byte | 01                              |
| Connection mark    | 1 byte | 00/FF (00 no follow-up objects) |
| Next object ID     | 1 byte | Object ID number                |

|                   |        |     |
|-------------------|--------|-----|
| Number of objects | 1 byte | ... |
| List:             |        |     |
| Object ID         | 1 byte |     |
| Object length     | 1 byte |     |
| Object value      | N byte |     |
| CRC               | 2 byte | N/A |

## Object list

| Object ID | Object name    | Description                              | kind  |
|-----------|----------------|--|-------|
| 0x00      | Trade Names    | “Renac Power”                            | Basic |
| 0x01      | Product Code   | “NAC8kW” /<br>“NAC30kW”                  |       |
| 0x02      | Major revision | ASCII string software,<br>version number |       |

## Abnormal response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1 byte | 1-247                         |
| function code      | 1 byte | 0xAB                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

### 1.3.6.2 Query device list command

## Read device identification request

| Data field         | Length | Description |
|--------------------|--------|-------------|
| Slave node address | 1 byte | 1-247       |
| function code      | 1 byte | 0x2B        |
| MEI type           | 1 byte | 0x0E        |
| ReadDevId code     | 1 byte | 03          |
| Object ID          | 1 byte | 0x87        |
| CRC                | 2 byte | N/A         |

## Read device indication request response

| Data field         | length | description      |
|--------------------|--------|------------------|
| Slave node address | 1 byte | 1-247            |
| function code      | 1 byte | 0x2B             |
| MEI type           | 1 byte | 0x0E             |
| ReadDevId          | 1 byte | 03               |
| Consistency level  | 1 byte | 03               |
| Connection mark    | 1 byte | 00/FF            |
| Next object ID     | 1 byte | Object ID number |
| Number of objects  | 1 byte | ...              |
| List:              |        |                  |
| Object ID          | 1 byte | 0x87             |
| Object length      | 1 byte | N                |
| Object value       | N byte |                  |
| CRC                | 2 byte | N/A              |

## Object list

| Object Id | Object name                                  | Types  | description   |
|-----------|--|--|---|
| 0x80-0x86 | Reserved                                     |  | Return object length is 0<br>Empty object   |
| 0x87      | Number of devices                            | int  | Attached under this 485 address<br>Number of devices  |
| 0x88      | Description of the first device information  | ASCII string<br>See device description below<br>Information definition | For a 485 address<br>Only one device is supported<br>Network element type, only return<br>Back to the description of the first device Information |
| 0x8A      | Description of the second device information |  |   |
| .....     |  |  |   |
| 0xFF      | Description of the 120th device Information  |  |   |

### 1.3.6.3 Device description definition

The description of each device is represented by a string of strings with all "attributes=values":

"Attribute ID=%s; attribute ID=%s;... attribute ID=%s"

for example: "1=NAC8Kw;2=00.01;3=00.01;4=00.01;5=1;6=1"

Attribute definition

| Attribute identifier | Attribute name                                       | Types        | description   |
|----------------------|--|--------------|---|
| 1                    | Equipment model                                      | ASCII string | "NAC8Kw"  |
| 2                    | Device main CPU software version number              | ASCII string |   |
| 3                    | Device sub CPU software version number               | ASCII string |   |
| 4                    | The device displays the CPU software version number. | ASCII string |   |
| 5                    | Interface protocol version number                    | ASCII string |   |
| 6                    | ESN  | ASCII string | 0,1,2,3,... (by network element<br>Assign, 0 means insert MODBUS card for this<br>Master device)  |
| 7                    | device ID  | Int          | 0,1,2,3,... (by network element<br>Assign, 0 means insert MODBUS card for this<br>Master device)  |
| 8                    | And the unit number                                  |              | 0,1,2,3,...by network element<br>And unit number assignment<br>0xFF - invalid value, table<br>Show does not belong to any parallel system.<br>(if it does not exist then<br>Return this property) |

Abnormal response frame format

| Data field | length | description |
|------------|--------|-------------|
|------------|--------|-------------|

|                    |        |                               |
|--------------------|--------|-------------------------------|
| Slave node address | 1 byte | 1-247                         |
| function code      | 1 byte | 0xAB                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

## 1.3.7 Write multi-segment registers (0x42)

### 1.3.7.1 Master node request frame format

| Data field                  | Length  | Description      |
|-----------------------------|---------|------------------|
| Slave node address          | 1 byte  | 1~247            |
| function code               | 1 byte  | 0x42             |
| Number of register segments | 1 byte  |                  |
| Register start address 1    | 2 byte  | 0x0000~0xFFFF    |
| Number of registers 1       | 2 byte  | 0x0000~0x007b(N) |
| Bytes 1                     | 1 byte  | 2xN              |
| Register value 1            | 2N byte | Value            |
| Register start address 2    | 2 byte  | 0x0000~0xFFFF    |
| Number of registers 2       | 2 byte  | 0x0000~0x007b(N) |
| Bytes 2                     | 1 byte  | 2xN              |
| Register value 2            | 2N byte | Value            |
| .....                       |         |                  |
| CRC                         | 2 byte  | N/A              |

Remark: The number of register segments determines how many consecutive registers need to be written. Determine the number of start addresses of the registers.

### 1.3.7.2 Slave node normal response frame format

| Data field         | Length | Description |
|--------------------|--------|-------------|
| Slave node address | 1 byte | 1~247       |

|                             |        |               |
|-----------------------------|--------|---------------|
| function code               | 1 byte | 0x42          |
| Number of register segments | 1 byte |               |
| Register address            | 2 byte | 0x0000~0xFFFF |
| Number of registers         | 2 byte | 0x0000~0xFFFF |
| .....                       |        |               |
| CRC                         | 2 byte | N/A           |

Remark: The number of register segments determines how many consecutive registers need to be written. Determine the number of start addresses of the registers.

### 1.3.7.3 Slave exception response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1byte  | 1~247                         |
| function code      | 1 byte | 0x90                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |
| CRC                | 2 byte | N/A                           |

## 1.3.8 Read multi-segment register (0x65) R0 area

### 1.3.8.1 Master node request frame format

Table 1-6 Master node request frame format

| Data field                          | Length        | Description             |
|-------------------------------------|---------------|-------------------------|
| Slave node address                  | 1byte         | 1~247                   |
| function code                       | 1 byte        | 0x65                    |
| <b>Read register segment number</b> | <b>1 byte</b> | <b>1~32</b>             |
| <b>Register start address 1</b>     | <b>2 byte</b> | <b>0x0000~0xFFFF</b>    |
| <b>Number of registers 1</b>        | <b>2 byte</b> | <b>0x0001~0x007b(N)</b> |
| <b>Register start address 2</b>     | <b>2 byte</b> | <b>0x0000~0xFFFF</b>    |

|                              |               |                         |
|------------------------------|---------------|-------------------------|
| <b>Number of registers 2</b> | <b>2 byte</b> | <b>0x0001~0x007b(N)</b> |
| .....                        | .....         | .....                   |
| CRC                          | 2 byte        | N/A                     |

Remark: The number of register segments determines how many consecutive registers need to be written to determine the number of start addresses of the registers.

### 1.3.8.2 Slave node normal response frame format

Table 1-7 Master node request frame format

| Data field                   | Length   | Description   |
|------------------------------|----------|---------------|
| Slave node address           | 1 byte   | 1~247         |
| Function code                | 1 byte   | 0x65          |
| Read register segment number | 1 byte   |               |
| Register start address 1     | 2 byte   | 0x0000~0xFFFF |
| Number of registers 1        | 1 byte   | 2N            |
| Register value 1             | 2xN byte | N/A           |
| Register start address 2     | 2 byte   | 0x0000~0xFFFF |
| Number of registers 2        | 1 byte   | 2N            |
| Register value 2             | 2xN byte | N/A           |
| .....                        | .....    | .....         |
| CRC                          | 2 byte   | N/A           |

Note: N is the number of registers

### 1.3.8.3 Slave exception response frame format

| Data field         | Length | Description                   |
|--------------------|--------|-------------------------------|
| Slave node address | 1 byte | 1~247                         |
| function code      | 1 byte | 0xE5                          |
| Exception code     | 1 byte | See 1.3.2 Exception Code List |

|     |        |     |
|-----|--------|-----|
| CRC | 2 byte | N/A |
|-----|--------|-----|

## 2 Register definition

Register address definition function table:

| Register address |                             |   |
|------------------|-----------------------------|---|
| 0-9999           | Read-only special area      | Store some special data or characters, only open to the inside. |
| 10000--29999     | Read-only data area         |   |
| 30000---39999    | Read and write special area | Store some special data or characters, only open to the inside  |
| 40000--49999     | Read and write data area    |   |
| 50000--65536     | Reserved                    |   |

The Renac inverter supports commands of 0X03, 0X06, 0X10, and 0x65.

### 2.1 Read-only data area

- Read rule: Each zone reads a one-time read, and the TBD reserved area is assembled by "read multi-segment register".
- NA signal name is invalid for reserved data and continuous
- **According to modbus regulations, the register is a 16-bit alignment**

| area                          | Signal name    | Read and write type | Types  | unit | Gain | address | Number of registers | range   |
|-------------------------------|----------------|---------------------|--------|------|------|---------|---------------------|---|
| Device information area start |                |                     |        |      |      |         |                     |   |
| Device information area       | Equipment type | RO                  | UINT16 | NA   | NA   | 10000   | 1                   | 2.4.1 Device Type Table                         |
|                               |                |                     |        |      |      |         |                     |   |
|                               | NA             | RO                  | NA     | NA   | NA   | 10001   | 3                   | Reserved=0                                      |
|                               | Machine name   | RO                  | STRING | NA   | NA   | 10004   | 16                  | ASCII mode, left alignment contains power level |
|                               | Manufact       | RO                  | STRING | NA   | NA   | 10020   | 16                  | ASCII mode,                                     |



|                                |                                     |    |            |       |    |                 |    |  |
|--------------------------------|-------------------------------------|----|------------|-------|----|-----------------|----|--|
| (0x65)                         | urer                                |    | G          |       |    |                 |    | left aligned                                   |
|                                | serial number                       | RO | STRIN<br>G | NA    | NA | 10036           | 16 | ASCII mode,<br>left aligned                    |
|                                | Protocol version                    | RO | UINT       | NA    | NA | 10052           | 1  | 1 到 3000                                       |
|                                | Main CPU version                    | RO | STRIN<br>G | NA    | NA | 10053           | 3  | '00.01'  |
|                                | Slave CPU version                   | RO | STRIN<br>G | NA    | NA | 10056           | 3  | '00.01'  |
|                                | HMI version                         | RO | STRIN<br>G | NA    | NA | 10059           | 3  | '00.01'<br>device type<br>0x31NA               |
|                                | TBD                                 |    |            |       |    | 10062-1<br>0499 |    | Reserved<br>space                              |
| End of device information area |                                     |    |            |       |    |                 |    |  |
| Instantaneous data area start  |                                     |    |            |       |    |                 |    |  |
| Instantaneous data area        | Operating mode                      | RO | UINT1<br>6 | NA    | NA | 10500           | 1  | 2.4.2 Inverter Status                          |
|                                | Safety country                      | RO | UINT1<br>6 | NA    | NA | 10501           | 1  | 2.4.8 Safety country Table                     |
|                                | MPPT mode                           | RO | UINT1<br>6 | NA    | NA | 10502           | 1  | 0: invalid<br>1: independent<br>2: in parallel |
|                                | NA                                  | NA | UINT1<br>6 | NA    | NA | 10503           | 1  | Reserved=0                                     |
|                                | NA                                  | NA | UINT1<br>6 | NA    | NA | 10504           | 1  | Reserved=0                                     |
|                                | NA                                  | NA | UINT1<br>6 | NA    | NA | 10505           | 1  | Reserved=0                                     |
|                                | NA                                  | NA | UINT1<br>6 | NA    | NA | 10506           | 1  | Reserved=0                                     |
|                                | Daily Yield                         | RO | UINT1<br>6 | KW.Hr | 10 | 10507           | 1  |  |
|                                | Daily Running time                  | RO | UINT1<br>6 | Hr    | 10 | 10508           | 1  |  |
|                                | Total power generation              | RO | UINT3<br>2 | KW.Hr | 10 | 10509           | 2  |  |
|                                | Total running time                  | RO | UINT3<br>2 | Hr    | 1  | 10511           | 2  |  |
|                                | Output active power                 | RO | INT32      | W     | 1  | 10513           | 2  |  |
|                                | Output reactive power               | RO | INT32      | Var   | 1  | 10515           | 2  |  |
|                                | Dynamic insulation resistance value | RO | UINT1<br>6 | k Ω   | 1  | 10517           | 1  |  |
|                                | R phase grid voltage                | RO | INT16      | V     | 10 | 10518           | 1  | (Single phase is subject to R phase)           |
|                                | R phase output                      | RO | INT16      | A     | 10 | 10519           | 1  | (Single phase is subject to R                  |

|                         |    |        |    |     |             |   |  |
|-------------------------|----|--------|----|-----|-------------|---|--|
| current                 |    |        |    |     |             |   | phase)   |
| R phase grid frequency  | RO | UINT16 | HZ | 100 | 10520       | 1 | (Single phase is subject to R phase)                   |
| T phase grid voltage    | RO | INT16  | V  | 10  | 10521       | 1 |  |
| T phase grid current    | RO | INT16  | A  | 10  | 10522       | 1 |  |
| T phase grid frequency  | RO | UINT16 | HZ | 100 | 10523       | 1 |  |
| S phase grid voltage    | RO | INT16  | V  | 10  | 10524       | 1 |  |
| S phase output current  | RO | INT16  | A  | 10  | 10525       | 1 |  |
| S phase grid frequency  | RO | UINT16 | HZ | 100 | 10526       | 1 |  |
| TBD                     |    |        |    |     | 10527-10699 |   |  |
| Inverter fault table 1  | RO | UINT32 | NA | NA  | 10700       | 2 | <a href="#">2.2.8 Inverter fault information table</a> |
| Inverter fault table 2  | RO | UINT32 | NA | NA  | 10702       | 2 |  |
| Inverter fault table 3  | RO | UINT32 | NA | NA  | 10704       | 2 |  |
| Inverter fault table 4  | RO | UINT32 | NA | NA  | 10706       | 2 |  |
| Inverter fault table 5  | RO | UINT32 | NA | NA  | 10708       | 2 |  |
| Inverter fault table 6  | RO | UINT32 | NA | NA  | 10710       | 2 |  |
| Inverter fault table 7  | RO | UINT32 | NA | NA  | 10712       | 2 |  |
| Inverter fault table 8  | RO | UINT32 | NA | NA  | 10714       | 2 |  |
| TBD                     |    |        |    |     | 10716-10799 |   |  |
| Number of DC connection | RO | INT16  | NA | NA  | 10800       | 1 |  |
| PV1 voltage             | RO | INT16  | V  | 10  | 10801       | 1 |  |
| PV1 current             | RO | INT16  | A  | 10  | 10802       | 1 |  |
| PV1 power               | RO | INT32  | W  | 1   | 10803       | 2 |  |
| PV2 voltage             | RO | INT16  | V  | 10  | 10805       | 1 |  |
| PV2 current             | RO | INT16  | A  | 10  | 10806       | 1 |  |
| PV2 power               | RO | INT32  | W  | 1   | 10807       | 2 |  |
| PV3 voltage             | RO | INT16  | V  | 10  | 10809       | 1 |  |
| PV3 current             | RO | INT16  | A  | 10  | 10810       | 1 |  |
| PV3 power               | RO | INT32  | W  | 1   | 10811       | 2 |  |
| PV4 voltage             | RO | INT16  | V  | 10  | 10813       | 1 |  |
| PV4 current             | RO | INT16  | A  | 10  | 10814       | 1 |  |
| PV4 power               | RO | INT32  | W  | 1   | 10815       | 2 |  |
| TBD                     |    |        |    |     | 10817-11999 |   |  |
| heat sink temperature   | RO | INT16  | °C | 10  | 12000       | 1 | <=-100 does not display                                |

|   |                                      |    |        |    |     |             |   |                               |
|---|--------------------------------------|----|--------|----|-----|-------------|---|-------------------------------|
|   | Ambient temperature                  | RO | INT16  | °C | 10  | 12001       | 1 | <=-100 does not display       |
|   | INV1 temperature                     | RO | INT16  | °C | 10  | 12002       | 1 | <=-100 does not display       |
|   | INV2 temperature                     | RO | INT16  | °C | 10  | 12003       | 1 | <=-100 does not display       |
|   | INV3 temperature                     | RO | INT16  | °C | 10  | 12004       | 1 | <=-100 does not display       |
|   | BoostMax temperature                 | RO | INT16  | °C | 10  | 12005       | 1 | <=-100 does not display       |
|   | TBD                                  |    |        |    |     | 12006-12999 |   |                               |
| End of Instantaneous data area                            |                                      |    |        |    |     |             |   |                               |
| Start of the bus board / Convergence box information area |                                      |    |        |    |     |             |   |                               |
| bus board /Convergence box information area               | Total input power of Convergence box | RO | UINT32 | W  | 1   | 13000       | 2 |                               |
|   | NA                                   | NA | UINT16 | NA | NA  | 13002       | 1 | Reserved = 0                  |
|   | NA                                   | NA | UINT16 | NA | NA  | 13003       | 1 | Reserved = 0                  |
|   | NA                                   | NA | UINT16 | NA | NA  | 13004       | 1 | Reserved = 0                  |
|   | NA                                   | NA | UINT16 | NA | NA  | 13005       | 1 | Reserved = 0                  |
|   | Convergence box temperature          | RO | INT16  | °C | 10  | 13006       | 1 |                               |
|   | Number of Convergence box branches   | RO | UINT16 | A  | 1   | 13007       | 1 | Display by quantity, read all |
|   | Convergence box branch1 voltage      | RO | INT16  | A  | 10  | 13008       | 1 |                               |
|   | Convergence box branch1 Current      | RO | INT16  | A  | 100 | 13009       | 1 |                               |
|   | Convergence box branch2 voltage      | RO | INT16  | A  | 10  | 13010       | 1 |                               |

|                                       |    |       |   |     |       |   |  |
|---------------------------------------|----|-------|---|-----|-------|---|--|
| Convergence box<br>branch2<br>Current | RO | INT16 | A | 100 | 13011 | 1 |  |
| Convergence box<br>branch3<br>voltage | RO | INT16 | A | 10  | 13012 | 1 |  |
| Convergence box<br>branch3<br>Current | RO | INT16 | A | 100 | 13013 | 1 |  |
| Convergence box<br>branch4<br>voltage | RO | INT16 | A | 10  | 13014 | 1 |  |
| Convergence box<br>branch4<br>Current | RO | INT16 | A | 100 | 13015 | 1 |  |
| Convergence box<br>branch5<br>voltage | RO | INT16 | A | 10  | 13016 | 1 |  |
| Convergence box<br>branch5<br>Current | RO | INT16 | A | 100 | 13017 | 1 |  |
| Convergence box<br>branch6<br>voltage | RO | INT16 | A | 10  | 13018 | 1 |  |
| Convergence box<br>branch6            | RO | INT16 | A | 100 | 13019 | 1 |  |

|  |                                  |    |       |   |     |       |   |  |
|--|----------------------------------|----|-------|---|-----|-------|---|--|
|  | Current                          |    |       |   |     |       |   |  |
|  | Convergence box branch7 voltage  | RO | INT16 | A | 10  | 13020 | 1 |  |
|  | Convergence box branch7 Current  | RO | INT16 | A | 100 | 13021 | 1 |  |
|  | Convergence box branch8 voltage  | RO | INT16 | A | 10  | 13022 | 1 |  |
|  | Convergence box branch8 Current  | RO | INT16 | A | 100 | 13023 | 1 |  |
|  | Convergence box branch9 voltage  | RO | INT16 | A | 10  | 13024 | 1 |  |
|  | Convergence box branch9 Current  | RO | INT16 | A | 100 | 13025 | 1 |  |
|  | Convergence box branch10 voltage | RO | INT16 | A | 10  | 13026 | 1 |  |
|  | Convergence box branch10 Current | RO | INT16 | A | 100 | 13027 | 1 |  |
|  | Convergence box branch11         | RO | INT16 | A | 10  | 13028 | 1 |  |

|  |                                  |    |       |   |     |        |   |
|--|----------------------------------|----|-------|---|-----|--------|---|
|  | voltage                          |    |       |   |     |        |   |
|  | Convergence box branch11 Current | RO | INT16 | A | 100 | 13029  | 1 |
|  | Convergence box branch12 voltage | RO | INT16 | A | 10  | 13030  | 1 |
|  | Convergence box branch12 Current | RO | INT16 | A | 100 | 13031  | 1 |
|  | Convergence box branch13 voltage | RO | INT16 | A | 10  | 13032  | 1 |
|  | Convergence box branch13 Current | RO | INT16 | A | 100 | 13033  | 1 |
|  | Convergence box branch14 voltage | RO | INT16 | A | 10  | 130634 | 1 |
|  | Convergence box branch14 Current | RO | INT16 | A | 100 | 13035  | 1 |
|  | Convergence box branch15 voltage | RO | INT16 | A | 10  | 13036  | 1 |
|  | Convergence box branch15         | RO | INT16 | A | 100 | 13037  | 1 |

|  |                                  |    |       |   |     |       |   |  |
|--|----------------------------------|----|-------|---|-----|-------|---|--|
|  | Current                          |    |       |   |     |       |   |  |
|  | Convergence box branch16 voltage | RO | INT16 | A | 10  | 13038 | 1 |  |
|  | Convergence box branch16 Current | RO | INT16 | A | 100 | 13039 | 1 |  |
|  | Convergence box branch17 voltage | RO | INT16 | A | 10  | 13040 | 1 |  |
|  | Convergence box branch17 Current | RO | INT16 | A | 100 | 13041 | 1 |  |
|  | Convergence box branch18 voltage | RO | INT16 | A | 10  | 13042 | 1 |  |
|  | Convergence box branch18 Current | RO | INT16 | A | 100 | 13043 | 1 |  |
|  | Convergence box branch19 voltage | RO | INT16 | A | 10  | 13044 | 1 |  |
|  | Convergence box branch19 Current | RO | INT16 | A | 100 | 13045 | 1 |  |
|  | Convergence box branch20         | RO | INT16 | A | 10  | 13046 | 1 |  |

|   |  |    |        |    |     |             |   |  |
|---|--|----|--------|----|-----|-------------|---|--|
|   | voltage  |    |        |    |     |             |   |  |
|   | Convergence box branch20 Current                     | RO | INT16  | A  | 100 | 13047       | 1 |  |
|   | TBD  |    |        |    |     | 13048-13499 |   |  |
|   | Convergence box failure table 1                      | RO | UINT32 | NA | 1   | 13500       | 2 | <a href="#">2.2.3 Fault table of Convergence box</a> |
|   | Convergence box failure table                        | RO | UINT32 | NA | 1   | 13502       | 2 |  |
|   | TBD  |    |        |    |     | 13504-13999 |   |  |
| End of the bus board / Convergence box information area |  |    |        |    |     |             |   |  |
| History fault area (read first 10)                      | Number 01  | RO | INT16  | NA | 1   | 14000       | 1 | No.0001 starting                                     |
|   | No.N fault Time ,year month, day, hour minute second | RO | INT16  | NA | 1   | 14001       | 7 | '20180808 080808'                                    |
|   | No.N fault ID  | RO | INT16  | NA | 1   | 14008       | 1 | See fault table                                      |
|   | Number 02  | RO | INT16  | NA | 1   | 14009       | 1 | No.0001 starting                                     |
|   | No.N fault Time ,year month, day, hour minute second | RO | INT16  | NA | 1   | 14010       | 7 | '20180808 080808'                                    |
|   | No.N fault ID  | RO | INT16  | NA | 1   | 14017       | 1 | See fault table                                      |
|   |  |    |        |    |     |             |   |  |
|   |  |    |        |    |     |             |   |  |



## 2.2 Writable data area (execute) 0x06

| Area | Signal name                      | Read and write types | Types  | Unit | Gain | Address     | Number of bytes | Range                                    |
|------|----------------------------------|----------------------|--------|------|------|-------------|-----------------|--|
|      | Reset (factory Reset)            | WO                   | UINT16 | NA   | NA   | 30000       | 1               | 0: invalid<br>1: execution               |
|      | Clear total power generation     | WO                   | UINT16 | NA   | NA   | 30001       | 1               | 0: invalid<br>1: execution               |
|      | Clear total run time             | WO                   | UINT16 | NA   | NA   | 30002       | 1               | 0: invalid<br>1: execution               |
|      | Clear the day's power generation | WO                   | UINT16 | NA   | NA   | 30003       | 1               | 0: invalid<br>1: execution               |
|      | Clear daily run time             | WO                   | UINT16 | NA   | NA   | 30004       | 1               | 0: invalid<br>1: execution               |
|      | Remote power on / off            | WO                   | UINT16 | NA   | NA   | 30005       | 1               | 0: invalid<br>1: start up<br>2: shutdown |
|      | Clear event list                 | WO                   | UINT16 | NA   | NA   | 30006       | 1               | 0: invalid<br>1: execution               |
|      | TBD                              |                      |        |      |      | 30007-30999 |                 |  |

## 2.3 Read / write data area

### 2.3.1 Safety protection data area

- Read / write data is divided into two parts:
  - Safety protection EEPROM list: 40000-49999
  - Common data area, power generation, time, etc.: 50000-59999
- Start-up power loading rate, voltage protection for 10 minutes, Active power remote manager, frequency, DCI, Active power remote manager, Active power derating with frequency, Reactive power control, Low voltage ride through, etc, Parameter setting needs to be completed once in a row.
- The voltage and frequency protection time is in units of 10ms, for example: 1s = 100 \* 10ms, 100 is divided by 2 in the program to get 50, which is 50 cycles (1s).
- About rate: N % per minute, For example: when N = 10, load 10% every minute to get Pn. 5min loading 100% is 20.
- Reactive power control mode 2: Q value is 1 / 10,000.
- About the positive and negative of the lead and lag of reactive power

| Startup protection parameter area               |  |    |        |         |      |              |   |   |
|---|--|----|--------|---------|------|--------------|---|---|
| Startup protection parameter area               | Startup time                             | RW | UINT16 | S       | 1    | 40000        | 1 | 1-3000  |
|   | Startup rate                             | RW | UINT16 | %Pn/min | 1    | 40001        | 1 | 1-100   |
|   | Reconnect time                           | RW | UINT16 | S       | 1    | 40002        | 1 | 1-3000  |
|   | Reconnect rate                           | RW | UINT16 | %Pn/min | 1    | 40003        | 1 | 1-100   |
|   | Grid over voltage protection recovery    | RW | INT16  | V       | 10   | 40004        | 1 | 230-270   |
|   | Grid under voltage protection recovery   | RW | INT16  | V       | 10   | 40005        | 1 | 100-230   |
|   | Grid over frequency protection recovery  | RW | UINT16 | HZ      | 100  | 40006        | 1 | 45-65   |
|   | Grid under frequency protection recovery | RW | UINT16 | HZ      | 100  | 40007        | 1 | 45-65   |
|   | TBD                                      |    |        |         |      | 40008--40199 |   |   |
| End of startup protection parameter area        |  |    |        |         |      |              |   |   |
| Start of Grid voltage protection parameter area |  |    |        |         |      |              |   |   |
| Grid voltage protection parameter area          | Voltage protection module enable flag    | RW | UINT16 | NA      | 1    | 40200        | 1 | <a href="#">2.2.4 Voltage protection module enable flag bit table</a> |
|   | Over voltage protection 1                | RW | INT16  | V       | 10   | 40201        | 1 | 200-320   |
|   | Over voltage protection 1 time           | RW | UINT16 | ms      | 0.01 | 40202        | 1 | 0-50000   |
|   | Over voltage protection 2                | RW | INT16  | V       | 10   | 40203        | 1 | 200-320   |
|   | Over voltage protection 2 time           | RW | UINT16 | ms      | 0.01 | 40204        | 1 | 0-50000   |
|   | under voltage protection 1               | RW | INT16  | V       | 10   | 40205        | 1 | 150-230   |
|   | Under voltage protection 1 time          | RW | UINT16 | ms      | 0.01 | 40206        | 1 | 0-50000   |
|   | under voltage protection 2               | RW | INT16  | V       | 10   | 40207        | 1 | 150-230   |
|   | Under voltage protection 2               | RW | UINT16 | ms      | 0.01 | 40208        | 1 | 0-50000   |
|   |  |    |        |         |      |              |   |   |

|   |  |    |        |    |      |             |   |   |
|---|--|----|--------|----|------|-------------|---|---|
|   | time                                   |    |        |    |      |             |   |   |
|   | 10 minutes protection voltage          | RW | INT16  | V  | 10   | 40209       | 1 | 230-320   |
|   | TBD                                    |    |        |    |      | 40210-40399 |   |   |
| End of Grid voltage protection parameter area     |  |    |        |    |      |             |   |   |
| Start of Grid frequency protection parameter area |  |    |        |    |      |             |   |   |
| frequency protection parameter area               | Frequenc protection module enable flag | RW | UINT16 | NA | 1    | 40400       | 1 | <a href="#">2.2.5 Frequency protection module enable flag bit table</a> |
|   | Over frequency protection 1            | RW | INT16  | HZ | 100  | 40401       | 1 | 5000-6500   |
|   | Over frequency protection 1 time       | RW | UINT16 | ms | 0.01 | 40402       | 1 | 0-50000   |
|   | Over frequency protection 2            | RW | INT16  | HZ | 100  | 40403       | 1 | 5000-6500   |
|   | Over frequency protection 2 time       | RW | UINT16 | ms | 0.01 | 40404       | 1 | 0-50000   |
|   | Under frequency protection 1           | RW | INT16  | HZ | 100  | 40405       | 1 | 4500-5000   |
|   | Under frequency protection 1 time      | RW | UINT16 | ms | 0.01 | 40406       | 1 | 0-50000   |
|   | Under frequency protection 2           | RW | INT16  | HZ | 100  | 40407       | 1 | 4500-5000   |
|   | Under frequency protection 2 time      | RW | UINT16 | ms | 0.01 | 40408       | 1 | 0-50000   |
|   | TBD                                    |    |        |    |      | 40409-40499 |   |   |
| End of Grid frequency protection parameter area   |  |    |        |    |      |             |   |   |
| DCI protection parameter area                     |  |    |        |    |      |             |   |   |
| DCI protection parameter area                     | DCI protection module enable flag      | RW | UINT16 | NA | 1    | 40500       | 1 | <a href="#">2.2.6 DCI protection module enable flag bit table</a>       |
|   | DCI protection1                        | RW | INT16  | mA | 1    | 40501       | 1 | 10-1000   |
|   | DCI protection1 time                   | RW | UINT16 | mS | 1    | 40502       | 1 | 0-50000   |
|   | DCI protection 2                       | RW | INT16  | mA | 1    | 40503       | 1 | 10-2000   |
|   | DCI protection2 time                   | RW | UINT16 | mA | 1    | 40504       | 1 | 0-50000   |
|   | DCI injectio                           | RW | INT16  | mA | 1    | 40505       | 1 | 0~5000  |
|   | TBD                                    |    |        |    |      | 40506-40599 |   |   |
| End of DCI protection parameter area              |  |    |        |    |      |             |   |   |

|  |   |    |        |             |      |             |   |   |
|--|---|----|--------|-------------|------|-------------|---|---|
| Start of Active power remote manager             |   |    |        |             |      |             |   |   |
| Active power remote manager                      | Active power remote manager enable            | RW | UINT16 | NA          | 1    | 40600       | 1 | 0: Disable<br>1: enable                                 |
|  | Active power limit (rated power percentage)   | RW | UINT16 | %Pn         | 1    | 40601       | 1 | 1-100   |
|  | Remote power on/off                           | RW | UINT16 | %Pn         | 1    | 40602       | 1 | 0: invalid<br>1: power on<br>1: power off               |
|  | TBD   |    |        |             |      | 40603-40699 |   |   |
| End of Active power remote manager               |   |    |        |             |      |             |   |   |
| Active power derating with frequency area        |   |    |        |             |      |             |   |   |
| Active power derating with frequency area        | Active power derating with frequency "enable" | RW | UINT16 | NA          | 1    | 40700       | 1 | 0: disable<br>1: enable                                 |
|  | Start frequency of power derating             | RW | UINT16 | Hz          | 100  | 40701       | 1 | 50-55   |
|  | Power derating slope                          | RW | UINT16 | %Pn/<br>Hz  | 1    | 40702       | 1 | 1-100   |
|  | Upper limit of frequency recovery             | RW | UINT16 | Hz          | 100  | 40703       | 1 | 50-55   |
|  | Lower limit of frequency recovery             | RW | UINT16 | Hz          | 100  | 40704       | 1 | 45-50   |
|  | Waiting time                                  | RW | UINT16 | s           | 1    | 40705       | 1 | 0-600   |
|  | Power recovery rate                           | RW | UINT16 | %Pn/<br>min | 1    | 40706       | 1 | 1-100   |
|  | TBD   |    |        |             |      | 40707-40799 |   |   |
| End of Active power derating with frequency area |   |    |        |             |      |             |   |   |
| Start Reactive power control area                |   |    |        |             |      |             |   |   |
| Reactive power control area                      | Control mode selection                        | RW | UINT16 | NA          | 1    | 40800       | 1 | <a href="#">2.2.7 Reactive parameter flag bit table</a> |
|  | Mode1cosphi                                   | RW | INT16  | NA          | 100  | 40801       | 1 | -0.8---0.8  |
|  | Mode2: Q value                                | RW | INT16  | %Pn         | 0.01 | 40802       | 1 | -5000---5000  |
|  | Mode3: cosphi1                                | RW | INT16  | NA          | 100  | 40803       | 1 | -0.8---0.8  |
|  | Mode3: P1                                     | RW | INT16  | %Pn         | 1    | 40804       | 1 | 0---200   |
|  | Mode3: cosphi2                                | RW | INT16  | NA          | 100  | 40805       | 1 | -0.8---0.8  |
|  | Mode3: P2                                     | RW | INT16  | %Pn         | 1    | 40806       | 1 | 0---200   |
|  | Mode3: cosphi3                                | RW | INT16  | NA          | 100  | 40807       | 1 | -0.8---0.8  |
|  | Mode3: P3                                     | RW | INT16  | %Pn         | 1    | 40808       | 1 | 0---200   |

|  |   |    |        |          |      |             |   |              |
|--|---|----|--------|----------|------|-------------|---|--------------|
|  |   |    |        | n        |      |             |   |              |
|  | Mode3: cosphi4                          | RW | INT16  | NA       | 100  | 40809       | 1 | -0.8---0.8   |
|  | Mode3: P4                               | RW | INT16  | %P<br>n  | 1    | 40810       | 1 | 0---200      |
|  | Mode3: LockinV                          | RW | INT16  | %U<br>n  | 1    | 40811       | 1 | 90---120     |
|  | Mode3: LockoutV                         | RW | INT16  | %U<br>n  | 1    | 40812       | 1 | 90---120     |
|  | Mode4/5: U1s                            | RW | INT16  | %U<br>n  | 1    | 40813       | 1 | 80---120     |
|  | Mode4/5: U2s                            | RW | INT16  | %U<br>n  | 1    | 40814       | 1 | 80---120     |
|  | Mode4/5: U1i                            | RW | INT16  | %U<br>n  | 1    | 40815       | 1 | 80---120     |
|  | Mode4/5: U2i                            | RW | INT16  | %U<br>n  | 1    | 40816       | 1 | 80---120     |
|  | Mode4/5: LockinP                        | RW | INT16  | %P<br>n  | 1    | 40817       | 1 | 80---120     |
|  | Mode4/5: LockoutP                       | RW | INT16  | %P<br>n  | 1    | 40818       | 1 | 80---120     |
|  | Mode4/5: Qmax                           | RW | INT16  | %P<br>n  | 0.01 | 40819       | 1 | -5000---5000 |
|  | Mode4/5: Time                           | RW | INT16  | s        | 1    | 40820       | 1 | 0---60       |
|  | TBD                                     |    |        |          |      | 40821-40999 |   |              |
| End of Reactive power control area     |   |    |        |          |      |             |   |              |
| Start of Low voltage ride through area |   |    |        |          |      |             |   |              |
| LVRT area                              | Enable flag                             | RW | UINT16 | NA       | 1    | 41000       | 1 | 0-1          |
|  | Start voltage                           | RW | UINT16 | %U<br>n  | 1    | 41001       | 1 | 1-100        |
|  | Low voltage ride-through curve point P1 | RW | UINT16 | %U<br>n  | 1    | 41002       | 1 | 0-100        |
|  | Low voltage ride-through curve point P1 | RW | UINT16 | ms       | 1    | 41003       | 1 | 0-1000       |
|  | Low voltage ride-through curve point P2 | RW | UINT16 | %U<br>n  | 1    | 41004       | 1 | 0-100        |
|  | Low voltage ride-through curve point P2 | RW | UINT16 | ms       | 1    | 41005       | 1 | 0-1000       |
|  | Low voltage ride-through curve point P3 | RW | UINT16 | 1%<br>Un | 1    | 41006       | 1 | 0-100        |
|  | Low voltage ride-through curve point P3 | RW | UINT16 | ms       | 1    | 41007       | 1 | 0-1000       |
|  | Low voltage ride-through curve point P4 | RW | UINT16 | %U<br>n  | 1    | 41008       | 1 | 0-100        |
|  | Low voltage ride-through curve point P4 | RW | UINT16 | ms       | 1    | 41009       | 1 | 0-1000       |
|  | Low voltage                             | RW | UINT16 | NA       | 10   | 41010       | 1 | 0-10         |

|   |  |    |        |         |    |             |   |                         |
|---|--|----|--------|---------|----|-------------|---|-------------------------|
|   | ride-through scale factor: k                       |    |        |         |    |             |   |                         |
|   | Low voltage ride-through recovery maintains :Tback | RW | UINT16 | s       | 1  | 41011       | 1 | 1-10                    |
|   | Low voltage ride-through return power rate         | RW | UINT16 | %Pn/min | 1  | 41012       | 1 | 1-300                   |
|   | TBD  |    |        |         |    | 41013-41199 |   |                         |
| End of Low voltage ride through area                                |  |    |        |         |    |             |   |                         |
| Start of Grid overvoltage derating area                             |  |    |        |         |    |             |   |                         |
|   | Over voltage derating enable flag                  | RW | UINT16 | NA      | 1  | 42000       | 1 | 0: disable<br>1: enable |
|   | Start of over voltage derating                     | RW | UINT16 | V       | 10 | 42001       | 1 |                         |
|   | Power derating rate                                | RW | UINT16 | %Pn/V   | 1  | 42002       | 1 |                         |
|   | Wait time of returning power                       | RW | UINT16 | S       | 1  | 42003       | 1 | Reserve                 |
|   | Return power rate                                  | RW | UINT16 | %Pn/V   | 10 | 42004       | 1 | Reserve                 |
|   | TBD  |    |        |         |    | 42005-42099 |   |                         |
| End of Grid overvoltage derating area                               |  |    |        |         |    |             |   |                         |
| Island、leakage current、insulation resistance extension table        |  |    |        |         |    |             |   |                         |
|   | Isolated Island enable flag (AI)                   | RW | UINT16 | NA      | 1  | 42100       | 1 | 0: disable<br>1: enable |
|   | leakage current enable flag (GFCI)                 | RW | UINT16 | NA      | 1  | 42101       | 1 | 0: disable<br>1: enable |
|   | Isolation enable flag                              | RW | UINT16 | NA      | 1  | 42102       | 1 | 0: disable<br>1: enable |
|   | Insulation threshold value                         | RW | UINT16 | KΩ      | 1  | 42103       | 1 |                         |
|   | TBD  |    |        |         |    |             |   |                         |
| End of Island、leakage current、insulation resistance extension table |  |    |        |         |    |             |   |                         |
|   |  |    |        |         |    |             |   |                         |
|   |  |    |        |         |    |             |   |                         |
|   |  |    |        |         |    |             |   |                         |

## 2.3.2 Common data area 0x10

| Common data area |                                       |    |        |       |    |             |    |  |
|------------------|---------------------------------------|----|--------|-------|----|-------------|----|--|
|                  | ModBUS address                        | RW | UINT16 | NA    | NA | 50000       | 1  | For modify   |
|                  | Inverter name                         | RW | STRING | NA    | 1  | 50001       | 16 |  |
|                  | Manufacturer                          | RW | STRING | NA    | 1  | 50017       | 16 |  |
|                  | Serial number                         | RW | STRING | NA    | 1  | 50033       | 16 |  |
|                  | Total power generation                | RW | UINT32 | KW.Hr | 10 | 50049       | 2  |  |
|                  | Total running time                    | RW | UINT32 | Hr    | 1  | 50051       | 2  |  |
|                  | Generation of the daily               | RW | UINT16 | KW.Hr | 10 | 50053       | 1  |  |
|                  | Daily running time                    | RW | UINT16 | Hr    | 10 | 50054       | 1  |  |
|                  | NA                                    | RW | UINT16 |       |    | 50055       | 1  |  |
|                  | NA                                    | RW | UINT16 |       |    | 50056       | 1  |  |
|                  | Fault insulation resistance threshold | RW | UINT16 | KΩ    | 1  | 50057       | 1  |  |
|                  | Communication board RTC               | RW | STRING | NA    | NA | 50058       | 7  | '201808080808'   |
|                  | Safety country                        | RW |        |       |    | 50065       | 1  |  |
|                  | MPPT mode                             | RW |        |       |    | 50066       | 1  | 0: invalid<br>1: independent<br>2: parallel  |
|                  | Factory mode                          | RW |        |       |    | 50067       | 1  | High byte:<br>0: invalid<br>1: Factory mode<br>2: Non-factory mode<br>Low byte: current percentage   |
|                  | Bus board testing                     | WO |        |       |    | 50068       | 1  | 0: disable<br>1: enable  |
|                  | SPD testing                           | WO |        |       |    | 50069       | 1  | 0: disable<br>1: enable  |
|                  | Enter normal state                    | WO |        |       |    | 50070       | 10 | Byte0 language<br>Byte1 country<br>Byte2 input mode<br>Byte3-16 time<br>Byte17 Reserve<br>Byte18 Reserve<br>Byte19 Reserve<br>Byte20 Reserve |
|                  | Fan testing                           | RW |        |       |    | 50080       | 1  | 0: disable/ Normal<br>1: Enable / fault  |
|                  | END                                   |    |        |       |    | 50081-59999 |    | END  |

## 2.4 Data sheet attachment

### 2.4.1 Inverter type

| Value | Description           |
|-------|-----------------------|
| 0x31  | single phase inverter |
| 0x32  | three-phase inverter  |
| 0x33  | String Combiner Box   |

### 2.4.2 Inverter status

| Value | Description  |
|-------|--------------|
| 0     | waiting      |
| 1     | checking     |
| 2     | normal       |
| 3     | fault        |
| 4     | reconnecting |
| 5     | Flash        |

### 2.4.3 Convergence box failure table

.....

### 2.4.4 Voltage protection module enable flag bit table

| 位       | 值   |
|---------|---|
| bit0    | 1= 1 <sup>st</sup> over voltage protection enable<br>0= 1 <sup>st</sup> over voltage protection disable   |
| bit1    | 1= 2 <sup>st</sup> over voltage protection enable<br>0= 1 <sup>st</sup> over voltage protection disable   |
| bit2    | 1= 1 <sup>st</sup> under voltage protection enable<br>0= 1 <sup>st</sup> under voltage protection disable |
| bit3    | 1= 2 <sup>st</sup> under voltage protection enable<br>0= 2 <sup>st</sup> under voltage protection disable |
| bit4-15 | reserved  |



## 2.4.5 Frequency protection module enable flag bit table

| 位       | 值   |
|---------|---|
| bit0    | 1= 1 <sup>st</sup> over frequency protection enable<br>0= 1 <sup>st</sup> over frequency protection disable   |
| bit1    | 1= 2 <sup>st</sup> over frequency protection enable<br>0= 2 <sup>st</sup> over frequency protection disable   |
| bit2    | 1= 1 <sup>st</sup> under frequency protection enable<br>0= 1 <sup>st</sup> under frequency protection disable |
| bit3    | 1= 2 <sup>st</sup> under frequency protection enable<br>0= 2 <sup>st</sup> under frequency protection disable |
| bit4-15 | reserved  |

## 2.4.6 DCI protection module enable flag bit table

| 位       | 值   |
|---------|---|
| bit0    | 1= 1 <sup>st</sup> protection enable<br>0= 1 <sup>st</sup> protection disable |
| bit1    | 1= 2 <sup>st</sup> protection enable<br>0= 2 <sup>st</sup> protection disable |
| bit2-15 | reserved  |

## 2.4.7 Reactive power parameter flag bit table

| Bit       | value                 |
|-----------|-----------------------|
| 0x00      | invalid               |
| 0x01      | Reactive power mode 1 |
| 0x02      | Reactive power mode 2 |
| 0x03      | Reactive power mode 3 |
| 0x04      | Reactive power mode 4 |
| 0x05      | Reactive power mode 5 |
| 0x06~0xFF | reserved              |

## 2.4.8 Safety country table

| No | Description        | Display              | Grid Standard Code Name |
|----|--------------------|----------------------|-------------------------|
| 0  | Germany            | Germany VDE AR-N4105 | VDE-AR-N-4105           |
| 1  | Italy              | Italy CEI0-21        | CEI0-21                 |
| 2  | Australia          | Australia            | AS4777                  |
| 3  | Spain              | Spain RD1699         | RD1699                  |
| 4  | Turkey             | Turkey               |                         |
| 5  | Denmark            | Denmark              |                         |
| 6  | Greece (Continent) | Greece Continent     |                         |
| 7  | Netherlands        | Netherland           | EN50438                 |
| 8  | Belgium            | Belgium              | C10/11                  |
| 9  | England            | UK-G59 (England)     | G59-England             |
| 10 | China              | China                | CN-NBT                  |
| 11 | France             | France               | VDE 0126                |
| 12 | Poland             | Poland               |                         |
| 13 | Germany            | Germany BDEW         | BDEW-MV                 |
| 14 | Germany            | Germany VDE 0126     | VDE 0126                |
| 15 | Italy              | Italy CEI0-21        | CEI0-16                 |
| 16 | England            | UK-G83               | G83-England             |
| 17 | Greece (Island)    | Greece island        |                         |
| 18 | Czech Republic     | EU EN50438           | EN50438Y2007-CZ         |
| 19 | India              | IEC EN61727          | IEC61727                |
| 20 | Korea              | Korea                |                         |
| 21 | Spain              | Sweden               | RD1699                  |
| 22 | China1             | China1               |                         |
| 23 | China2             | China2               |                         |
| 24 | India              | India                |                         |

## 2.4.9 Inverter fault information table

- The description should be a maximum of 14 English characters and 8 Chinese characters (two English correspond and one Chinese)
- uPrefix: unrecover

Table 1 (general fault table)

| Bit | Fault message<br>(program list) | Chinese / English<br>description | Remark   | ID number |
|-----|---------------------------------|----------------------------------|--|-----------|
| 31  | NoUtility                       | No utility<br>电网无电压              | Grid voltage is zero<br>电网无电压  | ID1       |
| 30  | PVConfigWrong                   | PVConfigWrong<br>输入模式错误          | PV settings is wrong<br>输入模式选择错误   | ID2       |
| 29  | GroundIFault                    | Ground I fault<br>漏电流过高          | Ground current is too<br>high<br>对地漏电流过高   | ID3       |
| 28  | GFDIFault                       | GFDI fault<br>GFDI 故障            | GFDI fault<br>GFDI 错误  | ID4       |
| 27  | uRelayFail                      | Relay failure<br>继电器故障           | Relay is Fail<br>继电器故障   | ID5       |
| 26  | TBD                             |                                  |  | ID6       |
| 25  | TBD                             |                                  |  | ID7       |
| 24  | TBD                             |                                  |  | ID8       |
| 23  | TBD                             |                                  |  | ID9       |
| 22  | TBD                             |                                  |  | ID10      |
| 21  | CommLose_HMI_S                  | HMI to S fail<br>显示通讯故障          | Communication fails<br>between HMI and<br>Ctrl board<br>通讯板和控制板通<br>讯错误          | ID11      |
| 20  | CommLose_M_S                    | M to S fail<br>主副通讯故障            | Communication<br>between main cpu<br>and slave is failing<br>主副 CPU 内部通讯<br>错误   | ID12      |
| 19  | CommLose_HMI_C                  | HMI to Cfail<br>汇流板通讯故障          | Communication<br>between salve cpu<br>and collect board is<br>failing<br>汇流板通讯错误 | ID13      |
| 18  | TBD                             |                                  |  | ID14      |
| 17  | TBD                             |                                  |  | ID15      |

|    |     |  |  |      |
|----|-----|--|--|------|
| 16 | TBD |  |  | ID16 |
| 15 | TBD |  |  | ID17 |
| 14 | TBD |  |  | ID18 |
| 13 | TBD |  |  | ID19 |
| 12 | TBD |  |  | ID20 |
| 11 | TBD |  |  | ID21 |
| 10 | TBD |  |  | ID22 |
| 9  | TBD |  |  | ID23 |
| 8  | TBD |  |  | ID24 |
| 7  | TBD |  |  | ID25 |
| 6  | TBD |  |  | ID26 |
| 5  | TBD |  |  | ID27 |
| 4  | TBD |  |  | ID28 |
| 3  | TBD |  |  | ID29 |
| 2  | TBD |  |  | ID30 |
| 1  | TBD |  |  | ID31 |
| 0  | TBD |  |  | ID32 |

Table 2 (Grid-side fault table)

| Bit | Fault message    | Chinese / English description | Remark                                 | ID number |
|-----|------------------|-------------------------------|--|-----------|
| 31  | VGridROverRating | GridOVP_R<br>R 相过压            | R phase Grid Volt Over Rating<br>R 相过压 | ID33      |

|    |                       |                    |   |      |
|----|-----------------------|--------------------|---|------|
| 30 | VGridRUnder<br>Rating | GridUVP_R<br>R 相欠压 | R phase Grid Volt Under<br>Rating<br>R 相欠压            | ID34 |
| 29 | VGridSOverR<br>ating  | GridOVP_S<br>S 相过压 | S phase Grid Volt Over<br>Rating<br>S 相过压             | ID35 |
| 28 | VGridSUnder<br>Rating | GridUVP_S<br>S 相欠压 | S phase Grid Volt Under<br>Rating<br>S 相欠压            | ID36 |
| 27 | VGridTOverR<br>ating  | GridOVP_T<br>S 相过压 | T phase Grid Volt Over<br>Rating<br>T 相过压             | ID37 |
| 26 | VGridTUnder<br>Rating | GridUVP_T<br>S 相欠压 | T phase Grid Volt Under<br>Rating<br>T 相欠压            | ID38 |
| 25 | GridOVP               | GridOVP<br>电网过压    | Grid volt over rating<br>电网电压过高（单相或<br>者三相总称）         | ID39 |
| 24 | GridUVP               | GridUVP<br>电网欠压    | Grid volt under rating<br>电网电压过低（单相或<br>者三相总称）        | ID40 |
| 23 | FGridROverR<br>ating  | GridOFP_R<br>R 相过频 | R phase Grid frequency<br>Over Rating<br>R 相过频        | ID41 |
| 22 | FGridRUnder<br>Rating | GridUFP_R<br>R 相欠频 | R phase Grid frequency<br>Under Rating<br>R 相欠频       | ID42 |
| 21 | FGridSOverR<br>ating  | GridOFP_S<br>R 相过频 | S phase Grid frequency<br>Over Rating<br>S 相过频        | ID43 |
| 20 | FGridSUnder<br>Rating | GridUFP_S<br>R 相欠频 | S phase Grid frequency<br>Under Rating<br>S 相欠频       | ID44 |
| 19 | FGridTOverR<br>ating  | GridOFP_T<br>R 相过频 | T phase Grid frequency<br>Over Rating<br>T 相过频        | ID45 |
| 18 | FGridTUnder<br>Rating | GridUFP_T<br>R 相欠频 | T phase Grid frequency<br>Under Rating<br>T 相欠频       | ID46 |
| 17 | GridOFR               | GridOFR<br>电网过频    | Grid frequency over<br>rating<br>电网频率过高（单相或<br>者三相总称） | ID47 |

|    |                        |                       |  |      |
|----|------------------------|-----------------------|--|------|
| 16 | GridUFR                | GridUFR<br>电网欠频       | Grid frequency under rating<br>电网频率过低（单相或者三相总称）              | ID48 |
| 15 | VGridRSOver<br>Rating  | GridOVP_RS<br>R-S 线过压 | RS line voltage is over rating<br>R-S 线电压过高                  | ID49 |
| 14 | VGridSTOver<br>Rating  | GridOVP_ST<br>S-T 线过压 | ST line voltage is over rating<br>S-T 线电压过高                  | ID50 |
| 13 | VGridTROver<br>Rating  | GridOVP_TR<br>T-R 相过压 | TR line voltage is over rating<br>T-R 线电压过高                  | ID51 |
| 12 | VGridRSUnder<br>Rating | GridUVP_RS<br>R-S 线欠压 | RS line voltage is under rating<br>R-S 线电压过低                 | ID52 |
| 11 | VGridSTUnder<br>Rating | GridUVP_RS<br>S-T 线欠压 | ST line voltage is under rating<br>S-T 线电压过低                 | ID53 |
| 10 | VGridTRUnder<br>Rating | GridUVP_TR<br>T-R 相欠压 | TR line voltage is under rating<br>T-R 线电压过低                 | ID54 |
| 9  | HwAcOCP_R              | HwAcOCP_R<br>R 硬件相过流  | R phase Grid Current Over Ratingtrig the HW protect<br>R 相过流 | ID55 |
| 8  | HwAcOCP_S              | HwAcOCP_S<br>S 硬件相过流  | S phase Grid Current Over Ratingtrig the HW protect<br>S 相过流 | ID56 |
| 7  | HwAcOCP_T              | HwAcOCP_T<br>T 硬件相过流  | T phase Grid Current Over Ratingtrig the HW protect<br>T 相过流 | ID57 |
| 6  | HwAcOCP                | HwAcOCP<br>AC 硬件过流    | Grid Current Over Rating<br>电网电流过高（单相或者三相可恢复总称）              | ID58 |
| 5  | uHwAcOCP               | uHwAcOCP<br>AC 硬件过流   | Output current over rating(unrecover)<br>输出端过流（单相或者三相不可恢复总称） | ID59 |

|   |           |                      |  |      |
|---|-----------|----------------------|--|------|
| 4 | SwAcOCP_R | SwAcOCP_R<br>R 相过流   | R phase Grid Current<br>RMS value Over Rating<br>R 相 RMS 过流（软件有效值保护）                       | ID60 |
| 3 | SwAcOCP_S | SwAcOCP_S<br>S 相过流   | S phase Grid Current<br>RMSvalue Over Rating<br>S 相 RMS 过流（软件有效值保护）                        | ID61 |
| 2 | SwAcOCP_T | SwAcOCP_T<br>T 相过流   | Tphase Grid Current<br>RMSvalue Over Rating<br>T 相 RMS 过流（软件有效值保护）                         | ID62 |
| 1 | SwAcOCP   | SwAcOCP<br>AC 输出过流   | RSTphase Grid Current<br>RMSvalue Over Rating<br><b>RST 相 RMS 过流（软件有效值保护，单相或者三相可恢复总称）</b>  | ID63 |
| 0 | uSwAcOCP  | uSwAcOCP<br>uAC 输出过流 | RSTphase Grid Current<br>RMSvalue Over Rating<br><b>RST 相 RMS 过流（软件有效值保护，单相或者三相不可恢复总称）</b> | ID64 |

Table 3 (PV &amp; BUS input fault table)

| Bit | Fault message   | Chinese / English description | Remark                                   | ID number |
|-----|-----------------|-------------------------------|--|-----------|
| 31  | Pv1VoltOvrFault | Pv1OVP<br>输入电压 1 高            | Pv-1 input volt is too high<br>输入电压 1 过高 | ID65      |
| 30  | Pv2VoltOvrFault | Pv2OVP<br>输入电压 2 高            | Pv-2 input volt is too high<br>输入电压 2 过高 | ID66      |
| 29  | Pv3VoltOvrFault | Pv3OVP<br>输入电压 3 高            | Pv-3 input volt is too high<br>输入电压 3 过高 | ID67      |
| 28  | Pv4VoltOvrFault | Pv4OVP<br>输入电压 4 高            | Pv-4 input volt is too high<br>输入电压 4 过高 | ID68      |
| 27  | TBD             |                               |  | ID69      |
| 26  | TBD             |                               |  | ID70      |

|    |                       |                      |  |      |
|----|-----------------------|----------------------|--|------|
| 25 | Pv1VoltLow<br>Fault   | Pv1UVP<br>输入电压 1 低   | Pv-1 input volt is too<br>low<br>输入电压 1 过低   | ID71 |
| 24 | Pv2VoltLow<br>Fault   | Pv2UVP<br>输入电压 2 低   | Pv-2 input volt is too<br>low<br>输入电压 2 过低   | ID72 |
| 23 | Pv3VoltLow<br>Fault   | Pv3UVP<br>输入电压 3 过低  | Pv-3 input volt is too<br>low<br>输入电压 3 过低   | ID73 |
| 22 | Pv4VoltLow<br>Fault   | Pv4UVP<br>输入电压 4 过低  | Pv-4 input volt is too<br>low<br>输入电压 4 过低   | ID74 |
| 21 | TBD                   |                      |  | ID75 |
| 20 | TBD                   |                      |  | ID76 |
| 19 | PvIsoFault            | PvIsoFault<br>组串绝缘故障 | Isolation resistance<br>of PV-plant is<br>abnormal<br>PV 绝缘阻抗错误<br>(单路或者多路共<br>同报) | ID77 |
| 18 | TBD                   |                      |  | ID78 |
| 17 | TBD                   |                      |  | ID79 |
| 16 | TBD                   |                      |  | ID80 |
| 15 | Pv1AveCurO<br>vrFault | SwOCP_PV1<br>组串 1 过流 | Pv-1 input current is<br>too high<br>输入电流 1 过高(软<br>件均值保护)                         | ID81 |
| 14 | Pv2AveCurO<br>vrFault | SwOCP_PV2<br>组串 2 过流 | Pv-2 input current is<br>too high<br>输入电流 2 过高(软<br>件均值保护)                         | ID82 |
| 13 | Pv3AveCurO<br>vrFault | SwOCP_PV3<br>组串 3 过流 | Pv-3 input current is<br>too high<br>输入电流 3 过高(软<br>件均值保护)                         | ID83 |



|    |                   |                         |  |      |
|----|-------------------|-------------------------|--|------|
| 12 | Pv4AveCurOvrFault | SwOCP_PV1<br>组串 4 过流    | Pv-4 input current is too high<br>输入电流 4 过高(软件均值保护)  | ID84 |
| 11 | HwOCP_Boost1      | HwOCP_BST1<br>升压 1 硬件过流 | Protection for boost-1 current over rating(unrecover)<br>Boost-1 过流保护                              | ID85 |
| 10 | HwOCP_Boost2      | HwOCP_BST1<br>升压 2 硬件过流 | Protection for boost-2 current over rating(unrecover)<br>Boost-2 过流保护                              | ID86 |
| 9  | HwOCP_Boost3      | HwOCP_BST1<br>升压 3 硬件过流 | Protection for boost-3 current over rating(unrecover)<br>Boost-3 过流保护                              | ID87 |
| 8  | HwOCP_Boost4      | HwOCP_BST1<br>升压 4 硬件过流 | Protection for boost-4 current over rating(unrecover)<br>Boost-3 过流保护                              | ID88 |
| 7  | HwOCP_Boost       | HwOCP_BST<br>升压硬件过流     | Hardware protection for Boost current over rating<br><b>Boost</b> 硬件过流保护 (单相或者三相可恢复总称)             | ID89 |
| 6  | uHwOCP_Boost      | uHwOCP_BST<br>升压硬件过流    | Hardware protection for Boost current over rating(unrecover)<br><b>Boost</b> 硬件过流保护 (单相或者三相不可恢复总称) | ID90 |
| 5  | TBD               |                         |  | ID91 |
| 4  | TBD               |                         |  | ID92 |
| 3  | HwBusOVP          | HwBusOVP<br>母线硬件过压      | Hardware protection for Bus voltage over rating<br>Bus 硬件过压保护                                      | ID93 |

|   |              |                     |   |      |
|---|--------------|---------------------|---|------|
| 2 | uHWBusOVP    | uHwBusOVP<br>母线硬件过压 | Hardware protection for Bus voltage over rating(unrecover)<br>Bus 硬件过压保护 (不可恢复) | ID94 |
| 1 | BusLowFault  | BusUVP<br>母线电压低     | DC Bus volt is low<br>母线电压低   | ID95 |
| 0 | BusOverFault | BusOVP<br>母线硬件过压    | DC Bus volt is high<br>母线电压高  | ID96 |

Table 4 (Grid-side fault table)

| Bit | Fault information  | Chinese / English description | Remark                                    | ID number |
|-----|--------------------|-------------------------------|---|-----------|
| 31  | PLLFault           | PLL fault<br>锁相错误             | PLL fails<br>锁相错误                         | ID97      |
| 30  | PhaseSequenceFault | Ph Seq fault<br>电网相序错误        | Sequence of Phase is incorrect<br>输出端相序错误 | ID98      |
| 29  | LVRTFault          | LvrtFault<br>低压穿越失败           | Low voltage ride through fails<br>低压穿越失败  | ID99      |
| 28  | TBD                |                               |   | ID100     |
| 27  | TBD                |                               |   | ID101     |
| 26  | TBD                |                               |   | ID102     |
| 25  | TBD                |                               |   | ID103     |
| 24  | TBD                |                               |   | ID104     |
| 23  | TBD                |                               |   | ID105     |
| 22  | TBD                |                               |   | ID106     |
| 21  | TBD                |                               |   | ID107     |
| 20  | TBD                |                               |   | ID108     |

|    |                         |                           |  |       |
|----|-------------------------|---------------------------|--|-------|
| 19 | TBD                     |                           |  | ID109 |
| 18 | TBD                     |                           |  | ID110 |
| 17 | TBD                     |                           |  | ID111 |
| 16 | TBD                     |                           |  | ID112 |
| 15 | TBD                     |                           |  | ID113 |
| 14 | TBD                     |                           |  | ID114 |
| 13 | TBD                     |                           |  | ID115 |
| 12 | TBD                     |                           |  | ID116 |
| 11 | TBD                     |                           |  | ID117 |
| 10 | TBD                     |                           |  | ID118 |
| 9  | TBD                     |                           |  | ID119 |
| 8  | TBD                     |                           |  | ID120 |
| 7  | ConsistFaultF<br>orVac  | ConsistVac<br>电网电压不一致     | Different value<br>between Master<br>and Slave for grid<br>voltage<br>电网电压值一致性<br>错误   | ID121 |
| 6  | ConsistFaultF<br>orFac  | Consist Fac<br>电网频率不一致    | Different value<br>between Master<br>and Slave for grid<br>frequency<br>电网频率值一致性<br>错误 | ID122 |
| 5  | ConsistFaultF<br>orGFCI | Consist GFCI<br>AC 漏电流不一致 | Different value<br>between Master<br>and Slave for GFCI<br>对地漏电流值一致性<br>错误             | ID123 |

|   |                    |                            |  |       |
|---|--------------------|----------------------------|--|-------|
| 4 | ConsistFaultForDCI | Consist DCI<br>直流分量不一致     | Different value between Master and Slave for output DC injection current<br>直流分量值一致性错误 | ID124 |
| 3 | TBD                |                            |  | ID125 |
| 2 | BusUnbalance       | Bus volt Ublc<br>Bus 电压不平衡 | Bus voltage is unbalance<br>Bus 电压不平衡  | ID126 |
| 1 | IacRmsUnbalance    | IacRmsUblc<br>电网电流不平衡      | The Current of Tree phase are unbalance<br>三相电网电流不平衡                                   | ID127 |
| 0 | VacRmsUnbalance    | VacRmsUblc<br>电网电压不平衡      | The voltage of Tree phase are unbalance<br>三相电网电压不平衡                                   | ID128 |

Table 5 (grid side &amp; temperature fault table)

| Bit | Fault information | Chinese / English description | Remark  | ID Number |
|-----|-------------------|-------------------------------|---|-----------|
| 31  | DCIGridROverLimit | DciOVP_R<br>R 相直流分量大          | R phase DC injection check for grid Current is over rating<br>R 相直流分量过大 | ID129     |
| 30  | DCIGridSOverLimit | DciOVP_S<br>S 相直流分量大          | S phase DC injection check for grid Current is over rating<br>S 相直流分量过大 | ID130     |
| 29  | DCIGridTOverLimit | DciOVP_T<br>T 相直流分量大          | T phase DC injection check for grid Current is over rating<br>T 相直流分量过大 | ID131     |

|    |                      |                              |  |       |
|----|----------------------|------------------------------|--|-------|
| 28 | DC_Inj_High          | DciOCP<br>直流分量高              | The DC injection check for grid Current is over rating<br>直流分量过高（单相或者三相总称） | ID132 |
| 27 | TBD                  |                              |  | ID133 |
| 26 | TBD                  |                              |  | ID134 |
| 25 | TBD                  |                              |  | ID135 |
| 24 | TBD                  |                              |  | ID136 |
| 23 | GFCIJumpOverLimit1   | GFCI > 30mA<br>漏电流大于 30mA    | Jump fault for Ground current over limit of 30mA<br>漏电流 30mA 跳变错误          | ID137 |
| 22 | GFCIJumpOverLimit2   | GFCI > 60mA<br>漏电流大于 60mA    | Jump fault for Ground current over limit of 60mA<br>漏电流 60mA 跳变错误          | ID138 |
| 21 | GFCIJumpOverLimit3   | GFCI > 150mA<br>漏电流大于 150mA  | Jump fault for Ground current over limit of 150mA<br>漏电流 150mA 跳变错误        | ID139 |
| 20 | GFCIJumpOverLimit4   | GFCI > 300mA<br>漏电流大于 300mA  | Ground current is higher than 300mA<br>漏电流大于 300mA                         | ID140 |
| 19 | uGFCIOver5TimesFault | GFCI > 5 times<br>GFCI 触发次数多 | Ground current is higher than 300mA more than N times<br>GFCI 次数多报永久性故障    | ID141 |
| 18 | uGFCIDeviceFault     | uHW_GFCI<br>GFCI 硬件故障        | GFCI sense device is failed<br>GFCI 硬件故障                                   | ID142 |
| 17 | TBD                  |                              |  | ID143 |

|    |                                 |                          |   |       |
|----|---------------------------------|--------------------------|---|-------|
| 16 | TBD                             |                          |   | ID144 |
| 15 | INVModule<br>OverTempF<br>ault  | INV OV Temp<br>逆变温度高     | INV Module over<br>temperature<br>逆变模块温度过高<br>总   | ID145 |
| 14 | INVModule<br>1OverTemp<br>Fault | INV1 OV Temp<br>逆变 1 温度高 | INV Module1 over<br>temperature<br>逆变模块 1 过温      | ID146 |
| 13 | INVModule<br>2OverTemp<br>Fault | INV2 OV Temp<br>逆变 2 温度高 | INV Module 2 over<br>temperature<br>逆变模块 2 过温     | ID147 |
| 12 | INVModule<br>3OverTemp<br>Fault | INV3 OV Temp<br>逆变 3 温度高 | INV Module 3 over<br>temperature<br>逆变模块 3 过温     | ID148 |
| 11 | BSTModule<br>OverTempF<br>ault  | BST OV Temp<br>升压温度高     | Boost Module over<br>temperature<br>升压模块温度过高<br>总 | ID149 |
| 10 | BSTModule<br>1OverTemp<br>Fault | BST1 OV Temp<br>升压 1 温度高 | Boost Module1 over<br>temperature<br>升压模块 1 过温    | ID150 |
| 9  | BSTModule<br>2OverTemp<br>Fault | BST2 OV Temp<br>升压 2 温度高 | Boost Module 2<br>over temperature<br>升压模块 2 过温   | ID151 |
| 8  | BSTModule<br>3OverTemp<br>Fault | BST3 OV Temp<br>升压 3 温度高 | Boost Module 3<br>over temperature<br>升压模块 3 过温   | ID152 |
| 7  | BSTModule<br>4OverTemp<br>Fault | BST4 OV Temp<br>升压 4 温度高 | Boost Module 4<br>over temperature<br>升压模块 4 过温   | ID153 |
| 6  | BSTModule<br>5OverTemp<br>Fault | BST5 OV Temp<br>升压 5 温度高 | Boost Module5 over<br>temperature<br>升压模块 5 过温    | ID154 |
| 5  | BSTModule<br>6OverTemp<br>Fault | BST6 OV Temp<br>升压 6 温度高 | Boost Module 6<br>over temperature<br>升压模块 6 过温   | ID155 |
| 4  | TBD                             |                          |   | ID156 |
| 3  | TBD                             |                          |   | ID157 |
| 2  | TBD                             |                          |   | ID158 |

|   |                         |                      |  |       |
|---|-------------------------|----------------------|--|-------|
| 1 | TBD                     |                      |  | ID159 |
| 0 | AMBModuleOverTemp Fault | AMB OV Temp<br>内部环温高 | Amb<br>Overtemperature<br>too high<br>内部环境温度过高 | ID160 |

Table 6

| Bit | Fault information        | Chinese / English description | Remark   | ID Number |
|-----|--------------------------|-------------------------------|--|-----------|
| 31  | RChipFault               | RChipFault<br>副 CPU 故障        | Slave CPU fails<br>副 CPU 故障  | ID161     |
| 30  | MChipFault               | MChipFault<br>主 CPU 故障        | Master CPU fails<br>主 CPU 故障                                       | ID162     |
| 29  | HMIChipFault             | HMIChipFault<br>通讯 CPU 故障     | HMI CPU fails<br>通讯 CPU 故障   | ID163     |
| 28  | TBD                      |                               |  | ID164     |
| 27  | EEPROM_Write_Failure_Ctl | Ctl EEPROM Wr<br>副存储器写故障      | EEPROM can't write(unrecover) on control board<br>EEPROM 不能写(不可恢复) | ID165     |
| 26  | EEPROM_Read_Failure_Ctl  | Ctl EEPROM Rd<br>副存储器读故障      | EEPROM can't read(unrecover) on control board<br>EEPROM 不能读(不可恢复)  | ID166     |
| 25  | EEPROM_Write_Failure_HMI | HMI EEPROM Wr<br>副存储器写故障      | EEPROM can't write(unrecover) on HMI board<br>EEPROM 不能写(不可恢复)     | ID167     |
| 24  | EEPROM_Read_Failure_HMI  | HMI EEPROM Rd<br>通讯存储器读故障     | EEPROM can't read(unrecover) on HMI board<br>EEPROM 不能读(不可恢复)      | ID168     |
| 23  | TBD                      |                               |  | ID169     |
| 22  | TBD                      |                               |  | ID170     |

|    |                  |                            |   |       |
|----|------------------|----------------------------|---|-------|
| 21 | TBD              |                            |   | ID171 |
| 20 | HwM_ADFAultVGrid | HwM_ADVGrid<br>主电网电压 AD 故障 | M CPU AD channel for<br>Grid voltage fault<br>主机采集输出电压的<br>AD 口错误 | ID172 |
| 19 | HwM_ADFAultVinv  | HwM_ADVInv<br>主逆变电压 AD 故障  | M CPU AD channel for<br>INV voltage fault<br>主机逆变电压采样 AD<br>口错误   | ID173 |
| 18 | HwM_ADFAultIGrid | HwM_ADIGrid<br>主输出电流 AD 故障 | M CPU AD channel for<br>Grid current fault<br>主机采集输出电流的<br>AD 口错误 | ID174 |
| 17 | HwM_ADFAultDCI   | HwM_AD_DCI<br>主直流分量 AD 故障  | M CPU AD channel for<br>DCI fault<br>主机采集直流分量的<br>AD 口错误          | ID175 |
| 16 | HwM_ADFAultGFCI  | HwM_AD_GFCI<br>主漏电流 AD 故障  | M CPU AD channel for<br>GFCI fault<br>主机采集漏电流的 AD<br>口错误          | ID176 |
| 15 | TBD              |                            |   | ID177 |
| 14 | HwS_ADFAultVGrid | HwM_ADVGrid<br>副电网电压 AD 故障 | S CPU AD channel for<br>Grid voltage fault<br>从机采集输出电压的<br>AD 口错误 | ID178 |
| 13 | HwS_ADFAultVinv  | HwM_ADVInv<br>副逆变电压 AD 故障  | S CPU AD channel for<br>INV voltage fault<br>从机采集输出电流的<br>AD 口错误  | ID179 |
| 12 | HwS_ADFAultIGrid | HwM_ADIGrid<br>副输出电流 AD 故障 | S CPU AD channel for<br>Grid current fault<br>从机采集输出电流的<br>AD 口错误 | ID180 |
| 11 | HwS_ADFAultDCI   | HwM_AD_DCI<br>副直流分量 AD 故障  | S CPU AD channel for<br>DCI fault<br>从机采集直流分量的<br>AD 口错误          | ID181 |



|    |                    |                           |   |       |
|----|--------------------|---------------------------|---|-------|
| 10 | HwS_ADFaultGFCI    | HwM_AD_GFCI<br>副漏电流 AD 故障 | S CPU AD channel for<br>GFCI fault<br>从机采集漏电流的 AD<br>口错误              | ID182 |
| 9  | TBD                |                           |   | ID183 |
| 8  | TBD                |                           |   | ID184 |
| 7  | Ref V Fault        | RefVFault<br>参考电压异常       | The reference voltage<br>inside are abnormal<br>参考电压不正常               | ID185 |
| 6  | RTCROWFault        | RTCROW fault<br>时钟模块故障    | RTC on Commuication<br>board can't read or<br>write<br>通讯板上时钟模块错<br>误 | ID186 |
| 5  | TBD                |                           |   | ID187 |
| 4  | TBD                |                           |   | ID188 |
| 3  | TBD                |                           |   | ID189 |
| 2  | TBD                |                           |   | ID190 |
| 1  | AuxPower1<br>Fault | HwSPS1Fault<br>辅助电源 1 故障  | Auxiliary power 1 fails<br>辅助电源 1 错误                                  | ID191 |
| 0  | AuxPower2<br>Fault | HwSPS2Fault<br>辅助电源 2 故障  | Auxiliary power 2 fails<br>辅助电源 2 错误                                  | ID192 |

Table 7 (non-common failure)

| Bit | Fault<br>information            | Chinese / English<br>description | Remark  | ID number |
|-----|---------------------------------|----------------------------------|---|-----------|
| 31  | uNoBusVolt<br>Fault             | BUS no volt<br>母线无电压             | Pv voltage is normal,<br>but bus no voltage<br>PV 有电压 BUS 无电压                   | ID193     |
| 30  | PVCurrentU<br>nbalanceFa<br>ult | PvI_Ublc<br>输入电流不平衡              | Multi PV current is<br>unbalance<br>输入端两路电流不平<br>衡（当 interleave 模式<br>并联 boost） | ID194     |
| 29  | TBD                             |                                  |   | ID195     |

|    |     |  |  |       |
|----|-----|--|--|-------|
| 28 | TBD |  |  | ID196 |
| 27 | TBD |  |  | ID197 |
| 26 | TBD |  |  | ID198 |
| 25 | TBD |  |  | ID199 |
| 24 | TBD |  |  | ID200 |
| 23 | TBD |  |  | ID201 |
| 22 | TBD |  |  | ID202 |
| 21 | TBD |  |  | ID203 |
| 20 | TBD |  |  | ID204 |
| 19 | TBD |  |  | ID205 |
| 18 | TBD |  |  | ID206 |
| 17 | TBD |  |  | ID207 |
| 16 | TBD |  |  | ID208 |
| 15 | TBD |  |  | ID209 |
| 14 | TBD |  |  | ID210 |
| 13 | TBD |  |  | ID211 |
| 12 | TBD |  |  | ID212 |
| 11 | TBD |  |  | ID213 |
| 10 | TBD |  |  | ID214 |
| 9  | TBD |  |  | ID215 |
| 8  | TBD |  |  | ID216 |

|   |     |  |  |       |
|---|-----|--|--|-------|
| 7 | TBD |  |  | ID217 |
| 6 | TBD |  |  | ID218 |
| 5 | TBD |  |  | ID219 |
| 4 | TBD |  |  | ID220 |
| 3 | TBD |  |  | ID221 |
| 2 | TBD |  |  | ID222 |
| 1 | TBD |  |  | ID223 |
| 0 | TBD |  |  | ID224 |

Table 8 (peripheral device failure)

| Bit | Fault information | Chinese / English description | Remark                               | ID Number |
|-----|-------------------|-------------------------------|--------------------------------------|-----------|
| 31  | DcFanFault        | Fan alarm<br>风扇故障             | Fan fails<br>风扇错误总                   | ID225     |
| 30  | DcFan1Fault       | Fan-1 alarm<br>风扇 1 故障        | Fan-1 fails<br>风扇 1 错误               | ID226     |
| 29  | DcFan2Fault       | Fan-2 alarm<br>风扇 2 故障        | Fan-2 fails<br>风扇 2 错误               | ID227     |
| 28  | DcFan3Fault       | Fan-3 alarm<br>风扇 3 故障        | Fan-3 fails<br>风扇 3 错误               | ID228     |
| 27  | DcFan4Fault       | Fan-4 alarm<br>风扇 4 故障        | Fan-4 fails<br>风扇 4 错误               | ID229     |
| 26  | TBD               |                               |                                      | ID230     |
| 25  | TBD               |                               |                                      | ID231     |
| 24  | TBD               |                               |                                      | ID232     |
| 23  | LightingAlarm     | LightingAlarm<br>防雷报警         | Lighting protection<br>alarm<br>防雷报警 | ID233     |
| 22  | TBD               |                               |                                      | ID234     |
| 21  | TBD               |                               |                                      | ID235     |
| 20  | TBD               |                               |                                      | ID236     |
| 19  | TBD               |                               |                                      | ID237     |
| 18  | TBD               |                               |                                      | ID238     |

|    |     |  |  |       |
|----|-----|--|--|-------|
| 17 | TBD |  |  | ID239 |
| 16 | TBD |  |  | ID240 |
| 15 | TBD |  |  | ID241 |
| 14 | TBD |  |  | ID242 |
| 13 | TBD |  |  | ID243 |
| 12 | TBD |  |  | ID244 |
| 11 | TBD |  |  | ID245 |
| 10 | TBD |  |  | ID246 |
| 9  | TBD |  |  | ID247 |
| 8  | TBD |  |  | ID248 |
| 7  | TBD |  |  | ID249 |
| 6  | TBD |  |  | ID250 |
| 5  | TBD |  |  | ID251 |
| 4  | TBD |  |  | ID252 |
| 3  | TBD |  |  | ID253 |
| 2  | TBD |  |  | ID254 |
| 1  | TBD |  |  | ID255 |
| 0  | TBD |  |  | ID256 |