

# ModBus Protocol

**S B G series**

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# Preface

This protocol specifies the communication format and data format for the Modbus communication of export residential air conditioners.

This protocol is applicable to Export Residential Air Conditioners.

Please pay attention to the following 3 points before developing the BMS software:

1. Controllers or wired controllers for the IDUs of this series have been integrated with MODBUS interface, so there is no need to connect communication modules. In this context, communication module indicates the module that is integrated by the controllers and the wired controllers.

2. Make sure you have read the precautions before developing the BMS interface of each unit, e.g. section 5.1.2—Precautions before the Development of the BMS Interface for Export Residential Air Conditioners.

3. Please contact Aermec to confirm the compatibility of the BMS system. Notice: This product is subject to change without prior notice.

## I. Terms and Definitions

### 1.1 Modbus communication

Modbus is a protocol used for industrial communication and a distributed control system. Modbus network is a master-slave network, which allows the communication between one master unit and one or multiple slave units to realize data interchange. The Modbus communication is realized in a request-response way, that is, each request sent by the master unit is corresponding to a response replied by the slave unit.

### 1.2 ASCII Mode

Under this mode, as for the communication via the Modbus, eight bits in one piece of information can be transmitted as two ASCII characters.

### 1.3 RTU Mode

Under this mode, eight bits can be divided into two 4-bit hexadecimal characters. The advantage of the RTU mode is that, with the same baud rate the transmitted character density is higher than that in the ASCII mode. Each piece of information should be transmitted continuously.

### 1.4 Master Unit

It indicates the device which sends out the request to Modbus, like a PC.

## 1.5 Slave Unit

It indicates the device which needs Modbus communication interface and is capable of responding to the request sent by the master unit, like a communication module, which is taken as an example in this protocol.

## 1.6 Coil

It is expressed by one bit, like the switch bit, failure bit, etc. The coil is a universal expression of the Modbus protocol and actually it is a one-bit data value, namely Boolean, switching value.

## 1.7 Register

It is expressed by two bytes (16 bits), like temperature, mode, etc. The register is a universal expression of the Modbus protocol and actually it is a word (16 bits), or an analog value.

## 1.8 Device Address

It indicates the address of the Modbus communication module, through which the master unit can identify each communication module in the network. Address range: 1~255. Address 0 is the address of broadcast (it can be received by all communication modules).

## 1.9 Broadcast

When the master unit sends out a control frame, then all slave units in the network can receive it and then all performs this control action (but no reply is given). The device address for the broadcast frame is 0.

## 1.10 Function Code

It is used to identify the function of the communication frame. See the following table for the function codes covered in this protocol.

Table 1 Function Code

| Description                  | Function Code |
|------------------------------|---------------|
| Read coils (read bit)        | 0x01          |
| Read registers (read word)   | 0x03          |
| Write coils (write bit)      | 0x0f          |
| Write registers (write word) | 0x10          |

## 1.11 Starting Address

It indicates the starting address of the register (coil: bit address; register: word address). The data translation starts from the high-order eight bits to the low-order eight bits.

### 1.12 Data Size

It indicates the counting number of to-be-operated data starting from the starting address (coil: bit count; register: word count). The data translation starts from the high-order eight bits to the low-order eight bits.

### 1.13 Byte Count

It indicates the count number of effective bytes during the data transmission.

### 1.14 Effective Data

It indicates the control data, status data, etc.

### 1.15 Aalarm Code

It indicates the error type which is detected by the communication module when the master unit is sending the request frame.

### 1.16 CRC

It indicates the cyclic redundancy code consisting of two bytes. The data translation starts from the low-order eight bits to the high-order eight bits. See Annex A for more details about its calculation.

### 1.17 Request Frame

It is the request sent by the master unit to the communication module.

### 1.18 Response Frame

It is the response replied by the communication module to the request frame sent by the master unit.

### 1.19 Communication Frame

It is the collection of continuously transmitted bytes during the communication.

### 1.20 BMS

Building management system

## II. Brief Introduction of the BMS System

The Modbus monitoring system of export residential air conditioners is capable of controlling up to 255 sets of units at the same time.

The interface RS485 of Modbus communication protocol, provided by the long-distance monitoring system, can be directly connected with the BMS or Aermec monitoring system, that is, can control up to 255 units and display their running status at the same time. The control function of the BMS/PC is equal to that of the unit itself. In other words, BMS/PC and units can both control the functions of units at the same time. However, the command sent later takes the priority.

## III. Network Topology

## 3.1 General

The network topology is as shown in Fig.1. The whole monitoring system consists of two communication networks: unit's internal network and Modbus network. The IDU or the wired controller is with MODBUS interface. It needs to set the address for each indoor unit or wired controller to make the communication data of these two networks interchangeable.

There are at most 255 communication modules in one monitoring system, that is, only 255 indoor units can be connected.

When there are more than 255 units, a new network can be established through another port which is also capable of connecting 255 communication modules.

## 3.2 Topological Structure

### 3.2.1 Topological Structure Consisting of Max. 255

#### Communication Modules

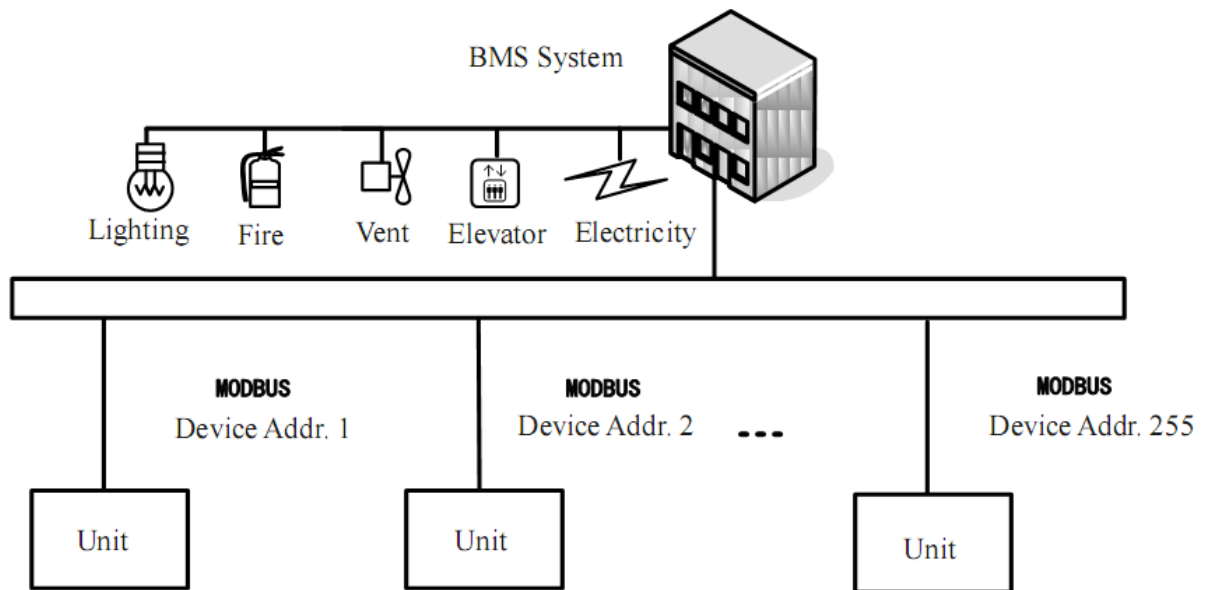


Fig.1 Topological Structure

### 3.2.2 Topological Structure Consisting of Min. 255

#### Communication Modules

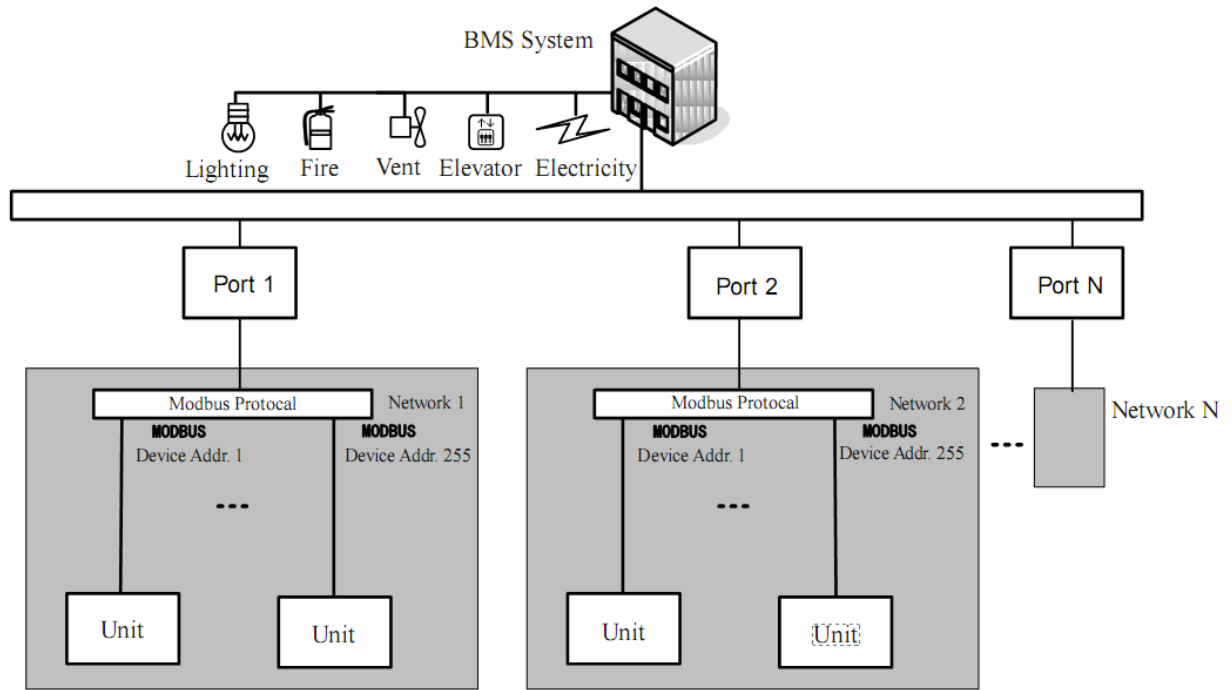


Fig.2 Topological Structure Consisting of Min. 255 Communication Modules

## IV. Modbus Protocol Format

### 4.1 General

Modbus has actually become an industrial communication standard because it is not only fully opened and used widely but also simple and can be debugged flexibly. Besides, as for the communication of multiple units, Modbus can be developed fast and also can be conveniently connected with devices which support this protocol. There are two communication modes: RTU and ASCII. The former one is adopted for the BMS interface.

### 4.2 Protocol Interface

The protocol interface is the Modbus RTU protocol.

### 4.3 Hardware Interface

(1)Communication Interface: RS485

(2)Communication Mode: baud rate: 9600 bit/s (In some special case, other baud rate can be selected but the communication mechanism should be in accord with this protocol.)

Start Bit: 1

Data Bit: 8

Check Bit: None

Stop Bit: 1

## 4.4 Universal Communication Frame Format of Modbus under RTU Mode

| Start Time Interval | Addr. Code | Function Code | Data Area | CRC     | Stop Time Interval |
|---------------------|------------|---------------|-----------|---------|--------------------|
| T1-T2-T3-T4         | 1 Byte     | 1 Byte        | n Bytes   | 2 Bytes | T1-T2-T3-T4        |

Under the RTU mode, there is at least 3.5ms dead time before the data transmission, which can be figured through the adopted baud rate (like T1-T2-T3-T4 in the table above) and there is another 3.5ms dead time after the transmission of the last character. After that, another set of data can be transmitted.

The whole set of data should be transmitted continuously. If there is a pause more than 1.5ms during the transmission, the receiver will jump to the transmission of the next set of data.

If the dead time is less than 3.5ms, the transmission would fail as the CRC for the information combination is ineffective.

## 4.5 MODBUS Standard Protocol Format

### 4.5.1 Coil (Bit)

Table 2: Coil Data

| Addr.  | Corresponding Byte | Values |
|--------|--------------------|--------|
| Bit 0  | Byte0.0            | 1      |
| Bit 1  | Byte0.1            | 0      |
| Bit 2  | Byte0.2            | 1      |
| Bit 3  | Byte0.3            | 0      |
| Bit 4  | Byte0.4            | 1      |
| Bit 5  | Byte0.5            | 0      |
| Bit 6  | Byte0.6            | 1      |
| Bit 7  | Byte0.7            | 0      |
| Bit 8  | Byte1.0            | 1      |
| Bit 9  | Byte1.1            | 0      |
| Bit 10 | Byte1.2            | 1      |
| Bit 11 | Byte1.3            | 0      |
| Bit 12 | Byte1.4            | 1      |
| Bit 13 | Byte1.5            | 0      |
| Bit 14 | Byte1.6            | 1      |
| Bit 15 | Byte1.7            | 0      |
| .....  | .....              | .....  |

1. “Coil” indicates the data of some flag bit or failure bit, etc.
2. The unit of data is bit and each bit has a corresponding address.
3. The data bit exists in the byte of the communication frame and each byte is composed of eight bits. The high-order byte is corresponding to the high-order bit

whereas the low-order byte is corresponding to the low-order bit. See table 2 for more details.

4. The master unit can operate one bit among the communication data or multiple bits at the same time.

5. The bit count which the master unit can read or transmit is less than  $\text{Byte} \times 8$ . The ineffective data bit of the last byte should be cleared when the effective data of the communication frame is transmitted or read. For instance, when nine bits (the value of each is 1) are read or transmitted, then two bytes are needed. The first one is “1111 1111” and the second one is “0000 0001”. For the last byte, the ineffective bits “0” should be cleared.

## 4.5.2 Register (Word, 16 bit)

Table 3: Registers Data

| Addr.  | Corresponding Byte | Values |
|--------|--------------------|--------|
| Word 0 | Byte 0             | AA 55  |
|        | Byte 1             |        |
| Word 1 | Byte 2             | AA 55  |
|        | Byte 3             |        |
| Word 2 | Byte 4             | 55 AA  |
|        | Byte 5             |        |
| .....  | .....              | .....  |
|        | .....              |        |

1. The unit of the register is “word” which has a corresponding address starting from 0.

2. When the master unit reads a word, it needs to read two bytes from the high-order eight bits to the low-order eight bits.

3. When the master unit transmits or reads the request frame, it can transmit or read one or multiple continuous words in the data list.

## 4.5.3 Read Coils (Read bit)

Note: It can read the coil data but not support the broadcast.

Function Code: 0x01

Table 4: Request Frame

| Device Addr. | Function Code | Starting Addr. | Data Size | CRC     |
|--------------|---------------|----------------|-----------|---------|
| 1 Byte       | 1 Byte        | 2 Bytes        | 2 Bytes   | 2 Bytes |

Table 5: Corresponding Frame

| Device Addr. | Function Code | Byte Count | Effective Data | CRC     |
|--------------|---------------|------------|----------------|---------|
| 1 Byte       | 1 Byte        | 1 Byte     | n Bytes        | 2 Bytes |

Starting Address: It is the starting place where to read a series of bits.

Data Size: it indicates the count number of bits.

For example: Read ten bits from the coil 5 of the device 10 (see table 2 for the coil data), as follows:

Request frame: 0A (device address) 01 (function code) 00 05 (starting address) 00 0A (data size) AD 77 (CRC)

Response Frame: 0A (device address) 01 (function code) 02 (byte count) AA 02 (effective data) E3 5C (CRC)

The last byte is “0000 0010”, among which the ineffective bits “0” should be cleared.

#### 4.5.4 Write Coils (Write bit)

Note: The master unit writes coil data into the communication module and also supports the broadcast.

Function Code: 0x0F

Table 6: Request Frame

| Device Addr. | Function Code | Starting Addr. | Data Size | Byte Count | Effective Data | CRC     |
|--------------|---------------|----------------|-----------|------------|----------------|---------|
| 1 Byte       | 1 Byte        | 2 Bytes        | 2 Bytes   | 1 Byte     | n Bytes        | 2 Bytes |

Table 7: Response Frame

| Device Addr.                                                                                                              | Function Code | Starting Addr. | Data Size | CRC     |
|---------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-----------|---------|
| 1 Byte                                                                                                                    | 1 Byte        | 2 Bytes        | 2 Bytes   | 2 Bytes |
| Note: The response frame has the same device address, function code, starting address and data size as the request frame. |               |                |           |         |

For example: Set eleven consecutive bits to “1” from device 10 and starting at the address 6, as follows:

Request Frame: 0A (device address) 0F (function code) 00 06 (starting address) 00 0B (data size) 02 (byte count) FF 07 (effective data) 97 A0 (CRC)

Response Frame: 0A (device address) 0F (function code) 00 06 (starting address) 00 0B (data size) F5 76 (CRC)

The last byte is “0000 0111”, among which the ineffective bits “0” should be cleared.

## 4.5.5 Read Registers (Read word)

Note: Read the register data but do not support the broadcast.

Function Code: 0x03

Table 8: Request Frame

| Device Addr. | Function Code | Starting Addr. | Data Size | CRC     |
|--------------|---------------|----------------|-----------|---------|
| 1 Byte       | 1 Byte        | 2 Bytes        | 2 Bytes   | 2 Bytes |

Table 9: Response Frame

| Device Addr. | Function Code | Byte Count | Effective Data | CRC     |
|--------------|---------------|------------|----------------|---------|
| 1 Byte       | 1 Byte        | 1 Byte     | n Bytes        | 2 Bytes |

Starting address: It indicates the starting address to read the data block.

Data size: It indicates the count number of words with the maximum of 127 each time.

For example: Read two continuous words (see table 3 for the registers data) from the device 10 and starting at the address 1, as follow:

Request Frame: 0A (device address) 03 (function code) 00 01 (starting address) 00 02 (data size) 94 B0 (CRC)

Response Frame: 0A (device address) 03 (function code) 04 (byte count) AA 55 55 AA (effective data) CE 14 (CRC)

## 4.5.6 Write Registers (Write word)

Note: Write control data from the master unit into the register and support broadcast.

Function Code: 0x10

Table 10: Request Frame

| Device Addr. | Function Code | Starting Addr. | Data Size | Byte Count | Effective Data | CRC     |
|--------------|---------------|----------------|-----------|------------|----------------|---------|
| 1 Byte       | 1 Byte        | 2 Bytes        | 2 Bytes   | 1 Byte     | n Bytes        | 2 Bytes |

Table 11: Response Frame

| Device Addr.                                                                                                              | Function Code | Starting Addr. | Data Size | CRC     |
|---------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-----------|---------|
| 1 Byte                                                                                                                    | 1 Byte        | 2 Bytes        | 2 Bytes   | 2 Bytes |
| Note: The response frame has the same device address, function code, starting address and data size as the request frame. |               |                |           |         |

For example: write three words (0x12, 0x23, 0x34) from the device 10 and starting at the address 2, as follow:

Request Frame: 0A (device address) 10 (function code) 00 02 (starting address) 00 03 (data size) 06 (byte count) 00 12 00 23 00 34 (effective data) 15 DF (CRC)

Response Frame: 0A (device address) 10 (function code) 00 02 (starting address) 00 03 (data size) 20 B3 (CRC)

## 4.5.7 Alarm Response

Note: The master unit sends out a request frame in order to receive a normal response, but when the communication module detects a failure, an alarm response will be sent back.

Function code: Set the highest-order bit to “1”, which is the value figured through the operation of the request frame’s function code and 0x80 (The function code of normal response will be back as it is).

Communication format of the alarm response frame:

Table12: Alarm Response Frame

| Device Addr. | Function Code | Alarm Code | CRC     |
|--------------|---------------|------------|---------|
| 1 Byte       | 1 Byte        | 1 Bytes    | 2 Bytes |

Description of the alarm codes:

Table 13: Alarm Codes

| Alarm Code | Name         | Description                                                 |
|------------|--------------|-------------------------------------------------------------|
| 0x03       | Illegal data | The transmitted data is incorrect or beyond the data range. |

For example: The master unit is to read 128 words from the device 10 and starting at the address 0. If it is out of the readable range of Modbus, alarm frame will be sent back as follows:

Request frame: 0A (device address) 03 (function code) 00 00 (starting address) 00 80 (data size) 45 11 (CRC)

Response frame: 0A (device address) 83 (device address) 03 (alarm code) 70 F3 (CRC)

# **V. Communication protocol for export residential air conditioners**

## **5.1 General**

Export residential air conditioner's indoor unit and wire controller is with BMS interface. As it has Modbus protocol interface, there is no need to connect the external communication modules. However, it's necessary to set the address for each indoor unit or wired controller. The long-distance monitoring system for export residential air conditioners can be used to monitor Gree's export residential air conditioners remotely or be incorporated into user's BMS system. By monitoring the PC or BMS system, users can realize a centralized management and control on up to 255 sets of export residential air conditioners. It is a highly efficient tool for the management of an intelligent air conditioning system in modern buildings.

Through this interface, it can not only realize the long-distance monitoring to units, including units' running temperature, compressor status and error status, but also can enable units' settings remotely, like temperature setting, mode setting, on/off setting, mode shield setting, on/off shield setting, etc.

In the protocol, "R" indicates "read only" and "W/R" indicates "write and read".

## **5.2 Precautions before the development of the BMS interface for export residential air conditioners**

(1)Cooling Only Unit: Heating instruction is invalid. It is recommended that the monitoring software can tell this operation is invalid.

(2)Energy Saving Solution:

Cooling mode: When the setting for energy saving under cooling is active, the temperature set by long-distance monitoring must be higher than the temperature lower limit for energy saving, otherwise units will not response to the command. It is suggested that the BMS software can tell the setting fails.

Heating mode: When the setting for energy saving under heating is active, the temperature set by long-distance monitoring must be lower than the temperature upper limit for energy saving, otherwise units will not response to the command. It is suggested that the BMS software can tell the setting fails.

(3)When the BMS system needs to cancel or set one of the two flag bits of energy saving, When the BMS system needs to cancel or set one of the two flag bits of energy saving, the two flag bits need to be cancelled or set simultaneously.

(4)When unit is in fan mode or auto mode, sleep setting will be invalid.

(5)If the connected unit is not the one whose temperature is adjustable under auto mode, when unit is in auto mode, the setting of long-distance temperature shield will be invalid.

(6)All data sent by the BMS system to the communication module should be verified if it is effective.

(7)If the connected unit is the one whose temperature is adjustable under auto mode, the temperature can be adjusted under the auto mode.

### **5.3 Definition of Effective Data**

The data for the Modbus communication protocol can be divided into two types: switching value and register. The register indicates the values of temperature, valves and other continuous or multi-mode values. Switching value indicates the value which has only two status, like the temperature sensor error (with only two status: abnormal or normal).

1. Data and Address Distribution of the Analog Values: (Word 0~Word X)

| Addr.   | Access Type<br>(R-read only,<br>W/R-write /read) | Data Meaning  | Range                                                                                                                                                 | Accuracy | Unit | Data Type<br>(actual value) | Pay special attention before development<br>(to the data marked with ★) | Remarks        |
|---------|--------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----------------------------|-------------------------------------------------------------------------|----------------|
| Word 0  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         | Broadcast data |
| Word 1  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 2  | W/R                                              | Unit On/Off   | 0xAA: Unit on;<br>0x55: Unit off                                                                                                                      | /        | /    | Unsigned, integer type      |                                                                         |                |
| Word 3  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 4  | R                                                | Ambient temp  | Transmission value=actual value,<br>actual value:<br>transmission value=temp value×10                                                                 | 0.1      | ℃    | Signed, interger type       |                                                                         |                |
| Word 5  | R                                                | IDU Addr.     | Transmission value=actual value,<br>address range is 1-255                                                                                            | 1        | /    | Unsigned, integer type      |                                                                         |                |
| Word 6  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 7  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 8  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 9  | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 10 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 11 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 12 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 13 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 14 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 15 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 16 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 17 | W/R                                              | Set mode      | Transmission value=actual value,<br>actual value:<br>001: cooling;<br>010: heating;<br>011: drying;<br>100: fan only;<br>101: auto mode.              | /        | /    | Unsigned, integer type      | ★(1)                                                                    |                |
| Word 18 | R                                                | Reserved      | /                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 19 | W/R                                              | Set fan speed | Transmission value=actual value,<br>actual value:<br>0: auto;<br>1: speed 1;<br>2: speed 2;<br>3: speed 3;<br>4: speed 4;<br>5: speed 5;<br>6: turbo. | /        | /    | Unsigned, integer type      |                                                                         |                |

| Addr.   | Access Type<br>(R-read only,<br>W/R-write /read) | Data Meaning           | Range                                                                                                                                                                                                                                                                                                                                 | Accuracy | Unit | Data Type<br>(actual value) | Pay special attention before development<br>(to the data marked with ★) | Remarks        |
|---------|--------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----------------------------|-------------------------------------------------------------------------|----------------|
| Word 20 | W/R                                              | Set temp               | Transmission value=actual value, actual value:16-30                                                                                                                                                                                                                                                                                   | 1        | ℃    | Unsigned, integer type      | ★(7)                                                                    | Broadcast data |
| Word 21 | R                                                | Reserved               | /                                                                                                                                                                                                                                                                                                                                     | /        | /    | /                           |                                                                         |                |
| Word 22 | W/R                                              | Up & down swing        | Transmission value=actual value, actual value:<br>0000---off;<br>0001---15 air swing;<br>0010--- 1 position;<br>0011--- 2 position;<br>0100--- 3 position;<br>0101--- 4 position;<br>0110--- 5 position;<br>0111--- 35 air swing;<br>1000--- 25 air swing;<br>1001--- 24 air swing;<br>1010--- 14 air swing;<br>1011--- 13 air swing. | /        | /    | Unsigned, integer type      |                                                                         |                |
| Word 23 | W/R                                              | Left & right swing     | Transmission value=actual value, actual value:<br>0000---off (default value after power on);<br>0001---air swing at same direction;<br>0010---1 position;<br>0011---2 position;<br>0100---3 position;<br>0101---4 position;<br>0110---5 position;<br>1100---15 position;<br>1101---air swing at opposite direction.                   | /        | /    | Unsigned, integer type      |                                                                         |                |
| Word 24 | W/R                                              | Fresh air valve status | Transmission value=actual value, actual value: 0~10, 0: indicates fresh air valve, 10 modes of fresh air                                                                                                                                                                                                                              | /        | /    | Unsigned, integer type      |                                                                         |                |
| Word 25 | W/R                                              | Sleep mode             | Transmission value=actual value, actual value:<br>0: no sleep mode;<br>1: sleep mode 1;<br>2: sleep mode 2;<br>3: sleep mode 3                                                                                                                                                                                                        | /        | /    | Unsigned, integer type      | ★(4)                                                                    |                |
| Word 26 | W/R                                              | Reserved               | /                                                                                                                                                                                                                                                                                                                                     | /        | /    | /                           |                                                                         |                |

| Addr.   | Acess Type<br>(R-read only,<br>W/R-write /read) | Data Meaning                                     | Range                                                                                                                                                                                                                                                                                                                                                                                                                  | Accuracy | Unit | Data Type<br>(actual value) | Pay special attention before development<br>(to the data marked with ★) | Remarks        |
|---------|-------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----------------------------|-------------------------------------------------------------------------|----------------|
| Word 27 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         | Broadcast data |
| Word 28 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 29 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 30 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 31 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 32 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 33 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 34 | W/R                                             | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 35 | W/R                                             | Temp lower limit for energy saving under cooling | Transmission value=actual value, actual value: 16~30                                                                                                                                                                                                                                                                                                                                                                   | 1        | ℃    | Unsigned, integer type      | ★(2)                                                                    |                |
| Word 36 | W/R                                             | Temp upper limit for energy saving under heating | Transmission value=actual value, actual value: 16~30                                                                                                                                                                                                                                                                                                                                                                   | 1        | ℃    | Unsigned, integer type      | ★(2)                                                                    |                |
| Word 37 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 38 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 39 | R                                               | Selection of ambient temp sensor                 | Transmission value=actual value, actual value:<br>001: air return temp sensor for indoor ambient temp.<br>010: wired controller temp sensor for indoor ambient temp.<br>011: air return temp sensor for cooling, drying and fan mode, wired controller temp sensor for heating and auto mode.<br>100: wired controller temp sensor for cooling, drying and fan mode, air return temp sensor for heating and auto mode. | /        | /    | Unsigned, integer type      |                                                                         |                |
| Word 40 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 41 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 42 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |
| Word 43 | R                                               | Reserved                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                      | /        | /    | /                           |                                                                         |                |

| Addr.   | Acess Type<br>(R-read<br>only,<br>W/R-write<br>/read) | Data<br>Meaning            | Range                                                                   | Accuracy | Unit | Data<br>Type<br>(actual<br>value) | Pay special<br>attention<br>before<br>development<br>(to the data<br>marked with<br>★) | Remarks                 |
|---------|-------------------------------------------------------|----------------------------|-------------------------------------------------------------------------|----------|------|-----------------------------------|----------------------------------------------------------------------------------------|-------------------------|
| Word 44 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        | Broadcast<br>data       |
| Word 45 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 46 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 47 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        | ODU<br>response<br>data |
| Word 48 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 49 | R                                                     | Outdoor<br>ambient<br>temp | Transmission<br>value=actual value,<br>actual value: -100--155          | 1        | ℃    | Signed,<br>interger<br>type       |                                                                                        |                         |
| Word 50 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 51 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 52 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 53 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 54 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 55 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 56 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 57 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 58 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 59 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 60 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 61 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 62 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 63 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 64 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 65 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 66 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 67 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 68 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 69 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 70 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 71 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 72 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 73 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 74 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 75 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 76 | R                                                     | Reserved                   | /                                                                       | /        | /    | /                                 |                                                                                        |                         |
| Word 77 | R                                                     | DRED<br>function           | 0: no DRED function;<br>1:DRED1 mode;<br>2:DRED2 mode;<br>3:DRED3 mode. | /        | /    | Unsigned,<br>integer<br>type      |                                                                                        |                         |

| Addr.   | Acess Type<br>(R-read only,<br>W/R-write /read) | Data<br>Meaning                                    | Range                                                                                   | Accuracy | Unit | Data Type<br>(actual<br>value) | Pay special<br>attention<br>before<br>development<br>(to the data<br>marked with<br>★) | Remarks                       |
|---------|-------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------|----------|------|--------------------------------|----------------------------------------------------------------------------------------|-------------------------------|
| Word 78 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        | ODU<br>response data          |
| Word 79 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 80 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 81 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 82 | R                                               | Ambient<br>temp at<br>the port<br>of air<br>return | Transmission<br>value=actual value,<br>actual value:<br>transmission=(temp<br>value)×10 | 0.1      | ℃    | Signed,<br>interger type       |                                                                                        | IDU<br>identification<br>data |
| Word 83 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 84 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 85 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 86 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 87 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 88 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 89 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 90 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 91 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |
| Word 92 | R                                               | Reserved                                           | /                                                                                       | /        | /    | /                              |                                                                                        |                               |

## 2. Data and Address Distribution of Switching Values: (Bit 0~Bit X)

| Addr. | Access Type<br>(R-read only,<br>W/R-write/<br>read) | Addr.<br>Bit | Data Meaning                                                      | Range                                                                                                                                              | Parameter<br>Type   | Pay special<br>attention before<br>development<br>(to the data<br>marked with<br>★) | Remarks           |
|-------|-----------------------------------------------------|--------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------|-------------------|
| Byte0 | R                                                   | Bit0         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit1         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit2         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit3         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit4         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit5         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit6         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
| Byte1 | R                                                   | Bit7         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit8         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     | Broadcast<br>data |
|       | R                                                   | Bit9         | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit10        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit11        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit12        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit13        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit14        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit15        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
| Byte2 | R                                                   | Bit16        | Reserved                                                          |                                                                                                                                                    |                     |                                                                                     |                   |
|       | W/R                                                 | Bit17        | Remote lock                                                       | 0 (no above lock or it is<br>unlocked) ;<br>1 (current status is<br>locked by long-distance<br>monitoring or the<br>household charging<br>system); | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit18        | Remote temp shield                                                | 0: without shield ;<br>1: with shield                                                                                                              | Status<br>parameter | ★ (5)                                                                               |                   |
|       | W/R                                                 | Bit19        | Remote mode<br>shield                                             | 0: without shield ;<br>1: with shield                                                                                                              | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit20        | Remote On/Off<br>shield                                           | 0: without shield ;<br>1: with shield                                                                                                              | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit21        | Remote energy<br>saving shield                                    | 0: without shield ;<br>1: with shield                                                                                                              | Status<br>parameter |                                                                                     |                   |
|       | R                                                   | Bit22        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
|       | R                                                   | Bit23        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |
| Byte3 | W/R                                                 | Bit24        | Absence mode<br>(8℃ heating)                                      | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit25        | Healthy function                                                  | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit26        | Comfortable and<br>energy saving:<br>I-Demand or<br>Energy-saving | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit27        | Turbo                                                             | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit28        | E-heating<br>permission mark                                      | 0: permit e-heating on<br>1: not permit e-heating<br>on                                                                                            | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit29        | X-fan                                                             | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit30        | Silent                                                            | 0: off;<br>1: on                                                                                                                                   | Status<br>parameter |                                                                                     |                   |
|       | W/R                                                 | Bit31        | Reserved                                                          | /                                                                                                                                                  | /                   |                                                                                     |                   |

| Addr. | Access Type<br>(R-read only,<br>W/R-write/<br>read) | Addr.<br>Bit | Data Meaning                                                     | Range                                                                                                                                        | Parameter Type   | Pay special attention before development (to the data marked with ★) | Remarks        |
|-------|-----------------------------------------------------|--------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------|----------------|
| Byte4 | W/R                                                 | Bit32        | Energy saving under cooling is active                            | 0: off;<br>1: on                                                                                                                             | Status parameter | ★(3)                                                                 | Broadcast data |
|       | W/R                                                 | Bit33        | Energy saving under heating is active                            | 0: off;<br>1: on                                                                                                                             | Status parameter | ★(3)                                                                 |                |
|       | W/R                                                 | Bit34        | Buttons lock (childlock) status                                  | 0: off;<br>1: on                                                                                                                             | Status parameter |                                                                      |                |
|       | W/R                                                 | Bit35        | On/Off memoring status                                           | 0: memorize,<br>1: not memorize                                                                                                              | Status parameter |                                                                      |                |
|       | W/R                                                 | Bit36        | °C/°F flag bit                                                   | 0: °C;<br>1: °F                                                                                                                              | Status parameter |                                                                      |                |
|       | R                                                   | Bit37        | 1°F flag bit                                                     | 0: no;<br>1: yes                                                                                                                             | Status parameter |                                                                      |                |
|       | R                                                   | Bit38        | 1°F flag bit of temp lower limit for energy saving under cooling | 0: no;<br>1: yes                                                                                                                             | Status parameter |                                                                      |                |
|       | R                                                   | Bit39        | 1°F flag bit of temp upper limit for energy saving under heating | 0: no;<br>1: yes                                                                                                                             | Status parameter |                                                                      |                |
| Byte5 | R                                                   | Bit40        | Timer status                                                     | 0: without timer;<br>1: with timer                                                                                                           | Status parameter |                                                                      |                |
|       | R                                                   | Bit41        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit42        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit43        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit44        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit45        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit46        | Gate control system is provided or not?                          | 0: no;<br>1: yes                                                                                                                             | Status parameter |                                                                      |                |
|       | R                                                   | Bit47        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
| Byte6 | R                                                   | Bit48        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit49        | Timer On flag                                                    | 0: not active;<br>1: active                                                                                                                  | Status parameter |                                                                      |                |
|       | R                                                   | Bit50        | Timer Off flag                                                   | 0: not active;<br>1: active                                                                                                                  | Status parameter |                                                                      |                |
|       | R                                                   | Bit51        | Indoor ambient temperature in current mode                       | 0: indoor ambient temperature is the air return ambient temperature;<br>1: indoor ambient temperature is the temperature at wired controller | Status parameter |                                                                      |                |
|       | R                                                   | Bit52        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit53        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit54        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |
|       | R                                                   | Bit55        | Reserved                                                         | /                                                                                                                                            | /                |                                                                      |                |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write/read) | Addr.<br>Bit | Data Meaning                                   | Range                                                                                            | Parameter<br>Type    | Pay special<br>attention<br>before<br>development<br>(to the data<br>marked with<br>★) | Remarks                     |
|--------|-------------------------------------------------|--------------|------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------|-----------------------------|
| Byte7  | R                                               | Bit56        | Reserved                                       | /                                                                                                | /                    |                                                                                        | Broadcast<br>data           |
|        | R                                               | Bit57        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit58        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit59        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit60        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit61        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit62        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit63        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
| Byte8  | R                                               | Bit64        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit65        | Wired controller temp<br>sensor error          | 0: normal;<br>1: error                                                                           | Failure<br>parameter |                                                                                        |                             |
|        | R                                               | Bit66        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit67        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit68        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit69        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit70        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit71        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
| Byte9  | W/R                                             | Bit72        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit73        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | W/R                                             | Bit74        | Up & down swing<br>mode                        | 0: mode 1-simple air<br>swing;<br>1: mode 2-fixed angle<br>air swing and small<br>area air swing | Status<br>parameter  |                                                                                        |                             |
|        | R                                               | Bit75        | Adjustable temperature<br>mark under auto mode | 0: no;<br>1: yes                                                                                 | Status<br>parameter  | ★(7)                                                                                   |                             |
|        | R                                               | Bit76        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit77        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit78        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit79        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
| Byte10 | R                                               | Bit80        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit81        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit82        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit83        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit84        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit85        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit86        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit87        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
| Byte11 | R                                               | Bit88        | Reserved                                       | /                                                                                                | /                    |                                                                                        | IDU board<br>identification |
|        | R                                               | Bit89        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit90        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit91        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit92        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit93        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit94        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |
|        | R                                               | Bit95        | Reserved                                       | /                                                                                                | /                    |                                                                                        |                             |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write/<br>read) | Addr. Bit | Data Meaning                                       | Range                      | Parameter Type    | Pay special attention before development (to the data marked with ★) | Remarks                  |
|--------|-----------------------------------------------------|-----------|----------------------------------------------------|----------------------------|-------------------|----------------------------------------------------------------------|--------------------------|
| Byte12 | R                                                   | Bit96     | Reserved                                           | /                          | /                 |                                                                      | IDU board identification |
|        | R                                                   | Bit97     | Indoor evaporator temp sensor error                | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit98     | Indoor air return temp sensor error                | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit99     | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit100    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit101    | Water overflow protection                          | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit102    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit103    | Reserved                                           | /                          | /                 |                                                                      |                          |
| Byte13 | R                                                   | Bit104    | Jumper cap error                                   | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit105    | Indoor fan error                                   | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit106    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit107    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit108    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit109    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit110    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit111    | Reserved                                           | /                          | /                 |                                                                      |                          |
| Byte14 | R                                                   | Bit112    | Card in/out status                                 | 0: card out;<br>1: card in | Status parameter  |                                                                      |                          |
|        | R                                                   | Bit113    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit114    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit115    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit116    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit117    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit118    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit119    | Reserved                                           | /                          | /                 |                                                                      |                          |
| Byte15 | R                                                   | Bit120    | Communication failure with master wired controller | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit121    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit122    | Communication failure with ODU                     | 0: normal;<br>1: error     | Failure parameter |                                                                      |                          |
|        | R                                                   | Bit123    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit124    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit125    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit126    | Reserved                                           | /                          | /                 |                                                                      |                          |
|        | R                                                   | Bit127    | Reserved                                           | /                          | /                 |                                                                      |                          |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write/<br>read) | Addr.<br>Bit | Data Meaning                                | Range                  | Parameter Type    | Pay special attention<br>before development<br>(to the data marked with ★) | Remarks                  |
|--------|-----------------------------------------------------|--------------|---------------------------------------------|------------------------|-------------------|----------------------------------------------------------------------------|--------------------------|
| Byte16 | R                                                   | Bit128       | Reserved                                    | /                      | /                 |                                                                            | IDU board identification |
|        | R                                                   | Bit129       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit130       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit131       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit132       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit133       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit134       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit135       | Reserved                                    | /                      | /                 |                                                                            |                          |
| Byte17 | R                                                   | Bit136       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit137       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit138       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit139       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit140       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit141       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit142       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit143       | Reserved                                    | /                      | /                 |                                                                            |                          |
| Byte18 | R                                                   | Bit144       | Reserved                                    | /                      | /                 |                                                                            | ODU response information |
|        | R                                                   | Bit145       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit146       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit147       | Outdoor fan status                          | 0: off;<br>1: on       | Status parameter  |                                                                            |                          |
|        | R                                                   | Bit148       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit149       | Reserved                                    | /                      | /                 |                                                                            |                          |
|        | R                                                   | Bit150       | 4-way valve status                          | 0: off;<br>1: on       | Status parameter  |                                                                            |                          |
|        | R                                                   | Bit151       | Compressor status                           | 0: off;<br>1: on       | Status parameter  |                                                                            |                          |
| Byte19 | R                                                   | Bit152       | Compressor discharge temperature protection | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit153       | Fluorine shortage protection                | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit154       | DC fan motor protection                     | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit155       | 4-way valve reverse error protection        | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit156       | Over power protection                       | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit157       | Over load protection                        | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit158       | Low pressure protection                     | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |
|        | R                                                   | Bit159       | High pressure protection                    | 0: normal;<br>1: error | Failure parameter |                                                                            |                          |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write/<br>read) | Addr.<br>Bit | Data Meaning                                                                             | Range                            | Parameter<br>Type | Pay special<br>attention<br>before<br>development<br>(to the data<br>marked with<br>★) | Remarks                  |
|--------|-----------------------------------------------------|--------------|------------------------------------------------------------------------------------------|----------------------------------|-------------------|----------------------------------------------------------------------------------------|--------------------------|
| Byte20 | R                                                   | Bit160       | Evaporator anti-freezing protection                                                      | 0: normal;<br>1: error           | Failure parameter |                                                                                        | ODU response information |
|        | R                                                   | Bit161       | Outdoor ambient temp sensor error                                                        | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit162       | Discharge temp sensor error                                                              | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit163       | Condenser temp sensor error                                                              | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit164       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit165       | Jumper cap error                                                                         | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit166       | ODU memory chip error                                                                    | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit167       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
| Byte21 | R                                                   | Bit168       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit169       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit170       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit171       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit172       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit173       | Indoor and outdoor units unmatched                                                       | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit174       | Drive communication failure                                                              | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit175       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
| Byte22 | R                                                   | Bit176       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit177       | Cooling only heat pump flag bit                                                          | 0: cool and heat<br>1: cool only | Status parameter  | ★(1)                                                                                   |                          |
|        | R                                                   | Bit178       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit179       | System defrosting                                                                        | 0: no;<br>1: yes                 | Status parameter  |                                                                                        |                          |
|        | R                                                   | Bit180       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit181       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit182       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
|        | R                                                   | Bit183       | Reserved                                                                                 | /                                | /                 |                                                                                        |                          |
| Byte23 | R                                                   | Bit184       | Inverter compressor drive DC busbar voltage overlow protection or voltage drop off error | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit185       | Inverter compressor drive DC busbar voltage overhigh protection                          | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit186       | Inverter compressor drive alternate current protection (input side)                      | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit187       | Inverter compressor drive IPM protection                                                 | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit188       | Inverter compressor drive PFC protection                                                 | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit189       | Inverter compressor startup failure                                                      | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit190       | Inverter compressor phase loss protection                                                | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |
|        | R                                                   | Bit191       | Inverter compressor drive module reset                                                   | 0: normal;<br>1: error           | Failure parameter |                                                                                        |                          |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write /read) | Addr. Bit | Data Meaning                                                                                                    | Range                  | Parameter Type    | Pay special attention before development (to the data marked with ★) | Remarks                  |
|--------|--------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------|------------------------|-------------------|----------------------------------------------------------------------|--------------------------|
| Byte24 | R                                                | Bit192    | Inverter compressor over-current protection                                                                     | 0: normal;<br>1: error | Failure parameter |                                                                      | ODU response information |
|        | R                                                | Bit193    | Inverter compressor power protection                                                                            | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit194    | Inverter compressor drive current check circuit failure                                                         | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit195    | Inverter compressor out-of-step protection                                                                      | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit196    | Compressor stalling                                                                                             | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit197    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit198    | Inverter compressor drive module high temperature protection                                                    | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit199    | Inverter compressor drive module temperature sensor failure                                                     | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
| Byte25 | R                                                | Bit200    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit201    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit202    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit203    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit204    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit205    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit206    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit207    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
| Byte26 | R                                                | Bit208    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit209    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit210    | Inverter compressor drive charged circuit failure                                                               | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit211    | Inverter compressor drive AC input voltage abnormal protection                                                  | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit212    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit213    | Reserved                                                                                                        | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit214    | Temperature drift protection                                                                                    | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit215    | Sensor connection protection (electric current sensor is not connected to the corresponding U phase or V phase) | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
| Byte27 | R                                                | Bit216    | Exit tube temperature sensor error of indoor unit (gas valve)                                                   | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit217    | Inlet tube temperature sensor error of indoor unit (liquid valve)                                               | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit218    | Ambient temperature sensor error of drive board                                                                 | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit219    | Outdoor condenser's inlet tube temperature sensor is open/short-circuited                                       | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit220    | Outdoor condenser's exit tube temperature sensor is open/short-circuited                                        | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit221    | Wrong connection wire connection or expansion valve error                                                       | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit222    | Mode conflict protection                                                                                        | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit223    | Compressor demagnetization protection                                                                           | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |

| Addr.  | Access Type<br>(R-read only,<br>W/R-write /read) | Addr. Bit | Data Meaning                                | Range                  | Parameter Type    | Pay special attention before development (to the data marked with ★) | Remarks                  |
|--------|--------------------------------------------------|-----------|---------------------------------------------|------------------------|-------------------|----------------------------------------------------------------------|--------------------------|
| Byte28 | R                                                | Bit224    | Whole unit current detecting error          | 0: normal;<br>1: error | Failure parameter |                                                                      | ODU response information |
|        | R                                                | Bit225    | AC contactor protection                     | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit226    | Overspeed                                   | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit227    | Outdoor fan 2 error                         | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit228    | PG motor zero crossing protection           | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit229    | Compressor suction temperature sensor error | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit230    | Indoor fan tripping error                   | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit231    | Communication error between IDU and grid    | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
| Byte29 | R                                                | Bit232    | Communication error between ODU and grid    | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit233    | Main error at grid side                     | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit234    | IDU network address error                   | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit235    | IP address allocation overflow              | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit236    | Other error and protection                  | 0: normal;<br>1: error | Failure parameter |                                                                      |                          |
|        | R                                                | Bit237    |                                             | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit238    |                                             | /                      | /                 |                                                                      |                          |
|        | R                                                | Bit239    |                                             | /                      | /                 |                                                                      |                          |

## VI. Common Failures of BMS System

| Failures                                                                                                                                                                         | Possible Causes                                                                                                                                 | Corrective Actions                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Based on the provided protocol BMS shows there is communication error and it fails to display any operation status for all or some units and fails to control all or some units. | Some communication cord is not twisted pair                                                                                                     | Replace the cord with the twisted pair.                                                                            |
|                                                                                                                                                                                  | The crystal head of the communication cord is not pressed down properly                                                                         | Press down the crystal head properly                                                                               |
|                                                                                                                                                                                  | The communication cord between indoor and outdoor units is disconnected                                                                         | Solder the disconnected communication cord                                                                         |
|                                                                                                                                                                                  | The communication cord is broken                                                                                                                | Solder the broken communication cord                                                                               |
|                                                                                                                                                                                  | It is not the two cords in the middle of the crystal head that are wired                                                                        | Wired the two cords in the middle of the crystal head                                                              |
|                                                                                                                                                                                  | The communication cord is short-circuit                                                                                                         | Repair the short-circuit communication cord                                                                        |
|                                                                                                                                                                                  | The twisted pairs are too close with the power cord (less than 15cm), resulting in too much interference which causes the communication failure | Separate the twisted pairs and the power cord. If impossible, it is recommended to shield them with the steel pipe |
|                                                                                                                                                                                  | Some communication interfaces are connected improperly                                                                                          | Reconnect the communication interface                                                                              |
| The wiring is in good condition, but there is no information displayed for all or some units and the software shows there is communication failure                               | After connecting indoor unit's controller or wired controller, the unit is not cut off from the power and then re-energized.                    | Re-energize the unit                                                                                               |
|                                                                                                                                                                                  | The serial port of the communication software fails to match with that of the PC                                                                | Replace the serial port or modify the setting of the serial port of the software                                   |
|                                                                                                                                                                                  | The unit address of the software does not match with the actual unit address                                                                    | Modify the set unit address of the software                                                                        |
|                                                                                                                                                                                  | The unit is not energized                                                                                                                       | Energize the unit                                                                                                  |
|                                                                                                                                                                                  | The unit address is wrong or repeated                                                                                                           | Modify the improperly set unit address                                                                             |
| The wiring and other devices are in good condition, but there is no information displayed for some device                                                                        | A repeater may be is needed or the repeater is connected improperly                                                                             | Install the repeater correctly                                                                                     |
| No information is displayed and there is a alarm indicating the communication failure. Besides the TX lamp on the converter lights all the time                                  | The communication A and B are connected reversely or incorrectly                                                                                | Check the wiring and follow the principle of line A-to-line A and line B-to-line B                                 |
| Although the communication cord, devices and the installation are in good condition, there is still communication failure on the software                                        | Incompatible wired controller or controller is used                                                                                             | Check the model of the wireless remote controller and the wired controller, If not, make a replacement             |

# **Annex A**

(Normative Annex)

## **CRC Calculation Method**

### **A.1 CRC Calculation Method**

Calculation Method of CRC: The CRC is first preloading a 16-bit register to all 1's. Then successively transact each 8-bit bytes of the message. During calculating the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB is a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit character is exclusive ORed with the register's current value, and the process repeats for eight shifts as described above. The final contents of the register, after all the characters of the message have been applied, is the CRC value. During transmission and reception of data in CRC, low order byte is in the front.

### **A.2 Procedure step for calculating CRC code**

- 1) Preload a 16-bit register with FFFF hex (all 1's). Call this the CRC register.
- 2) Exclusive OR the first 8-bit byte of the message with the low-order byte of the 16-bit CRC register, putting the result in the CRC registers.
- 3) Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
- 4) (If the LSB was 0): Repeat Step 3 (another shift). (If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 (1010 0000 0000 0001).
- 5) Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8-bit byte will have been processed.
- 6) Repeat Steps 2 and 5 to process the next 8-bit data.
- 7) The final obtained CRC register is CRC.

## A.3 CRC Example (Only for Reference)

**Parameters:** Data (Starting address of the block data), Data Size (Byte count of the block data)

**Return:** CRC Calculating Result

```
uint16 CRC_Calculate(uint8 *data, uint16 dataSize)
{
    uint8 i;
    uint8 temp;
    uint16 j;
    uint16 CRCode;
    CRCode=0xffff;
    for(j=0;j<dataSize;j++)
    {
        CRCode = CRCode^data[j];
        for( i = 0; i < 8; i++ )
        {
            temp = CRCode & 0x0001;
            CRCode = (CRCode >> 1);
            if(temp ==1)
            {
                CRCode = (CRCode^0xA001);
                //0xA001 is a preset multinomial, a constant value
            }
        }
    }
    return CRCode;
}
```

## References

- 1.MODBUS Protocol
- 2.User's Technical Conditions of BMS Communication Protocol for All DC Inverter



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