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**Eybond**

**Modbus RTU**

Shenzhen Yibang Sunshine Co.

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**Protocol**

Document History

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| --- | --- | --- | --- | --- |
| **Document version** | **Modifications** | **Modified by** | **Date** | **Remarks** |
| 1.0 | First Edition Release | Mencius | 2015-10-16 |  |

**Catalogue**

* Collection
* utensil
* e
* About this document

(hereinafter referred to as "the Company") has abstracted and designed a logical entity layer and a communication protocol layer as shown in the figure below, based on a deep understanding of the Industrial Internet of Things.

Based on this, this document describes the communication protocol between the device layer (a generic term for all types of end devices, including but not limited to PV inverters, PV converters, environmental detectors, smart meters, etc.) and the data acquisition layer (hereinafter referred to as "this protocol", i.e. the "Eybond (hereinafter referred to as "this protocol", i.e. "Eybond RTU Protocol" in the above diagram), to facilitate the data collector (hereinafter referred to as "data collector") to implement the communication between the various devices following this protocol

(hereinafter referred to as "the Equipment") is monitored and remotely controlled in real time.

This agreement applies to all equipment developed and manufactured by Shenzhen Yibang Sunshine Co. This agreement refers to and conditionally complies with the GBT 19582 -2008 Specification for Industrial Automation Networks based on Modbus Protocol.

* About this Agreement

One protocol that has become the de facto industry standard for communication applications in industrial equipment is the Modbus protocol. It is a standard, open, message-oriented protocol that establishes a common format for message field grids and content. More information about the protocol can be found on its official website: [http://www.modbus.org](http://www.modbus.org/).

The Modbus protocol has three transmission modes, ASCII, RTU and TCP, and this protocol uses the Modbus RTU

mode (hereinafter collectively referred to as the "Modbus\_RTU protocol"), the Modbus\_RTU protocol is described below.

* Modbus\_RTU protocol message frames

The message frame of the Modbus\_RTU protocol contains: address field, function code, data field and checksum field, as shown in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **area** | Address field | Function Code | Data fields | Checksum field | |
| **Number of bytes** | 1 byte | 1 byte | 0~252 bytes | 2 bytes | |
| **Remarks** |  | Collectively referred to as PDUs | | Low Byte | High Byte |

The maximum length of a Modbus\_RTU message frame is 256 bytes, of which the maximum length of the data field is 252 bytes.

In Modbus RTU transmission mode, the entire message frame must be sent in a continuous stream of characters. If the idle interval between two characters is greater than 1.5 characters, then the message frame is considered incomplete and should be discarded by the receiver.

A minimum idle time of 3.5 characters is required between two frames to differentiate them, as shown in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Modbus\_RTU telegrams** | | | | | |
| Start | Address field | Function Code | Data fields | Checksum field | End |
| ≥3.5 Character time | 8 bits | 8 bits | N\*8 bits | 16-bit | ≥3.5 Character time |

* Modbus\_RTU protocol byte sequence

In the RTU transmission mode of Modbus, the address and data items are represented in big-ended byte order, which means that when sending multiple bytes, the first byte sent is the high byte, e.g. when sending data 0x1234, the first byte sent is 0x12, followed by 0x34.

For each byte, an asynchronous communication format is used, i.e. 1 start bit, 8 data bits (the least significant bit is sent first), no parity bit and 2 stop bits, for a total of 11 bits. The data bits of each byte are sent in this order (from left to right): lowest significant bit (LSB)... highest significant bit (MSB), as shown in the table below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Starting position | Data bits | | | | | | | | Stop bits |
| 1 place | Bit0 | Bit1 | Bit2 | Bit3 | Bit4 | Bit5 | Bit6 | Bit7 | 2 places |

* Address fields of the Modbus\_RTU protocol

The Modbus protocol is a master-slave communication mode in which communication is initiated by the master and answered by the slave at the corresponding address. In this protocol, the digitizer acts as the master and the device as the slave. In general, the slave should not initiate any data transfer when the master has not initiated a session.

In the Modbus\_RTU protocol, the master has no address and the address field refers to the slave's address, which is valid from 1 to 247. Specifically, 0 is the broadcast address and 255 bits is the communication address between the components within the slave.

On the Modbus serial bus, the slave address is unique.

* Check Field for Modbus\_RTU Protocol

The Modbus\_RTU protocol uses a 16-bit CRC checksum algorithm. the CRC field is appended to the message as the last field of the message: first the low byte of the field is appended, then the high byte of the field. the CRC high byte is the last byte sent in the message.

Description of the CRC checksum algorithm.

(1). A 16-bit register is preset to 0xFFFF (hexadecimal, all 1s) and is called the CRC register.

(2). The first byte of the message is heterodyned with the low byte of the CRC register (only the 8 data bits in each character are involved in the calculation of the generated CRC. The start, stop and check bits are not involved in the CRC calculation) and the result is stored back in the CRC register.

(3). Shift the CRC register to the right by one bit, filling the highest bit with 0 and shifting the lowest bit out for the next detection step.

(4). If the bit shifted out in the previous step is 0, step 3 (next shift) is repeated; otherwise the CRC register is heterodyned to a preset fixed value (0xA001).

(5). Repeat steps 3 and 4 until 8 shifts have been made. This completes the processing of a complete 8-bit byte.

(6). Repeat step 2 to step 5

step to process the next byte until all bytes have been processed.

(7). The value of the final CRC register is the value of the CRC.

* Exception codes for Modbus\_RTU protocol

**Ming**

Exception codes are used in exception responses to requests and the table below lists only the exception codes applied to this protocol.

|  |  |  |
| --- | --- | --- |
| **Exception Code** | **Says** | **Remarks** |
| 0x01 | Illegal function codes | Function code not recognised or not supported |
| 0x02 | Illegal data address | Data address and length mismatch |
| 0x03 | Illegal data values | Illegal data values, e.g. incorrect number of registers, data out of bounds |
| 0x04 | Slave equipment failure | Read and write errors (failed to fetch register data or write operation to read-only register) |
| 0x06 | Busy slave equipment | There are more important tasks to be completed at the moment |

When a host sends a request to a slave device and the host expects a response, one of the following four events may occur during communication between the two parties.

* If the slave device receives a request with no communication errors and can handle the query normally, then the slave device will return a normal response.
* If the request is not received by the slave device due to a communication error, then no response can be returned. The host program will eventually process the timeout status of the request.
* If the slave device receives the request but detects a communication error (CRC checksum failure), then no response can be returned. The host program will eventually handle the timeout status of the request.
* If the slave device receives a request with no communication error but cannot process the request (for example, if a non-existent output or register is requested to be read), the slave device will return an exception response as per the exception code above, informing the host of the cause of the error.
* Function codes for the Modbus\_RTU protocol

**Class**

**Preparation**

The following table lists only the function codes to which this protocol applies.

|  |  |  |  |
| --- | --- | --- | --- |
| **Function Code** | **功能码 Type** | **Description** | **Note** |
| 0x03 | Public Function Code | Read register | Contains reads of read-only and writable registers |
| 0x10 | Public Function Code | Write register | Contains writes to single registers and multiple registers |

In the Modbus\_RTU protocol, the position and length of the address and check fields remain the same for both request and response frames (including normal and abnormal response frames), but only the PDUs (including function codes and data fields) change. Therefore, in the following detailed description of each function code, only the corresponding PDUs are described.

* Read register (function code: 0x03)
* Request PDU

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Function Code | 1 byte | 0x03 |
| Start register address | 2 bytes | 0x0000~0xFFFF |
| Number of registers | 2 bytes | 0x0001~ 0x007D |

* Normal response PDUs

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Function Code | 1 byte | 0x03 |
| Byte Count | 1 byte | N x 2 |
| Register value | N x 2 bytes |  |

Note: N = number of registers

* Exception Response PDUs

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Error Code | 1 byte | 0x83 |
| Exception Code | 1 byte | See "exception codes" for details |

* Example

Request to read out the value of 3 consecutive registers starting at address 107 (PDUs only).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Request** | | **Normal response** | | **Exception response** | |
| Field Name | Field Value | Field Name | Field Value | Field Name | Field Value |
| Function Code | 0x03 | Function Code | 0x03 | Error Code | 0x83 |
| Start address Hi | 0x00 | Byte Count | 0x06 | Exception Code | 0x04 |
| Start address Lo | 0x6B | Register [107] Hi | 0x02 |  |  |
| Number of registers Hi | 0x00 | Register [107] Lo | 0x2B |  |  |
| Number of registers Lo | 0x03 | Register [108] Hi | 0x00 |  |  |
|  |  | Register [108] Lo | 0x00 |  |  |
|  |  | Register [109] Hi | 0x00 |  |  |
|  |  | Register [109] Lo | 0x64 |  |  |

* Write register (function code: 0x10)
* Request PDU

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Function Code | 1 byte | 0x10 |
| Start register address | 2 bytes | 0x0000~0xFFFF |
| Number of registers | 2 bytes | 0x0001~0x007B |
| Byte Count | 1 byte | N x 2 |
| Register value | N x 2 bytes |  |

Note: N = number of registers

* Normal response PDUs

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Function Code | 1 byte | 0x10 |
| Starting address | 2 bytes | 0x0000~0xFFFF |
| Number of registers | 2 bytes | 0x0001~0x007B |

* Exception Response PDUs

|  |  |  |
| --- | --- | --- |
| Data structure | Data length | Range of values |
| Error Code | 1 byte | 0x90 |
| Exception Code | 1 byte | See "exception codes" for details |

* Example

**Request**

Request to write 0x000A and 0x0102 to two registers starting at address 1 (only PDUs are described).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Please** | | **Normal response** | | **Exception response** | |
| Field Name | Field Value | Field Name | Field Value | Field Name | Field Value |
| Function Code | 0x10 | Function Code | 0x10 | Error Code | 0x90 |
| Start address Hi | 0x00 | Start address Hi | 0x00 | Exception Code | 0x04 |
| Start address Lo | 0x01 | Start address Lo | 0x01 |  |  |
| Number of registers Hi | 0x00 | Number of registers Hi | 0x00 |  |  |
| Number of registers Lo | 0x02 | Number of registers Lo | 0x02 |  |  |
| Byte Count | 0x04 |  |  |  |  |
| Register value Hi | 0x00 |  |  |  |  |
| Register value Lo | 0x0A |  |  |  |  |
| Register value Hi | 0x01 |  |  |  |  |
| Register value Lo | 0x02 |  |  |  |  |

* Specific applications of the protocol

This protocol is based on the standard Modbus\_RTU protocol with appropriate modifications, as specified below.

* Physical interface: RS-232 or RS-485
* Communication method: Universal asynchronous transceiver (UART)
* Baud rate: 9600bps
* Minimum polling period: 1 second
* Register width: 2 bytes (unsigned integer)
* Decoding order of 16-bit integers: standard Modbus definition is used, the order of high and low bytes is not reversed, e.g. 0x12 0x34 should be decoded as integer 4660.
* 32-bit integer decoding order: using the standard Modbus definition, the high and low words in a double word are reversed, but the high and low bytes within the word are not reversed, e.g. 0x1234 0x5678, should be decoded as 1450709556.

Differences from the standard Modbus\_RTU protocol are.

* Instead of the default even parity byte order, a byte format of 1 start bit, 8 data bits, no parity bits and 1 stop bit is used, for a total of 10 bits.
* The input register list and the output register list are not separated separately, but are combined together and distinguished by read and write attributes.
* The function code for writing a single register is omitted because it is a special case of writing the function code for multiple registers, which already contains that function.
* The requirement for a minimum idle time of 3.5 characters between frames is simply solved by using a minimum polling period and does not strictly adhere to the "3.5 character time" limit.

The following register mapping table is defined according to the device type.

Note: Reserved words, reserved bytes, reserved bits, and unsupported registers are always filled with 0x00.

* Photovoltaic inverter register mapping table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Address** | **Register Meaning** | **Reading and writing** | **Range of values** | **Unit** | **Remarks** |
| Intrinsic Property Zone | | | | | |
| 000 | Type of equipment | R | - | - | Fixed to 0x0200 |
| 001 | Correspondence address | R | [1,247] | - |  |
| 002 | Communication protocol versions | R | - | - | the version of this agreement to which the firmware is subject.  e.g. 0x0102 for version 1.2 |
| 003 | Serial number byte 01 | R | '0'~'9'; 'A'~'Z' | - | The serial number is a ten-digit ASCII character, e.g. "AH12345678", then  Byte 01 is 0x41 (A) and byte 02 is 0x48 (H).  ……  Byte 09 is 0x37 (7) and byte 10 is 0x38 (8). |
| Serial number byte 02 | '0'~'9'; 'A'~'Z' | - |
| 004 | Serial number byte 03 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 04 | '0'~'9'; 'A'~'Z' | - |
| 005 | Serial number byte 05 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 06 | '0'~'9'; 'A'~'Z' | - |
| 006 | Serial number byte 07 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 08 | '0'~'9'; 'A'~'Z' | - |
| 007 | Serial number byte 09 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 10 | '0'~'9'; 'A'~'Z' | - |
| 008 | Reserved words | R | 0x0000 | - |  |
| 009 | Reserved words | R | 0x0000 | - |  |
| 010 | Factory time byte 1 | R | [0,255] | Year | Based on the year 2000 |
| Factory time byte 2 | [1,12] | Month |  |
| 011 | Factory time byte 3 | R | [1,31] | Day |  |
| Factory time byte 4 | [0,23] | Time |  |
| 012 | Factory time byte 5 | R | [0,59] | Score |  |
| Factory time byte 6 | [0,59] | seconds |  |
| 013 | Control board firmware version | R | - | - | The upper 4 bits of the high byte indicate the major version, which is upgraded in case of backward incompatibility or major architectural changes; the lower 4 bits of the high byte indicate the minor version, which is officially released  When upgrading; the high 4 bits of the low byte indicate the applicable region, see the region information code table for details; the low 4 bits of the low byte are the test version number. For example: 0x1234 indicates the version number: 1.2.3.4, where the primary version number is 1, the secondary version number is 2, and the area code  is 3 and the test version number is 4 |
| 014 | Communication board firmware version | R | - | - |
| 015 | Type of safety regulations | R | - | - | See table of safety type codes |
| 016 | Rated power low word | R | - | 0.1W |  |
| 017 | Rated power high word |
| 018 | Number of MPPT paths and phases | R | [1,8] | - | e.g. 0x0503 means: 5-way MPPT  Three cameras |
| 1,3 | - |
| 019 | Reserved words | R | 0x0000 | - |  |
| Variable property area | | | | | |
| 020 | Power on | R/W | 0.1W |  |  |
| 021 | Power-on self-test time | R/W | S |  |  |
| 022 | System time byte 1 | R/W | [0,255] | Year | Based on the year 2000 |
| System time byte 2 | [1,12] | Month |  |
| 023 | System time byte 3 | R/W | [1,31] | Day |  |
| System time byte 4 | [0,23] | Time |  |
| 024 | System time byte 5 | R/W | [0,59] | Score |  |
| System time byte 6 | [0,59] | seconds |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 025 | Lower limit of insulation resistance | R/W | [100,20000] | 0.1KΩ |  |
| 026 | DC voltage limit | R/W | [2000,10000] | 0.1V |  |
| 027 | Grid voltage limit | R/W | [1600,5500] | 0.1V |  |
| 028 | Lower voltage limit of the grid | R/W | [1600,5500] | 0.1V |  |
| 029 | Grid frequency limit | R/W | [4500,6500] | 0.01 Hz |  |
| 030 | Lower limit of grid frequency | R/W | [4500,6500] | 0.01 Hz |  |
| 031 | Grid current limit | R/W | [10,20,000] | 0.1A |  |
| 032 | Upper limit of power-on voltage | R/W | [7000,9000] | 0.1V |  |
| 033 | Lower limit of power-on voltage | R/W | [4500,9000] | 0.1V |  |
| 034 | MPPT upper voltage limit | R/W | [300,850] | 0.1V |  |
| 035 | MPPT Lower voltage limit | R/W | [300,850] | 0.1V |  |
| 036 | Upper temperature limit inside the machine | R/W | [500,3000] | 0.1°C |  |
| 037 | Correspondence address | R | 0x0000 | - | Customization |
| 038 | Communication baud rate | R | 0x0000 | - | Customization |
| 039 | Power factor adjustment | R/W | [0,2000] | 0.001 | Value after +1000 offset from true value, e.g.  -0.852 means 148  0 means 1000  0.982 denotes 1982 |
| 040 | Active power regulation | R/W | [0,1200] | 0.1% | e.g. 800 means adjusted to 80.0% |
| 041 | Reactive power regulation | R/W | [0,1200] | 0.1% | e.g. 800 means adjusted to 80.0% |
| 042 | Visual power regulation | R/W | [0,1200] | 0.1% | e.g. 800 means adjusted to 80.0% |
| 043 | Switching enable | R/W | [0,1] | - | 0: Off; 1: On |
| 044 | Restore factory enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 045 | Self-test enablement | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 046 | Island protection enablement | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 047 | Grid management enablement | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 048 | GFDI Enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 049 | RCD Enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 050 | RISO Enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 051 | GFDI ground enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 052 | PV curve enable | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 053 | Low voltage crossing enablement | R/W | [0,1] | - | 0: deactivated; 1: enabled |
| 054 | EEPROM initial enable | R/W | [0,2] | - | 0: Normal operation  1: Initialise the control board EEPROM  2: Initialising the communication board EEPROM |
| 055 | Firmware update enable | R/W | [0,3] | - | 0: Normal operation  1: Burning generic firmware  2: Burning of the communication board firmware  3: Burning the control board firmware |
| 056 | Limter function enabled | R | 0x0000 | - | Customization |
| 057 | Reserved words | R | 0x0000 | - |  |
| 058 | Reserved words | R | 0x0000 | - |  |
| Real-time operational data area | | | | | |
| 059 | Operational status | R | [0,5] | - | See table of operational status codes |
| 060 | Active power generation for the day | R | [0,65535] | 0.1kWh |  |
| 061 | Reactive power generation for the day | R | [0,65535] | 0.1kVarh |  |
| 062 | Same day grid connection time | R | [0,65535] | S |  |
| 063 | Low total active power generation | R | [0,0xFFFFFFFF] | 0.1kWh |  |
| 064 | High total active power generation | R |  |
| 065 | Total reactive power generation low word | R | [0,0xFFFFFFFF] | 0.1kVarh |  |
| 066 | Total reactive power generation high word | R |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 067 | Low total generation time | R | [0,0xFFFFFFFF] | 0.1h |  | |
| 068 | Total generation time high word | R |  | |
| 069 | Inverter efficiency | R | [0,999] | 0.1% |  | |
| 070 | Grid voltage AB | R | [0,9999] | 0.1V |  | |
| 071 | Grid voltage BC | R | [0,9999] | 0.1V |  | |
| 072 | Grid voltage AC | R | [0,9999] | 0.1V |  | |
| 073 | Grid voltage A | R | [0,9999] | 0.1V |  | |
| 074 | Grid voltage B | R | [0,9999] | 0.1V |  | |
| 075 | Grid voltage C | R | [0,9999] | 0.1V |  | |
| 076 | Grid current A | R | [0,65535] | 0.1A |  | |
| 077 | Grid current B | R | [0,65535] | 0.1A |  | |
| 078 | Grid current C | R | [0,65535] | 0.1A |  | |
| 079 | Grid frequency | R | [0,9999] | 0.01Hz |  | |
| 080 | Display power low byte | R | 0x0000 | - | Custom - Display Live, Upload 10minAV | |
| 081 | Display power high byte | R | 0x0000 | - | Customization | |
| 082 | Input active power low word | R | [0,0xFFFFFFFF] | 0.1W |  | |
| 083 | Input active power high word | R |  | |
| 084 | Output apparent power low word | R | [0,0xFFFFFFFF] | 0.1VA |  | |
| 085 | Output apparent power high word | R |  | |
| 086 | Output active power low word | R | [0,0xFFFFFFFF] | 0.1W |  | |
| 087 | Output active power high word | R |  | |
| 088 | Output reactive power low word | R | [0,0xFFFFFFFF] | 0.1Var |  | |
| 089 | Output reactive power high word | R |  | |
| 090 | Module 1 Heatsink temperature | R | [0,3000] | 0.1°C | Value after +1000 offset from true value, e.g.  -56.2°C denotes 438  0°C denotes 1000  50.5°C is expressed as 1505 | |
| 091 | Module 2 Heatsink temperature | R | [0,3000] | 0.1°C |
| 092 | Inductor 1 Temperature | R | [0,3000] | 0.1°C |
| 093 | Inductance 2 Temperature | R | [0,3000] | 0.1°C |
| 094 | Transformer temperature | R | [0,3000] | 0.1°C |
| 095 | Ambient temperature | R | [0,3000] | 0.1°C |
| 096 | GFDI1 Grounding current | R | [0,65535] | 0.01A |  | |
| 097 | GFDI2 Grounding current | R | [0,65535] | 0.01A |  | |
| 098 | RCD Leakage current | R | [0,65535] | 0.01A |  | |
| 099 | Limter power | R | 0x0000 | 1W | Customization | |
| 100 | Reserved words | R | 0x0000 | - |  | |
| 101 | Alarm message 1st word | R | [0,65535] | - | See alarm message code table | |
| 102 | Alarm message 2nd word | R | [0,65535] | - | See alarm message code table | |
| 103 | Fault message 1st word | R | [0,65535] | - | See faults | |
| 104 | Fault message 2nd word | R | [0,65535] | - | See faults | |
| 105 | Fault message 3rd word | R | [0,65535] | - | See faults | |
| 106 | Fault message word 4 | R | [0,65535] | - | See faults | |
| 107 | Reserved words | R | 0x0000 | - | Reserved words | |
| 108 | Reserved words | R | 0x0000 | - | Reserved words | |
| 109 | DC voltage1 | R | [0,65535] | 0.1V |  | |
| 110 | DC current 2 | R | [0,65535] | 0.1A |  |  |
| 111 | DC voltage2 | R | [0,65535] | 0.1V |  |
| 112 | DC current 2 | R | [0,65535] | 0.1A |  | |
| 113 | DC voltage3 | R | [0,65535] | 0.1V |  | |
| 114 | DC current3 | R | [0,65535] | 0.1A |  | |
| 115 | DC voltage 4 | R | [0,65535] | 0.1V |  | |
| 116 | DC current4 | R | [0,65535] | 0.1A |  | |
| 117 | Reserved words | R | 0x0000 | - | Reserved words | |

E

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 118 | Reserved words | R | 0x0000 | - | Reserved words |
| 119 | Reserved words | R | 0x0000 | - | Reserved words |
| 120 | Commissioning data | R | 0x0000 | - | Reserved words |
| 121 | Commissioning data | R | 0x0000 | - | Reserved words |
| 122 | Commissioning data | R | 0x0000 | - | Reserved words |
| 123 | Commissioning data | R | 0x0000 | - | Reserved words |
| 124 | Commissioning data | R | 0x0000 | - | Reserved words |
| Daily power generation data area | |  | | | |
| 151 | Daily power generation data 1 | R | [0,65535] | 0.1kWh | 120 daily power generation data, one every 12 minutes (counting the power generated during that period), for a total of 120 in 24 hours. It is possible to  One command acquired |
| 152 | Daily power generation data 2 | R | [0,65535] | 0.1kWh |
| ... | Power generation data for the day n | R | [0,65535] | 0.1kWh |
| 270 | Daily power generation data 120 | R | [0,65535] | 0.1kWh |
| Current month power generation data area | |  | | | |
| 271 | Power generation on day 1 of the month | R | [0,65535] | kWh | A month is counted as 31 days, no 31 days  for the month, filled with 0 values |
| 272 | Power generation on day 2 of the month | R | [0,65535] | kWh |
| ... | Power generation on day n of the month | R | [0,65535] | kWh |
| 301 | Power generation on the 31st day of the month | R | [0,65535] | kWh |
| Current year generation data area | |  | | | |
| 305 | Low word on electricity generation in January of the year | R | [0,0xFFFFFFFF] | kWh |  |
| 306 | High word for electricity generation in January of the year | R |  |
| 307 | Low word on electricity generation in February of the year | R | [0,0xFFFFFFFF] | kWh |  |
| 308 | High word for electricity generation in February of the year | R |  |
| ... | Low word for electricity generation in month n of the current year | R | [0,0xFFFFFFFF] | kWh |  |
| ... | High word for electricity generation in month n of the year | R |  |
| 327 | Low power generation in December of the year  Word | R | [0,0xFFFFFFFF] | kWh |  |
| 328 | High electricity generation in December of the year  Word | R |  |
| 25 years of electricity generation data area | |  | | | |
| 331 | Total electricity generation in year 1 low word | R | [0,0xFFFFFFFF] | kWh |  |
| 332 | Total generation in year 1 High | R |  |
| 333 | Total electricity generation in year 2 low word | R | [0,0xFFFFFFFF] | kWh |  |
| 334 | Year 2 Total Generation High | R |  |
| ... | Total electricity generation in year n Low | R | [0,0xFFFFFFFF] | kWh |  |
| ... | Total electricity generation in year n High | R |  |
| 379 | Low total electricity generation in year 25  Word | R | [0,0xFFFFFFFF] | kWh |  |
| 380 | High total electricity generation in year 25  Word | R |  |
| Historical fault logging area | |  | | | |
| 451 | Fault Record No. 1: Year | R | [0,255] | Year | The time when the fault occurred. Where the year offset is +2000, e.g.  12 Represents 2012 |
| Fault log #1: Month | R | [1,12] | Month |
| 452 | Fault log #1: Day | R | [1,31] | Day |
| Fault record No. 1: Hours | R | [0,23] | Time |
| 453 | Fault record No. 1: Sub | R | [0,59] | Score |
| Fault record No. 1: seconds | R | [0,59] | seconds |
| 454 | Fault log entry 1: edit  Code | R | [0,65535] | - | See fault information code table |
| 455 | Fault record No. 1: Number  Value | R | [0,65535] |  |
| 456 | Fault Record No. 2: Year | R | [0,255] | Year | The time when the fault occurred. Where the year |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Fault Log #2: Month | R | [1,12] | Month | Offset +2000, e.g.  12 Represents 2012 |
| 457 | Fault log #2: Day | R | [1,31] | Day |
| Fault log #2: Hours | R | [0,23] | Time |
| 458 | Fault log #2: Sub | R | [0,59] | Score |
| Fault record No. 2: seconds | R | [0,59] | seconds |
| 459 | Fault log #2: edit  Code | R | [0,65535] | - | See fault information code table |
| 460 | Fault record No. 2: Number  Value | R | [0,65535] |  |
| ... | Fault record No. n: Year | R | [0,255] | Year | The time when the fault occurred. Where the year offset is +2000, e.g.  12 Represents 2012 |
| Fault record n: month | R | [1,12] | Month |
| ... | Fault record entry n: day | R | [1,31] | Day |
| Fault record number n: time | R | [0,23] | Time |
| ... | Fault record number n: sub | R | [0,59] | Score |
| Fault record number n: seconds | R | [0,59] | seconds |
| ... | Fault record No. n: ed.  Code | R | [0,65535] | - | See fault information code table |
| ... | Fault record number n: number  Value | R | [0,65535] |  |
| 546 | Fault Record No. 20: Year | R | [0,255] | Year | The time when the fault occurred. Where the year offset is +2000, e.g.  12 Represents 2012 |
| Fault Log #20: Month | R | [1,12] | Month |
| 547 | Fault log #20: Day | R | [1,31] | Day |
| Fault record No. 20: Hours | R | [0,23] | Time |
| 548 | Fault log #20: Sub | R | [0,59] | Score |
| Fault record number 20: seconds | R | [0,59] | seconds |
| 549 | Fault log entry 20: edit  Code | R | [0,65535] | - | See fault information code table |
| 550 | Fault record No. 20: Number  Value | R | [0,65535] |  |

* Environmental detector register mapping table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Address** | **Register Meaning** | **Reading and writing** | **Range of values** | **Unit** | **Remarks** |
| 000 | Type of equipment | R | - | - | Fixed to 0x0300 |
| 001 | Correspondence address | R | [1,247] | - |  |
| 002 | Communication protocol versions | R | - | - | The version of this agreement to which the firmware is subject  This, e.g. 0x0102 for version 1.2 |
| 003 | Serial number byte 01 | R | '0'~'9'; 'A'~'Z' | - | The serial number is a ten-digit ASCII character, e.g. "AH12345678", then  Byte 01 is 0x41 (A) and byte 02 is 0x48 (H).  ……  Byte 09 is 0x37 (7) and byte 10 is 0x38 (8). |
| Serial number byte 02 | '0'~'9'; 'A'~'Z' | - |
| 004 | Serial number byte 03 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 04 | '0'~'9'; 'A'~'Z' | - |
| 005 | Serial number byte 05 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 06 | '0'~'9'; 'A'~'Z' | - |
| 006 | Serial number byte 07 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 08 | '0'~'9'; 'A'~'Z' | - |
| 007 | Serial number byte 09 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 10 | '0'~'9'; 'A'~'Z' | - |
| 008 | Reserved words | R | 0x0000 | - |  |
| 009 | Reserved words | R | 0x0000 | - |  |
| 010 | Factory time byte 1 | R | [0,255] | Year | Based on the year 2000 |
| Factory time byte 2 | [1,12] | Month |  |
| 011 | Factory time byte 3 | R | [1,31] | Day |  |
| Factory time byte 4 | [0,23] | Time |  |
| 012 | Factory time byte 5 | R | [0,59] | Score |  |
| Factory time byte 6 | [0,59] | seconds |  |
| 013 | Firmware versions | R | - | - | The upper 4 bits of the high byte indicate the major version, in case of backward incompatibility, or upgrade in case of major architecture change; the lower 4 bits of the high byte indicate the minor version, positive  The lower 4 bits of the lower byte indicate the applicable region, see the region code table for details; the lower 4 bits of the lower byte are the test version number. For example, 0x1234 indicates the version number: 1.2.3.4, where the primary version number is 1, the secondary version number is 2, the area code is 3, and the test version number is 3.  This number is 4 |
| 014 | Reserved words | R | 0x0000 | - |  |
| 015 | Wind speed | R | - | 0.1M/S |  |
| 016 | Wind direction | R | - | 0.1° |  |
| 017 | Ambient temperature | R | - | 0.1°C |  |
| 018 | Radiation intensity | R | - | 0.1W/ M2 |  |
| 019 | Battery panel backplane temperature | R | - | 0.1°C |  |

* Smart meter register mapping table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Address** | **Register Meaning** | **Reading and writing** | **Range of values** | **Unit** | **Remarks** |
| 000 | Type of equipment | R | - | - | Fixed to 0x0400 |
| 001 | Correspondence address | R | [1,247] | - |  |
| 002 | Communication protocol versions | R | - | - | The version of this agreement to which the firmware is subject  This, e.g. 0x0102 for version 1.2 |
| 003 | Serial number byte 01 | R | '0'~'9'; 'A'~'Z' | - | The serial number is a ten-digit ASCII character, e.g. "AH12345678", then  Byte 01 is 0x41 (A) and byte 02 is 0x48 (H).  ……  Byte 09 is 0x37 (7) and byte 10 is 0x38 (8). |
| Serial number byte 02 | '0'~'9'; 'A'~'Z' | - |
| 004 | Serial number byte 03 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 04 | '0'~'9'; 'A'~'Z' | - |
| 005 | Serial number byte 05 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 06 | '0'~'9'; 'A'~'Z' | - |
| 006 | Serial number byte 07 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 08 | '0'~'9'; 'A'~'Z' | - |
| 007 | Serial number byte 09 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 10 | '0'~'9'; 'A'~'Z' | - |
| 008 | Reserved words | R | 0x0000 | - |  |
| 009 | Reserved words | R | 0x0000 | - |  |
| 010 | Factory time byte 1 | R | [0,255] | Year | Based on the year 2000 |
| Factory time byte 2 | [1,12] | Month |  |
| 011 | Factory time byte 3 | R | [1,31] | Day |  |
| Factory time byte 4 | [0,23] | Time |  |
| 012 | Factory time byte 5 | R | [0,59] | Score |  |
| Factory time byte 6 | [0,59] | seconds |  |
| 013 | Firmware versions | R | - | - | The upper 4 bits of the high byte indicate the major version, in case of backward incompatibility, or upgrade in case of major architecture change; the lower 4 bits of the high byte indicate the minor version, positive  The lower 4 bits of the lower byte indicate the applicable region, see the Geographical Information Code table for details; the lower 4 bits of the lower byte are the test version number. For example, 0x1234 indicates version number 1.2.3.4, in which the major version number is 1, the minor version number is 2, the area code is 3, and the test version number is 3.  This number is 4 |
| 014 | Reserved words | R | 0x0000 | - |  |
| 015 | Active power | R | [0,65535] | 0.1 KWH |  |
| 016 | Reactive power | R | [0,65535] | 0.1 KVarH |  |
| 017 | Active power | R | [0,65535] | 0.1 W |  |
| 018 | Reactive power | R | [0,65535] | 0.1 Var |  |
| 019 | Apparent power | R | [0,65535] | 0.1 VA |  |
| 020 | Power Factor | R | - | 0.001 |  |
| 021 | Rate wave positive active power | R | [0,65535] | 0.1 KWH |  |
| 022 | Rate peak positive active power | R | [0,65535] | 0.1 KWH |  |
| 023 | Rate Valley Positive Active Power | R | [0,65535] | 0.1 KWH |  |
| 024 | Rate level positive active power | R | [0,65535] | 0.1 KWH |  |
| 025 | Reserved words | R | 0x0000 | - |  |

* Photovoltaic convergence box register mapping table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Address** | **Register Meaning** | **Reading and writing** | **Range of values** | **Unit** | **Remarks** |
| 000 | Type of equipment | R | - | - | Fixed to 0x0500 |
| 001 | Correspondence address | R | [1,247] | - |  |
| 002 | Communication protocol versions | R | - | - | The version of this agreement to which the firmware is subject  This, e.g. 0x0102 for version 1.2 |
| 003 | Serial number byte 01 | R | '0'~'9'; 'A'~'Z' | - | The serial number is a ten-digit ASCII character, e.g. "AH12345678", then  Byte 01 is 0x41 (A) and byte 02 is 0x48 (H).  ……  Byte 09 is 0x37 (7) and byte 10 is 0x38 (8). |
| Serial number byte 02 | '0'~'9'; 'A'~'Z' | - |
| 004 | Serial number byte 03 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 04 | '0'~'9'; 'A'~'Z' | - |
| 005 | Serial number byte 05 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 06 | '0'~'9'; 'A'~'Z' | - |
| 006 | Serial number byte 07 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 08 | '0'~'9'; 'A'~'Z' | - |
| 007 | Serial number byte 09 | R | '0'~'9'; 'A'~'Z' | - |
| Serial number byte 10 | '0'~'9'; 'A'~'Z' | - |
| 008 | Reserved words | R | 0x0000 | - |  |
| 009 | Reserved words | R | 0x0000 | - |  |
| 010 | Factory time byte 1 | R | [0,255] | Year | Based on the year 2000 |
| Factory time byte 2 | [1,12] | Month |  |
| 011 | Factory time byte 3 | R | [1,31] | Day |  |
| Factory time byte 4 | [0,23] | Time |  |
| 012 | Factory time byte 5 | R | [0,59] | Score |  |
| Factory time byte 6 | [0,59] | seconds |  |
| 013 | Firmware versions | R | - | - | The upper 4 bits of the high byte indicate the major version, in case of backward incompatibility, or upgrade in case of major architecture change; the lower 4 bits of the high byte indicate the minor version, positive  The lower 4 bits of the lower byte indicate the applicable region, see the region code table for details; the lower 4 bits of the lower byte are the test version number. For example, 0x1234 indicates the version number: 1.2.3.4, where the primary version number is 1, the secondary version number is 2, the area code is 3, and the test version number is 3.  This number is 4 |
| 014 | Reserved words | R | 0x0000 | - |  |
| 015 | Number of active channels | R | [0,65535] | - |  |
| 016 | Busbar voltage (V) | R | [0,65535] | 0.1 V |  |
| 017 | Photovoltaic DC channel 01 | R | [0,65535] | 0.1 A |  |
| 018 | Photovoltaic DC channel 02 | R | [0,65535] | 0.1 A |  |
| 019 | Photovoltaic DC channel 03 | R | [0,65535] | 0.1 A |  |
| 020 | Photovoltaic DC channel 04 | R | [0,65535] | 0.1 A |  |
| 021 | Photovoltaic DC channel 05 | R | [0,65535] | 0.1 A |  |
| 022 | Photovoltaic DC channel 06 | R | [0,65535] | 0.1 A |  |
| 023 | Photovoltaic DC channel 07 | R | [0,65535] | 0.1 A |  |
| 024 | Photovoltaic DC channel 08 | R | [0,65535] | 0.1 A |  |
| 025 | Photovoltaic DC channel 09 | R | [0,65535] | 0.1 A |  |
| 026 | Photovoltaic DC channel 10 | R | [0,65535] | 0.1 A |  |
| 027 | Photovoltaic DC channel 11 | R | [0,65535] | 0.1 A |  |
| 028 | Photovoltaic DC channel 12 | R | [0,65535] | 0.1 A |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 029 | Photovoltaic DC channel 13 | R | [0,65535] | 0.1 A |  |
| 030 | Photovoltaic DC channel 14 | R | [0,65535] | 0.1 A |  |
| 031 | Photovoltaic DC channel 15 | R | [0,65535] | 0.1 A |  |
| 032 | Photovoltaic DC channel 16 | R | [0,65535] | 0.1 A |  |
| 033 | Photovoltaic DC channel 17 | R | [0,65535] | 0.1 A |  |
| 034 | Photovoltaic DC channel 18 | R | [0,65535] | 0.1 A |  |
| 035 | Photovoltaic DC channel 19 | R | [0,65535] | 0.1 A |  |
| 036 | Photovoltaic DC channel 20 | R | [0,65535] | 0.1 A |  |
| 037 | Photovoltaic DC channel 21 | R | [0,65535] | 0.1 A |  |
| 038 | Photovoltaic DC channel 22 | R | [0,65535] | 0.1 A |  |
| 039 | Photovoltaic DC channel 23 | R | [0,65535] | 0.1 A |  |
| 040 | Photovoltaic DC channel 24 | R | [0,65535] | 0.1 A |  |
| 041 | Photovoltaic DC channel 25 | R | [0,65535] | 0.1 A |  |
| 042 | Photovoltaic DC channel 26 | R | [0,65535] | 0.1 A |  |
| 043 | Photovoltaic DC channel 27 | R | [0,65535] | 0.1 A |  |
| 044 | Photovoltaic DC channel 28 | R | [0,65535] | 0.1 A |  |
| 045 | Photovoltaic DC channel 29 | R | [0,65535] | 0.1 A |  |
| 046 | Photovoltaic DC channel 30 | R | [0,65535] | 0.1 A |  |
| 047 | Photovoltaic DC channel 31 | R | [0,65535] | 0.1 A |  |
| 048 | Photovoltaic DC channel 32 | R | [0,65535] | 0.1 A |  |
| 049 | Photovoltaic power channel 01 | R | [0,65535] | 0.1 W |  |
| 050 | Photovoltaic power channel 02 | R | [0,65535] | 0.1 W |  |
| 051 | Photovoltaic power channel 03 | R | [0,65535] | 0.1 W |  |
| 052 | Photovoltaic power channel 04 | R | [0,65535] | 0.1 W |  |
| 053 | Photovoltaic power channel 05 | R | [0,65535] | 0.1 W |  |
| 054 | Photovoltaic power channel 06 | R | [0,65535] | 0.1 W |  |
| 055 | Photovoltaic power channel 07 | R | [0,65535] | 0.1 W |  |
| 056 | Photovoltaic power channel 08 | R | [0,65535] | 0.1 W |  |
| 057 | Photovoltaic power channel 09 | R | [0,65535] | 0.1 W |  |
| 058 | Photovoltaic power channel 10 | R | [0,65535] | 0.1 W |  |
| 059 | Photovoltaic power channel 11 | R | [0,65535] | 0.1 W |  |
| 060 | Photovoltaic power channel 12 | R | [0,65535] | 0.1 W |  |
| 061 | Photovoltaic power channel 13 | R | [0,65535] | 0.1 W |  |
| 062 | Photovoltaic power channel 14 | R | [0,65535] | 0.1 W |  |
| 063 | Photovoltaic power channel 15 | R | [0,65535] | 0.1 W |  |
| 064 | Photovoltaic power channel 16 | R | [0,65535] | 0.1 W |  |
| 065 | Photovoltaic power channel 17 | R | [0,65535] | 0.1 W |  |
| 066 | Photovoltaic power channel 18 | R | [0,65535] | 0.1 W |  |
| 067 | Photovoltaic power channel 19 | R | [0,65535] | 0.1 W |  |
| 068 | Photovoltaic power channel 20 | R | [0,65535] | 0.1 W |  |
| 069 | Photovoltaic power channel 21 | R | [0,65535] | 0.1 W |  |
| 070 | Photovoltaic power channel 22 | R | [0,65535] | 0.1 W |  |
| 071 | Photovoltaic power channel 23 | R | [0,65535] | 0.1 W |  |
| 072 | Photovoltaic power channel 24 | R | [0,65535] | 0.1 W |  |
| 073 | Photovoltaic power channel 25 | R | [0,65535] | 0.1 W |  |
| 074 | Photovoltaic power channel 26 | R | [0,65535] | 0.1 W |  |
| 075 | Photovoltaic power channel 27 | R | [0,65535] | 0.1 W |  |
| 076 | Photovoltaic power channel 28 | R | [0,65535] | 0.1 W |  |
| 077 | Photovoltaic power channel 29 | R | [0,65535] | 0.1 W |  |
| 078 | Photovoltaic power channel 30 | R | [0,65535] | 0.1 W |  |
| 079 | Photovoltaic power channel 31 | R | [0,65535] | 0.1 W |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 080 | Photovoltaic power channel 32 | R | [0,65535] | 0.1 W |  |

* Reference flow chart
* Flowchart of the digital picker querying equipment data

**Digital picker side Equipment side**

System initialisation complete

System initialisation complete

Data polling based on device address

Waiting for orders

Send 0x03 function code command

Is the function code supported

No

Yes

0x0001 <= Number of registers <= 0x007D

whether

The starting address is legal and

Start address + number of registers Not out of bounds

Yes

Yes

Exception code = 01

Exception code = 03

No

Awaiting response

Get register data for encapsulation

Exception code = 02

Acquired and wrapped successfully

No

Code

Abnormal =04

Yes

Department

Send response

Responding to commands

Parsing commands and processing them accordingly

Is the device data polling cycle up?

No

Handling other matters

* Flowchart for setting up device data for the digital picker

**Digital picker side Equipment side**

System initialisation complete

System initialisation complete

Waiting for orders

Is there a device parameter setting operation

Yes

Send register write command

Send 0x10 function code command

Is the function code supported

whether

0x0001 <= Number of registers <= 0x007B

and

Byte count == Number of registers\*2

whether

The starting address is legal and

Start address + number of registers Not out of bounds

Awaiting response

No Yes

Exception code = 01

No

Exception code = 03

Registers are all writeable attributes

Exception code = 02

Yes

Performing register write operations

No

写操作成功 No

Code

Abnormal =04

Yes

Department

Send response

Responding to commands

Parsing commands and processing them accordingly

Handling other matters

* Appendix
* Safety type code table

|  |  |  |
| --- | --- | --- |
| Hexadecimal values | Information content | Remarks |
| 0x0000 | UL |  |
| 0x0001 | CE |  |
| 0x0002 | CQC |  |
| 0x0003 | TUV |  |
| 0x0004 | DK5940 |  |
| 0x0005 | AS4777 |  |
| 0x0006 | RD1663 |  |

* Operational status code table

|  |  |  |
| --- | --- | --- |
| Hexadecimal values | Information content | Remarks |
| 0x0000 | Standby |  |
| 0x0001 | Self-check |  |
| 0x0002 | Normal |  |
| 0x0003 | Alerts |  |
| 0x0004 | Fault |  |

* Alarm message code table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Word order** | **Bit0~ Bit15** | **Indicates the content of the message (1: its status is valid; 0: its status is invalid)** | | **Coding** |
| **English** | **Chinese** |
| 1 | Bit00 | DC\_Insulation\_Warning | Alarm for low DC insulation impedance | W01 |
| Bit01 | Comm\_LCD\_Lose\_Warning | LCD screen and control board communication disconnection alarm | W02 |
| Bit02 | LVRT\_Fault\_Warning | Low voltage ride-through fault alarms | W03 |
| Bit03 | Fan\_Fault\_Warning | Fan fault alarm | W04 |
| Bit04 | DC\_AirSwitchOpenWarning | DC main circuit breaker break alarm | W05 |
| Bit05 | Fault\_Feedback\_Warning | Total hardware failure for latching | W06 |
| Bit06 | AC\_Volt\_Unbalance\_Warning | AC three-phase voltage unbalance fault alarm | W07 |
| Bit07 | AC\_PLL\_Warning | AC phase-locked loop fault alarm | W08 |
| Bit08 | DC\_Thunder\_Warning | Lightning protection fault alarm on DC side | W09 |
| Bit09 | AC\_Thunder\_Warning | Lightning fault alarm on AC side | W10 |
| Bit10 | Smoke\_Detect\_Warning | Smoke alarm | W11 |
| Bit11 | Power\_Derate\_ Warning | Derated operation alarms | W12 |
| Bit12 | Reseverd | Reserved | W13 |
| Bit13 | Reseverd | Reserved | W14 |
| Bit14 | Reseverd | Reserved | W15 |
| Bit15 | Reseverd | Reserved | W16 |
| 2 | Bit00 | Reseverd | Reserved | W17 |
| Bit01 | Reseverd | Reserved | W18 |
| Bit02 | Reseverd | Reserved | W19 |
| Bit03 | Reseverd | Reserved | W20 |
| Bit04 | Reseverd | Reserved | W21 |
| Bit05 | Reseverd | Reserved | W22 |
| Bit06 | Reseverd | Reserved | W23 |
| Bit07 | Reseverd | Reserved | W24 |
| Bit08 | Reseverd | Reserved | W25 |
| Bit09 | Reseverd | Reserved | W26 |
| Bit10 | Reseverd | Reserved | W27 |
| Bit11 | Reseverd | Reserved | W28 |
| Bit12 | Reseverd | Reserved | W29 |
| Bit13 | Reseverd | Reserved | W30 |
| Bit14 | Reseverd | Reserved | W31 |
| Bit15 | Reseverd | Reserved | W32 |

* Fault message code table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Word order** | **Bit0~ Bit15** | **Indicates the content of the message (1: its status is valid; 0: its status is invalid)** | | **Coding** |
| **English** | **Chinese** |
| 1 | Bit00 | DC Inversed Failure | DC input polarity reversal fault | F01 |
| Bit01 | DC\_Insulation\_Failure | DC insulation impedance permanent fault | F02 |
| Bit02 | GFDI\_Failure | DC leakage current faults | F03 |
| Bit03 | GFDI\_Ground\_Failure | GFDI (grounded at one end of the battery) earth fault | F04 |
| Bit04 | EEPROM\_Read\_Failure | Read memory error | F05 |
| Bit05 | EEPROM\_Write\_Failure | Write memory error | F06 |
| Bit06 | GFDI\_Fuse\_Failure | GFDI fuse blown | F07 |
| Bit07 | GFDI\_Relay\_Failure | GFDI (grounded at one end of the battery) earth contact  Machine failure | F08 |
| Bit08 | IGBT\_Failure | IGBT caused by excessive IGBT conduction voltage drop  Fault | F09 |
| Bit09 | AuxPowerBoard\_Failure | Auxiliary switching power supply failure (auxiliary switching power supply)  (Over or under voltage of the main feedback DC voltage) | F10 |
| Bit10 | AC\_MainContactor\_Failure | AC main contactor error  (AC\_MainContactor\_Fault reports an error 3 times in a row) | F11 |
| Bit11 | AC\_SlaveContactor\_Failure | AC auxiliary contactor error  (AC\_SlaveContactor\_ Fault  (3 consecutive occurrences) | F12 |
| Bit12 | Reseverd | Reserved | F13 |
| Bit13 | DC\_OverCurr\_Failure | DC software overcurrent faults | F14 |
| Bit14 | AC\_OverCurr\_Failure | AC software overcurrent fault | F15 |
| Bit15 | GFCI\_Failure | GFCI (RCD) AC leakage current fault | F16 |
| 2 | Bit00 | Tz\_COM\_OC\_Fault | Three-phase current and overcurrent faults | F17 |
| Bit01 | Tz\_Ac\_OverCurr\_Fault | Hardware AC overcurrent faults | F18 |
| Bit02 | Tz\_Integ\_Fault | Hardware integration failures (all hardware failures combined)  (into) | F19 |
| Bit03 | Tz\_Dc\_OverCurr\_Fault | DC hardware overcurrent faults | F20 |
| Bit04 | Tz\_GFDI\_OC\_Fault | DC leakage current overcurrent fault | F21 |
| Bit05 | Tz\_EmergStop\_Fault | Emergency stop fault, the emergency stop button is pressed and the fault is reported  Fault, inverter off grid and disconnects direct circuit breaker | F22 |
| Bit06 | Tz\_GFCI\_OC\_Fault | AC leakage current momentary overcurrent fault | F23 |
| Bit07 | DC\_Insulation\_ Fault | DC insulation impedance faults | F24 |
| Bit08 | DC\_Feedback\_Fault | DC backfilling fault | F25 |
| Bit09 | BusUnbalance\_Fault | DC busbar unbalance fault | F26 |
| Bit10 | DC\_Insulation\_Fault | Incorrect isolation of the DC side | F27 |
| Bit11 | DCIOver\_M1\_Fault | Inverter 1 High direct flow failure | F28 |
| Bit12 | AC\_AirSwitch\_Fault | AC load switch faults | F29 |
| Bit13 | AC\_MainContactor\_Fault | AC main contactor failure | F30 |
| Bit14 | AC\_SlaveContactor\_Fault | AC auxiliary contactor failure | F31 |
| Bit15 | DCIOver\_M2\_Fault | Inverter 2 High direct flow failure | F32 |
| 3 | Bit00 | AC\_OverCurr\_Fault | High AC current (software quoted AC current)  (Overcurrent fault, 1 frequency cycle to report) | F33 |
| Bit01 | AC\_Overload\_Fault | AC overload | F34 |
| Bit02 | AC\_NoUtility\_Fault | No mains error on the AC side | F35 |
| Bit03 | AC\_GridPhaseSeque\_Fault | Incorrect phase sequence of the AC grid | F36 |

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|  | Bit04 | AC\_Volt\_Unbalance\_Fault | AC three-phase voltage unbalance fault | F37 |  |
| Bit05 | AC\_Curr\_Unbalance\_Fault | AC three-phase current unbalance fault | F38 |
| Bit06 | INT\_AC\_OverCurr\_Fault | AC overcurrent faults (software reported overcurrent faults)  (obstacle, reported in one switching cycle) | F39 |
| Bit07 | INT\_DC\_OverCurr\_Fault | DC overcurrent faults | F40 |
| Bit08 | AC\_WU\_OverVolt\_Fault | High AC WU line voltage | F41 |
| Bit09 | AC\_WU\_UnderVolt\_Fault | AC WU line voltage too low | F42 |
| Bit10 | AC\_VW\_OverVolt\_Fault | AC VW line voltage too high | F43 |
| Bit11 | AC\_VW\_UnderVolt\_Fault | AC VW line voltage too low | F44 |
| Bit12 | AC\_UV\_OverVolt\_Fault | High AC UV line voltage | F45 |
| Bit13 | AC\_UV\_UnderVolt\_Fault | AC UV line voltage too low | F46 |
| Bit14 | AC\_OverFreq\_Fault | AC frequency too high fault | F47 |
| Bit15 | AC\_UnderFreq\_Fault | AC frequency too low fault | F48 |
| 4 | Bit00 | AC\_U\_GridCurr\_DcHigh\_Fault | High DC component of U-phase grid-connected current | F49 |
| Bit01 | AC\_V\_GridCurr\_DcHigh\_Fault | High DC component of V-phase grid-connected current | F50 |
| Bit02 | AC\_W\_GridCurr\_DcHigh\_Fault | High DC component of W-phase grid-connected current | F51 |
| Bit03 | AC\_A\_InductCurr\_DcHigh\_Fault | AC inductor A phase current DC component too high | F52 |
| Bit04 | AC\_B\_InductCurr\_DcHigh\_Fault | AC inductor B phase current DC component too high | F53 |
| Bit05 | AC\_C\_InductCurr\_DcHigh\_Fault | AC inductance C phase current DC component too high | F54 |
| Bit06 | DC\_VoltHigh\_Fault | DC busbar over-voltage fault | F55 |
| Bit07 | DC\_VoltLow\_Fault | DC bus voltage too low fault | F56 |
| Bit08 | AC\_BackFeed\_Fault | AC backfilling fault | F57 |
| Bit09 | AC\_U\_GridCurr\_High\_Fault | AC grid U current overcurrent fault | F58 |
| Bit10 | AC\_V\_GridCurr\_High\_Fault | AC grid V Current overcurrent fault | F59 |
| Bit11 | AC\_W\_GridCurr\_High\_Fault | AC grid W overcurrent fault | F60 |
| Bit12 | AC\_A\_InductCurr\_High\_Fault | Reactor A phase current overcurrent fault | F61 |
| Bit13 | AC\_B\_InductCurr\_High\_Fault | Reactor B phase current overcurrent fault | F62 |
| Bit14 | AC\_C\_InductCurr\_High\_Fault | Reactor C phase current overcurrent fault | F63 |
| Bit15 | Heatsink\_LowTemp\_Fault | IGBT heatsink temperature too low fault | F64 |

* Geographical information code table

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| --- | --- | --- |
| Coded values (decimal) | Information content | Remarks |
| 0 | Available worldwide | Default value |
| 1 | China General |  |
| 2 |  |  |
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| 11 |  |  |
| 12 |  |  |
| 13 |  |  |
| 14 |  |  |
| 15 |  |  |

* Reference material
* GB-T19582.1-2008\_Network specification for industrial automation based on Modbus protocol\_Part 1.pdf
* GB-T19582.2-2008\_Network Specification for Industrial Automation based on Modbus Protocol\_Part 2.pdf
* GB-T19582.3-2008\_Modbus Protocol-based Industrial Automation Network Specification\_Part 3.pdf
* Eybond Modbus TCP Protocol