



变频模块机 Modbus 通讯协议 V1.3

Modbus Long-distance Monitoring Protocol (V1.3)

for A Series Inverter Modular Air-cooled Chiller (Heat Pump)

珠海格力电器股份有限公司

GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI

为了您正常进行楼宇监控集成，请在使用前仔细阅读本通讯协议书

并妥善保存以供今后参考

Thanks for your purchase of the long-distance monitoring communication module for GREE commercial air conditioners. In order to seamlessly interface it to the Building Management System (BMS), please read this manual carefully before installation and use and keep it in a handy place for future reference.

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前言

Preface

本协议规定了变频模块机 Modbus 通讯时的通讯格式和数据格式。

This protocol specifies the communication format and also the data format for the communication of the A Series Inverter Modular Air-cooled Chiller (Heat Pump).

您在进行 BMS 软件开发前，需注意如下三点：

Please pay particular attention to the following three points before the development of the BMS software.

1、请务必认真阅读第六章，工程接线注意事项。

1. Make sure you have read the section 6 *"Wirng Notices"* .

2、请务必认真阅读各机型 BMS 接口开发前注意事项，如 5.1 BMS 接口开发前注意事项。

2. Make sure you have read all parts which are about the precautions before the development to the BMS interface of each unit, like 5.1 *"Precautions before the Development to the BMS Interface"*

3、请务必与格力联系以确定与 BMS 系统的兼容性。

3. Please contact GREE technicians to confirm the compatibility of the BMS system.

注意：本 MODBUS 通讯协议是以 IC 程序 Z26301HJV15 和 IC 程序 Z26300KJV14 版本为基础。产品规格如有变更，恕不另行通知。

Note：

This Modbus communication protocol is based on the Z26301HJV15 and IC 程序 Z26300KJV14 they are subject to some changes without notice.

一. 术语和定义

1. Terms and Definitions

1) Modbus 通讯

1) Modbus Communication

Modbus 协议是一种工业通讯和分布式控制系统协议。Modbus 网络属于一种主从网络，允许一个主机与一个或多个从机通讯，来完成数据交互。它采用请求/响应方式，每一种请求消息都对应着一种响应消息。请求消息由上位机发出，当下位机收到发给自己的请求消息后，就发送响应消息进行应答。

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

2) ASCII 模式

2) ASCII Mode

在 Modbus 总线上进行通讯时，一个信息中的每 8 位字节作为 2 个 ASCII 字符进行传输。

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

3) RTU 模式

3) RTU Mode

信息中的每 8 位字节分成 2 个 4 位 16 进制的字符，该模式的主要优点是在相同波特率下其传输的字符的密度高于 ASCII 模式，每个信息必须连续传输。

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

4) 上位机

4) Master Unit

发起通讯，发出 Modbus 请求帧的设备，如 PC 机等。

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

5) 下位机

5) Slave Unit

需要提供 Modbus 通讯接口，能够响应上位机的查询请求的设备，如通讯模块等。为表述方便，本标准中，以“通讯模块”为例。

It indicates such a device as 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.

6) 线圈

6) Coil

用 1 个 Bit 表达的量。如开关位、故障位等。线圈是 Modbus 协议的通用表达方式，其实它就是用 1 个 Bit 来表达的数据量，即布尔型 Bool、开关量。

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

7) 寄存器

7) Register

用 2 个 Byte 表达的量 (16 Bit)。如温度、模式等。寄存器是 Modbus 协议的通用表达方式，其实它就是一个数据 Word (16 个 Bit)、模拟量。

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

8) 设备地址

8) Device Address

Modbus 通讯模块地址，上位机通过此地址来识别网络中的各个通讯模块，地址范围：1 ~ 255，0 地址表示广播（所有通讯模块都能接收）。

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. "0" is the address of the broadcast (it can be received by all communication modules).

9) 广播

9) Broadcast

上位机下发控制帧（仅指控制帧），网络中所有的下位机都能接收到，并执行这个控制动作（下位机不作回复），广播帧的设备地址值为 0。

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

10) 功能码

10) Function Code

用于标识通讯帧的功能。本标准用到的功能码如下表所示：

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

表 1 功能码

Table 1 Function Code

名称 Description	功能码 Function Code
读线圈 (读 Bit) Read Coils	0x01
读寄存器 (读 Word) Read Registers	0x03
写线圈 (写 Bit) Write Coils	0x05, 0x0f
写寄存器 (写 Word) Write Registers	0x06, 0x10

11) 起始地址

11) Starting Address

设备数据寄存器块的起始地址 (线圈 : Bit 地址 ; 寄存器 : Word 地址) 。先传高 8 位 , 后传低 8 位。

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.

12) 数据数量

12) Data Size

从起始地址开始的一系列要操作的数据个数 (线圈 : Bit 个数 ; 寄存器 : Word 个数) 。先传高 8 位 , 后传低 8 位。

It indicates the operated data count 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.

13) 字节个数

13) Byte Count

数据传输中，有效数据字节的个数。

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

14) 有效数据

14) Effective Data

空调的控制数据和状态数据等。

It indicates the control data, status data etc.

15) 异常码

15) Alarm Code

上位机向通讯模块发请求帧，通讯模块检测到错误，返回的错误类型。

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

16) CRC 校验码

16) CRC

指冗余循环码，占 2 个字节。先传低 8 位，后传高 8 位。此码的计算方法见附录 A。

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

17) 请求帧

17) Request Frame

上位机发起的通讯帧。

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

18) 响应帧

18) Response Frame

对上位机请求帧的回复。

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

19) 通讯帧

19) Communication Frame

网络通讯中的连续传输的字节集合。

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

20) BMS

20) BMS

楼宇管理系统。

Its full name is building management system.

二. BMS 系统概述

2. Brief Introduction to the BMS System

MODBUS 监控系统，具备统一监控 255 个机组的功能。

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

远程监控网络提供 Modbus 通讯协议的 RS485 接口，可以直接接入楼宇自控系统或者是格力的监控系统，即可完成对 255 个机组的控制和运行状态的显示。楼宇自控系统/电脑在机组控制的功能上，跟机组是同等地位的。也即是楼宇自控系统/电脑和机组可以同时控制机组，谁最后下发控制命令，机组就执行谁的控制命令。

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

三. 局域网络接线

3. LAN Connection

- 1、485 通讯线是有极性的，接线时各节点的 A 与 A 相连，B 与 B 相连，注意不要接错，否则会出现通讯故障。同一网络中，每台机组的“远程监

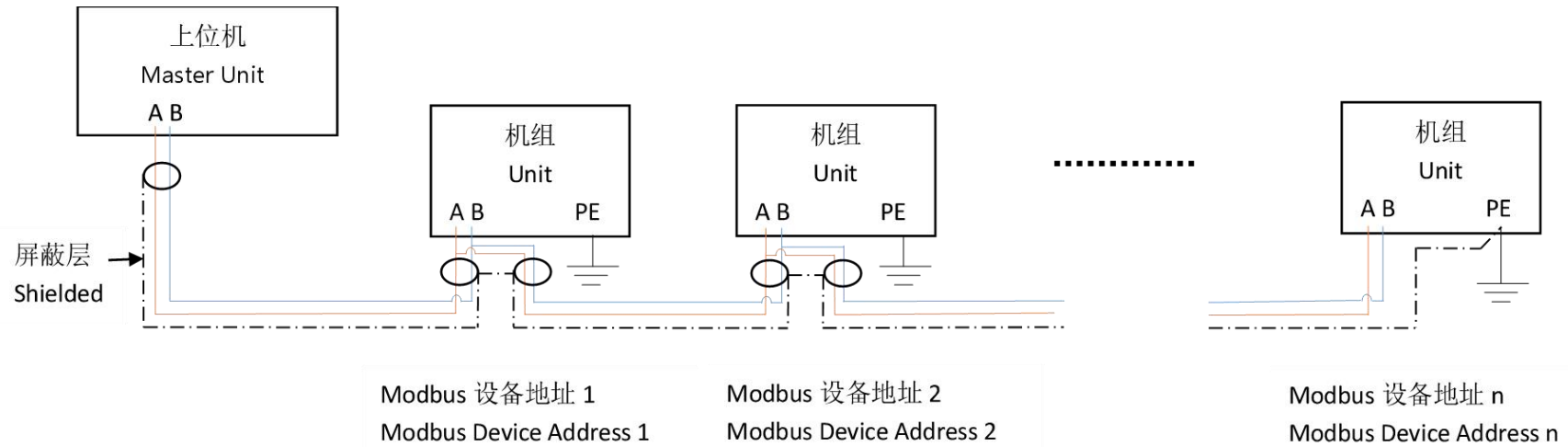
控地址”设置不能重复，设置范围为 1~255。通讯线的屏蔽层依次相连，并且单点唯一接地，见下图所示：

1、 RS485 communication line is a kind of polar lines. During connection, A should be connected to A, and B to B, otherwise it would lead to communication error. At the same network, the Modbus address of each unit can not be repeated. The Modbus setting ranges from 1 to 255. The shielding layers of the connection lines are connected one by one, with only a single point grounded as shown in the figure below.

注意：

Notes:

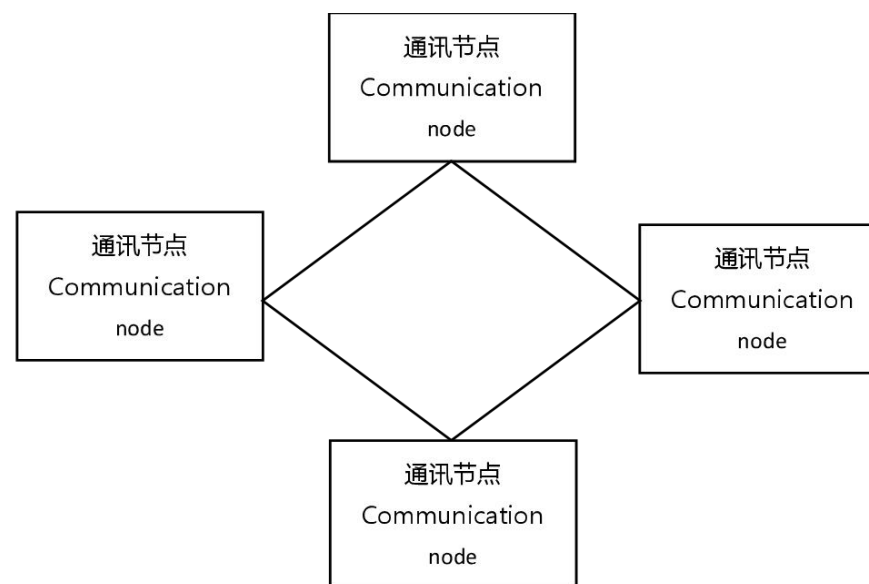
- 1) 屏蔽层要唯一接地，禁止多点接地，需确保此处接地可靠性，否则可能会影响通讯质量。
- 1) **The** shielding layers should be grounded by only a single point reliably, otherwise it would lead to poor communication.
- 2) 屏蔽层接线头需绝缘处理，不允许裸露金属丝，以免导致意外短路。
- 2) **The connectors of the** shielding layers should be insulated, as the exposed metal cord would lead to short circuits.



图一：机组 Modbus 网络通讯接线图

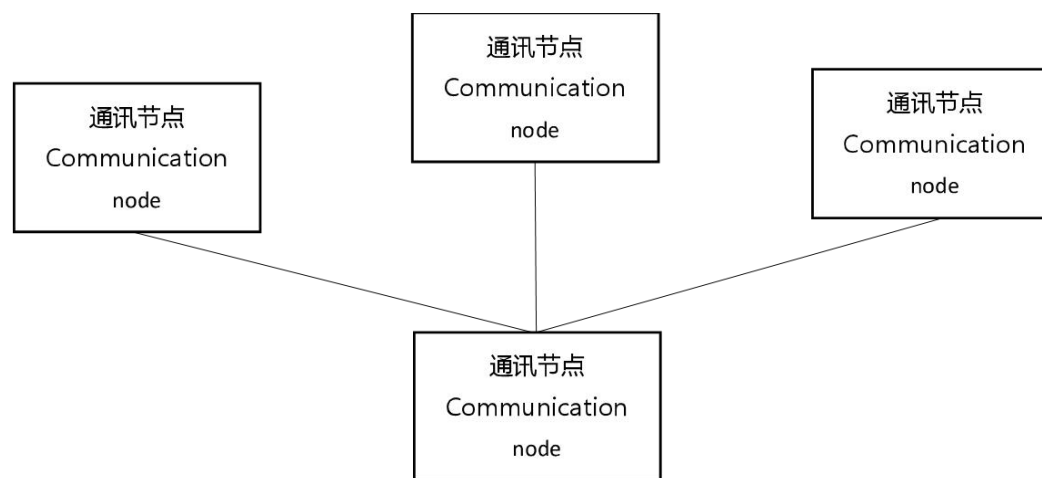
Fig.1 : Connection Diagram of the Modbus Communication Network

- 2、楼宇自控系统与多个机组之间连线方式需使用“手拉手”串联总线方式（手拉手接线方式见图一），不能采用“环形”或“星形”的总线方式。
- 2、The BMS and controlled units should be connected in series (as shown in Figure 1) rather than in ring or star type.



图二：环形网络示意图

Fig.2 : Ring-type Network



图三：星形网络示意图

Fig.3 : Star-type Network

四. MODBUS 协议格式

4. MODBUS Protocol Format

4.1 概述

4.1 General

由于 Modbus 协议完全开放、应用广泛，而且协议简单、调试手段丰富，在多机通讯的场合很容易提高开发速度，还可以很方便地与市场上已有支持 Modbus 协议的设备连接，实现数据通讯，从而成为一种事实上的工业通讯标准。Modbus 通讯协议有两种传输模式，分为 RTU 模式和 ASCII 模式。本 BMS 接口采用 Modbus RTU 通讯模式。

Modbus actually has become the 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, it can be developed fast and also can be conveniently connected with the devices which support this protocol. There are two communication modes, RTU and ASCII. The former one is adopted for the BMS interface.

4.2 协议接口

4.2 Protocol Interface

协议接口为 Modbus RTU 协议。

The protocol interface is the Modbus RTU protocol.

4.3 硬件接口

4.3 Hardware Interface

1) **通讯接口** : RS485

1) Communication Interface : RS485

2) **通讯方式** : 波特率 : 9600 bit/s (特殊情况可选择其它波特率4800bit/s和19200bit/s, 但通讯机制要与本规范一致) :

2) Communication Mode : Baud Rate : 9600 bit/s (In some special event, other baud rate 4800bit/s和19200bit/s also can be selected but the communication mode should be compatible with this protocol)

◆ 起始位 : 1

◆ Start Bit : 1

◆ 数据位 : 8

◆ Data Bit : 8

◆ 校验位 : 无

◆ Check Bit : None

◆ 停止位 : 1

◆ Stop Bit : 1

4.4 Modbus 的 RTU 模式的通用通讯帧格式

4.4 Universal Communication Frame Format of Modbus under RTU Mode

起始时间间隔 Start Time Interval	地址码 Add. Code	功能码 Function Code	数据区 Data Area	CRC 校验码 CRC	结束时间间隔 Stop Time Interval
T1-T2-T3-T4	1 Byte	1 Byte	n Bytes	2 Bytes	T1-T2-T3-T4

RTU 模式中，信息开始至少需要有 3.5ms 的静止时间，依据使用的波特率，很容易计算这个静止的时间(如上图中的 T1-T2-T3-T4)。发送完最后一个字符后，也有一个 3.5ms 的静止时间，然后才能发送一个新的信息。

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

整个信息必须连续发送。如果在发送帧信息期间，出现大于 1.5ms 的静止时间时，则接收设备刷新不完整的信息，并假设下一个地址数据。

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

同样一个信息后，立即发送的一个新信息，(若无 3.5 ms 的静止时间)这将会产生一个错误。是因为合并信息的 CRC 校验码无效而产生的错误。

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

4.5 MODBUS 标准协议格式

4.5 MODBUS Standard Protocol Format

4.5.1 线圈 (Bit)

4.5.1 Coil (Bit)

表2 线圈数据

Table 2: Coils Data

地址 Add.	对应 Byte 地址 Corresponding Byte	数据 (实例) 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) 线圈是空调的一些标志位、故障位等数据，即用一个 Bit 表达的数据。
- 1) “Coil” indicates the data of some flag bit or failure bit etc.

- 2) 数据以 Bit 为单位，每个 Bit 对应一个地址。
- 2) The unit of date is bit and each bit has a corresponding address.

- 3) 数据 Bit 存在通讯帧 Byte 中，每个 Byte 有 8 个 Bit。Byte 低位对应低地址 Bit，高位对应高地址 Bit，详情见表 2。
- 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, so is the low-order byte and bit. See Table 2 for more details.

- 4) 上位机能够操作机组数据中的一个 Bit，或同时操作多个连续 Bit。
- 4) The master unit can operate one bit among the communication data or multiple continuous bits at the same time.

- 5) 上位机读取 Bit 或下发 Bit 的个数小于 $\text{Byte} \times 8$ ，下发或读取通讯帧中“有效数据”的最后 Byte 无效数据位需清零。例如：读取或下发 9 个 Bit，每个 Bit 值都为 1，则需要 2 Bytes，第一个 Byte 为 “1111 1111”，第二个 Byte 为 “0000 0001”，其中有效数据 “1” 前面的部份为无效数据，需清零。
- 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 transmit or read the effective data of the communication frame. For instance, when nine “1” bits are read or transmitted, then two bytes are need, “1111 1111” and “0000 0001”. For the later byte, the ineffective bits “0” should be cleared.

4.5.2 寄存器 (Word , 16 Bit)

4.5.2 Register (Word, 16 Bits)

表3 寄存器数据

Table 3: Registers Data

地址 Add.	对应 Byte 地址 Corresponding Byte	数据 (实例) 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) 寄存器即数据 Word，数据以 Word 为单位，每个 Word 对应一个地址，地址从 0 开始。
- 1) The unit of the register is "word " which has a corresponding address starting from 0.
- 2) 上位机如果要读取一个 Word 的数据，则要读取 2 个 Byte，先传高 8 位，再传低 8 位。
- 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) 上位机下发读取请求帧，可同时读取或下发数据列表中的一个 Word 或多个连续 Word。
- 3) When the master unit transmits or read the request frame, it can transmit or read one or multiple continuous words in the data list.

4.5.3 读线圈 (读 Bit)

4.5.3 Read Coils

说明：读取线圈、状态数据，不支持广播。

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

表4 功能码

Table 4: Function Code

标准名称 Normative Name	功能码 Function Code
读线圈状态 Read Coils	0x01

表5 请求帧

Table 5: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

表6 响应帧

Table 6: Response Frame

设备地址 Device Add.	功能码 Function Code	字节个数 Byte Count	有效数据 Effective Data	CRC 校验码 CRC
1 Byte	1 Byte	1 Byte	n Bytes	2 Bytes

起始地址：要读取的一系列 Bit 的开始地址。

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

数据数量：要读取 Bit 的个数。

Data size : It indicates the bit count.

实例：从设备 10 中的线圈地址 5 开始连续读取 10 个 Bit (线圈数据见表 2)，如下：

Example: take 10 bits (see Table 2) continuously starting from address 5 from the device 10, as shown below:

请求帧：0A (设备地址) 01 (功能码) 00 05 (起始地址) 00 0A (数据数量) AD 77 (CRC 校验码)

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

应帧：0A (设备地址) 01 (功能码) 02 (字节个数) AA 02 (有效数据) E3 5C (CRC 校验码)

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

返回数据最后为 1 个 Byte 的数据 “0000 0010”，其中有效数据 “10” 前面的部分为无效数据，需清零。

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

4.5.4 写单个线圈 (Bit)

4.5.4 Write Single Coil

说明：上位机对机组写入线圈数据，支持广播。

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

◆ **功能码：**0x05

◆ **Function Code：**0x05

表7 请求帧

Table 7: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	有效数据 Effective Data	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

表8 响应帧

Table 8: Response Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	有效数据 Effective Data	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

注：响应帧的设备地址、功能码、起始地址、有效数据都与请求帧的相同。

Note: The response frame has the same device address, function code, starting address and data size as the request frame.

有效数据中：FF00H值请求线圈处于ON 状态，0000H值请求线圈处于OFF状态，其它值对线圈无效，不起作用。
 Effectiave data: FF00H request coil is ON, 0000H quest coil is OFF, and any other value is invalid for the coil.

实例：将设备为10，地址为Bit 6置1，如下：

Example: set to the device 10, addree bit 6 to 1, as shown below:

请求帧：0A（设备地址）05（功能码）00 06（起始地址）FF 00（有效数据）6D 40（CRC校验码）

Request Frame：0A(device address)05(function code)00 06(starting address)FF 00(effective data)6D 40 (CRC)

响应帧：0A（设备地址）05（功能码）00 06（起始地址）FF 00（有效数据）6D 40（CRC校验码）

Response Frame：0A(device address)05(function code)00 06(starting address)FF 00(effective data)6D 40 (CRC)

4.5.5 写多个线圈 (Bit)

4.5.5 Write Multiple Coils

说明：上位机对机组写入线圈数据，支持广播。

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

- ◆ **功能码：0x0F**
- ◆ **Function Code：0x0F**

表9 请求帧

Table 9: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	字节个数 Byte Count	有效数据 Effective Data	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	n Bytes	2 Bytes

表10 响应帧

Table 10: Response Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes
注：响应帧的设备地址、功能码、起始地址、数据数量都与请求帧的相同。 Note: The response frame has the same device address, function code, starting address and data size as the request frame.				

实例：将设备为10，地址从6开始的连续11个Bit置1，如下：

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

请求帧：0A（设备地址）0F（功能码）00 06（起始地址）00 0B（数据数量）02（字节个数）FF 07（有效数据）97 A0（CRC校验码）

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) ;

响应帧：0A（设备地址）0F（功能码）00 06（起始地址）00 0B（数据数量）F5 76（CRC校验码）

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

下发数据最后为1个Byte的数据“0000 0111”，其中有效数据“111”前面的部分为无效数据，需清零。

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

4.5.6 读寄存器 (读 Word)

4.5.6 Read Registers

说明：读取机组寄存器数据，不支持广播。

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

表11 功能码

Table 11: Function Code

标准名称 Normative Name	功能码 Function Code
读保持寄存器 Read Holding Registers	0x03

表12 请求帧

Table 12: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

表13 响应帧

Table 13: Response Frame

设备地址 Device Add.	功能码 Function Code	字节个数 Byte Count	有效数据 Effective Data	CRC 校验码 CRC
1 Byte	1 Byte	1 Byte	n Bytes	2 Bytes

起始地址：要读取 Word 数据块的开始地址。

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

数据数量：Word 的个数，每次最多能读取 125 个 Word。

Data Size: It indicates the word count with the maximum of 125 each time.

实例：从设备10中，地址为1开始连续读取2个Word（寄存器数据见表3），如下：

Case: read two continuous words (see Table 3) from the device 10 starting at the address 1, as follows:

请求帧：0A（设备地址）03（功能码）00 01（起始地址）00 02（数据数量）94 B0（CRC 校验码）

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

响应帧：0A（设备地址）03（功能码）04（字节个数）AA 55 55 AA（有效数据）CE 14（CRC 校验码）

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

4.5.7 写单个寄存器（Word）

4.5.7 Write Single Registers

说明：将上位机控制数据写入寄存器（Word），支持广播。

Note：Write control data from the master unit to the register and also supports the broadcast.

- ◆ 功能码 : 0x06
- ◆ Function Code : 0x06

表 14 请求帧

Table 14: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	有效数据 Effective Date	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

表15 响应帧

Table 15: Response Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	有效数据 Effective Date	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes
注：响应帧的设备地址、功能码、起始地址、数据数量都与请求帧的相同。 Note: The response frame has the same device address, function code, starting address and data size as the request frame.				

实例：在设备 10 中，地址为 Word 2 开始写入 0x12，如下：

Examlp: for the unit 10, if the address is word 2, write 0x12 as shown below.

请求帧： 0A (设备地址) 06 (功能码) 00 02 (起始地址) 00 12 (有效数据) A9 7C (CRC 校验码)

Request Frame:0A(device address)06(function code)00 02 (starting address)00 12(effective data) A9 7C (CRC) ;

响应帧： 0A (设备地址) 06 (功能码) 00 02 (起始地址) 00 12 (有效数据) A9 7C (CRC 校验码)

Request Frame: 0A(device address)06(function code)00 02 (starting address)00 12(effective data) A9 7C (CRC)

4.5.8 写多个寄存器 (Word)

4.5.8 Write Multiple Registers

说明：将上位机控制数据写入寄存器 (Word) ，支持广播。

Note：Write control data from the master unit to the register and also supports the broadcast.

- ◆ 功能码：0x10
- ◆ Function Code：0x10

表 16 请求帧

Table 16: Request Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	字节个数 Byte Count	有效数据 Effective Date	CRC 校验 码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	n Bytes	2 Bytes

表17 响应帧

Table 17: Response Frame

设备地址 Device Add.	功能码 Function Code	起始地址 Starting Add.	数据数量 Data Size	CRC 校验码 CRC
1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes

注：响应帧的设备地址、功能码、起始地址、数据数量都与请求帧的相同。

Note: The response frame has the same device address, function code, starting address and data size as the request frame.

实例：在设备 10 中，地址为 2 开始写入 3 个 Word (0x12、0x23、0x34)，如下：

Case: Write three words (0x12, 0x23, 0x34) from the device 10 starting at the address 2, as follows:

请求帧：0A (设备地址) 10 (功能码) 00 02 (起始地址) 00 03 (数据数量) 06 (字节个数) 00 12 00 23 00 34 (有效数据) 15 DF (CRC 校验码)

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)

响应帧：0A (设备地址) 10 (功能码) 00 02 (起始地址) 00 03 (数据数量) 20 B3 (CRC 校验码)

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

4.5.9 异常响应

4.5.9 Alarm Response

说明：上位机对通讯模块发送请求帧，希望得到一个正常的响应，但通讯模块检测到异常，回复异常响应帧。

Description: when the master unit sends a request frame to the communication unit, it expects to get a normal response. However, if something abnormal is detected by the communication unit, it will reply with an alarm response frame.

功能码：请求帧的功能码的最高 Bit 置 1，即请求帧的功能码与 0x80 进行或运算后得到的值（而正常响应的功能码原样返回）。

Function Code: it is the value when the highest bit of the function code of the request frame is set to 1, namely the value after “or”

calculation between the function code of the request frame and 0x80 (the function code with normal response can go back as original).

设备回复异常帧的通讯格式：

Communication format for device response to the alarm frame

表18 异常响应帧

Table 18 Alarm Response Frame

设备地址 Device Add.	功能码 (bit7=1) Function Code(bit7=1)	异常码 Alarm Code	CRC 校验码 CRC
1 Byte	1 Byte	1 Bytes	2 Bytes

表19 异常码列表

Table 19 Alarm Code List

异常码 Alarm Code	名称 Name	说明 Description
0x02	非法数据值 Illegal data	接收的数据地址，是从机不允许的地址。特别是，起始地址和数据长度的组合是无效的。例如：寄存器长度为 100，发送偏移量 96 和长度 4 的请求会被成功处理，偏移量 96 和长度 5 的请求将产生异常码 02。 The received data address is out of allowed address range of the slave unit. Especially, combination of the starting address and the data length is

		invalid. For example, when the length of the register is 100, request of 96 deviation and 4 data length will be handled, but 96 deviation and 5 data length will give birth to an alarm code 02.
0x03	非法数据值 Illegal data	<p>1、下发的有效数据是从机不允许的数据，例如：05功能码有效数据是0xff00和0x0000，除此之外则回复异常码。</p> <p>1、 The sent data is not allowed by the slave unit. For instance, for function code 05, only 0xff00 and 0x0000 are valid, and all other data are invalid.</p> <p>2、请求帧数据数量和字节个数不匹配，例如：10功能码下发写5个word，但是字节个数不是10个，则返回异常码。</p> <p>2、 The number of request frame data does not match the number of bytes. For example: function code 10 are used to write 5 words, but the number of bytes is not 10, the exception code is returned.</p> <p>3、读取数据过多，如：读取字节的个数大于250。</p> <p>3、 Over-sized data is read, for instance, the over 250 bytes are read.</p> <p>4、读取或写入数据长度为0。</p> <p>4、 The read or written data size is 0.</p>

五. 通讯协议

5. Communication Protocol

5.1. BMS 接口开发前注意事项

5.1 Precautions before the Software Development to the BMS Interface

◆ 软件设计注意事项 (参照协议查看):

◆ Precautions to the Software Design :

★(1)上位机开发前需注意参照协议表格中的“开发前需注意事项”。

★(1) Refer to this section before development of the master unit.

★(2) BMS 系统软件下发给机组触摸屏的所有数据需要进行有效范围判断。

★(2) All data that the BMS communicates to the touch screen of the unit should be verified if they are among the effective range.

★(3)机组显示器上的“ 远程监控地址 ”，设置范围是 1~255，是机组对应的 Modbus 通讯的设备地址，无论是监视数据还是控制机组，都需要对“ 远程监控地址 ”进行设置，默认值是 1。注意：同一通讯网络下，不同机组的“远程监控地址”不能重复。

★(3) “Modbus Address” of the control panel ranges from 1 to 255 and is the communication address for the unit. No matter for data monitoring or unit control, it should be set. The default setting is 1. Note: it can not be set repeatedly under the same network.

★(4)BMS 系统上位机软件无更改数据操作时只对机组显示器进行读操作，只有在有更改数据操作时才下发写命令，当写命令执行成功后不可再定时重复下发。

★(4) If there is no data change from the master unit, it will make read-only operation to the display screen of unit, only if there is a data change, the write operation can be executed, the write operation cannot be operated repeatedly by timer if it already ran successfully.

5.2. 有效数据定义

5.2 Definition of Effective Data

远程监控 Modbus 通讯协议的数据空间分为两类：开关量和寄存器。寄存器值为空调的温度值、运行模式、运行状态等连续值或多状态值。开关量只有两种状态的量，如感温包故障，只有两种状态，分别为有故障和无故障。

The data for the Modbus communication protocol can be divided into two types: register and switching value. The former one indicates the values of temperature, valves and other continuous, multi-mode values, while the later one indicates the value which only has two status, like the temperature sensor failure (with only two options: "Yes" or "No").

1. 模拟量的数据和地址分布：(Word 0 ~ Word 1269)

1. Data and Address Distribution of the Analog Values: (Word 0 ~ Word 1269)

注：

Notices:

- 1) “R” 表示参数只能读，不能写；“R/W” 表示参数既可读又可写。
- 1) “R” indicates only read is allowed; “R/W” indicates both read and write are allowed.
- 2) 格力保留产品升级时不另行通知的权利。
- 2) GREE reserves the right to update the product without notice.

- 3) 表格中“X”值为0~9、11~16，表示模块1到模块16，如下面表格。例如：模块三的主板的机组状态寄存器位置计算：X值为3-1=2，所以位置为Word(70*X+80) = Word(70*2+80) = Word220。其中“X”值为10的数据区为预留区域，即Word780~Word849为预留区域其值没有意义。
- 3) The “X” value in the table is 0~9、11~16, which means that unit 1 to unit 16. For example, the unit status register position of the mainboard of module three:the X value is 3-1=2, so the position is Word(70*X+80) = Word(70*2+80) = Word220. The data area with the "X" value of 10 is the reserved area, that is, Word780~Word849 is the reserved area and its value has no meaning.

模块 Unit	X 的值 X value	模块状态位置说明 Unit state Description
模块一 Unit 1	0	Word80~Word149
模块二 Unit 2	1	Word150~Word219
模块三 Unit 3	2	Word220~Word289
模块四 Unit 4	3	Word290~Word359
模块五 Unit 5	4	Word360~Word429
模块六 Unit 6	5	Word430~Word499
模块七 Unit 7	6	Word500~Word569
模块八 Unit 8	7	Word570~Word639
模块九 Unit 9	8	Word640~Word709
模块十 Unit 10	9	Word710~Word779
模块十一 Unit 11	11	Word850~Word919
模块十二 Unit 12	12	Word920~Word989
模块十三 Unit 13	13	Word990~Word1059
模块十四 Unit 14	14	Word1060~Word1129
模块十五 Unit 15	15	Word1130~Word1199
模块十六 Unit 16	16	Word1200~Word1269

4) 实际值与传输值的关系：1：表示传输值 = 实际值；10：表示传输值 = 实际值×10。

4) Relation between the actual and transferred values：1：Transfer Value= Actual Value；10：Transfer Value= Actual Value×10。

寄存器 (读 0x03 , 多个写 0x10 , 单个写 0x06)																	
Register(read: 0x03; multiple write: 0x10; single read: 0x06)																	
地址 <i>Add.</i>	访问类型 <i>Access Type</i>	数据名称 <i>Meaning</i>	英文全称 <i>Full Name</i>	英文简称 <i>Short Name</i>	范围值 <i>Range</i>			默认值 <i>Default</i>	实际值与传输值的关系 Relation between the actual and transferred values	精度 <i>Accuracy</i>	单位 <i>Unit</i>	传输值数据类型 Transferred Data Type	开发前需注意事项 <i>Notices (★)</i>	机型一 Unit 1	机型二 Unit 2	参数类型 Data Type	
					最小值 <i>Min.</i>	最大值 <i>Max.</i>	枚举值 <i>Enumeration</i>										
Word 0	R	机型码 (ID)	Model ID	Model ID	/	/	0x2017,为变频模块机 A Series Inverter Modular Air-cooled Chiller	0x2017	1	/	/	Uint16		√	√	显示板 Control Panel	
Word 1	W/R	开关机	ON/OFF	ON/OFF	/	/	0x00AA 开机 ON /0x0055: 关机 OFF	0x0055	1	/	/	Uint16	加密解密器到期后无法开启。 干触点控制开关机状态下不可设。 手动化霜模式下不可设。 The encryption decryptor cannot be opened after it	√	√		

													expires. The dry contact control switch can not be set. Cannot be set in manual defrosting mode.				
Word 2	W/R	工作模式	Running mode	Mode	/	/	0x0001 :制冷模式 Cool ; 0x0002 :制热模式 Heat ; 0x0003 :手动化霜 Manual-defrost	0x0001	1	1	/	Uint16	手动化霜未结束 不允许设定模式。 开机状态下不可设。 单冷机型不可设。 Manual defrosting is not finished , Setting mode is not allowed. Cannot be set when the power is on. Single cold models are not available.	√	√		
Word 3	W/R	中英文语言设置	Language Setting	Language Setting	/	/	1 : 英文显示 ,English 0 : 中文显示 Chinese	0	/	/	/	Uint16		√	√		
Word 4	W/R	制冷进水设置温度	Entering water temperature for cooling	Entering water-T for cooling	10	25	/	12	10	0.1	℃	Uint16		√	√		
Word 5	W/R	制热进水设置温度	Entering water temperature for heating	Entering water-T for heating	30	45	/	40	10	0.1	℃	Uint16		√	√		
Word 6	W/R	制冷出水设置温度	Leaving water temperature for cooling	Leaving water-T for cooling	5	20	/	7	10	0.1	℃	Uint16		√	√		
Word 7	W/R	制热出水设置温度	Leaving water temperature for	Leaving water-T for	35	50	/	45	10	0.1	℃	Uint16		√	√		

			heating	heating													
Word 8	W/ R	辅助电加热开始温度	Start temperature for E-heating	Start-T for E-heating	33	37	/	36	10	0.1	℃	Uint16		√	√		
Word 9	W/ R	辅助电加热结束温度	End temperature for E-heating	End-T for E-heating	38	45	/	39	10	0.1	℃	Uint16		√	√		
Word 10	W/ R	手动化霜使能模块号	Manual defrosting enable module number	Manual defrosting enable module number	0	255	/	0	1	1	/	Uint16	<p>先把模式设为手动化霜模式才可设。</p> <p>1~16：化霜使能对应模块，0xFF 表示清除使能（不使能）任何模块。</p> <p>0 或者大于 16 且小于 255 为无无效。</p> <p>The mode can be set to manual defrosting mode first.</p> <p>1~16: Defrost enable corresponding module, 0xFF means clear enable (not enabled) any module.</p> <p>0 or greater than 16 and less than 255 is invalid.</p>	√	√		
Word 11	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 12	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 13	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 14	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 15	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 16	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 17	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 18	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 19	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 20	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		

Word 21	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 22	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 23	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 24	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 25	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 26	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 27	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 28	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 29	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 30	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 31	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 32	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 33	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 34	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 35	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 36	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 37	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 38	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 39	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 40	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 41	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 42	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 43	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 44	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 45	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 46	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 47	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 48	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 49	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		

Word 50	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 51	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 52	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 53	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 54	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 55	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 56	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 57	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 58	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 59	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 60	R	电加热功率	Electric heater power	Electric heater power	0	40	/	0	1	1	kW	Uint16		√	√		
Word 61	R	化霜开始温度	Defrosting start temperature	Defrosting start-T	-10	-2	/	-4	10	0.1	℃	Int16		√	√		
Word 62	R	化霜结束温度	Defrosting end temperature	Defrosting end-T	10	30	/	20	10	0.1	℃	Uint16		√	√		
Word 63	R	化霜持续设置时间	Defrosting duration setting	Defrosting duration setting	4	15	/	8	1	1	min	Uint16		√	√		
Word 64	R	制冷防冻结设置温度	Anti-freeze temperature setting for cooling	Anti-freeze T-cooling	-5	4	/	3	10	0.1	℃	Int16		√	√		
Word 65	R	制热防过热设置温度	Anti-over-heating temperature setting for heating	Anti-over-heating T-heating	51	55	/	53	10	0.1	℃	Uint16		√	√		
Word 66	R	平均进水温度	Average inlet water temperature	Average inlet water temperature	-30	70		-30	10	0.1	℃	Int16		√	√		
Word 67	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 68	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		

Word 69	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 70	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 71	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 72	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 73	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word 74	R	水泵一累计运行时间	Pump 1 cumulative running time	Pump 1 cumulative running time	0	65535	/	0	1	1	h	Uint16	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word 75	R	水泵二累计运行时间	Pump 2 cumulative running time	Pump 2 cumulative running time	0	65535	/	0	1	1	h	Uint16	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word 76	R	辅助电加热一累计时间	Auxiliary electric heating 1 cumulative time	Auxiliary electric heating 1 cumulative time	0	65535	/	0	1	1	h	Uint16	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word 77	R	辅助电加热二累计时间	Auxiliary electric heating 2 cumulative time	Auxiliary electric heating 2 cumulative time	0	65535	/	0	1	1	h	Uint16	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word 78	R	显示板程序版本号	Display board program version number	Display board program version	10	65535	/	10	1	1	/	Uint16	例：V1.7 传输数据为：0x11 Example: V1.7 transmits data as: 0x11	√	√		
Word 79	R	协议版本	Protocol Version	Protocol Version	10	65535	/	10	1	1	/	Uint16	例：V17 传输数据为：0x11 Example: V17 transmits data as: 0x11	√	√		
Word (70*X+80)	R	机组状态	Unit status	System status	/	/	0：关机 Off； 1：制冷 Cooling；	0	1	/	/	Uint16		√	√	模块 Unit s1(X=0)	

							2：制热 Heating； 3：化霜运 行 Defrosting ； 4：冬天自 动防冻 Automatic antifreeze									模块 Unit s2(X =1) 模块 Unit s3(X =2) 模块 Unit s4(X =3)	
Word (70*X+81)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√	模块 Unit s5(X =4) 模块 Unit s6(X =5) 模块 Unit s7(X =6) 模块 Unit s8(X =7) 模块 Unit s9(X =8)	
Word (70*X+82)	R	进水温度	Entering water temperature for the air conditioning	Entering water-T	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+83)	R	出水温度	Leaving water temperature for the air conditioning	Leaving water-T	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+84)	R	防冻/防过热温 度	Anti-freezing-T/Anti -over-heating temperature	Anti-freezing -T/Anti-over- heating-T	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+85)	R	环境温度	Ambient temperature	Ambient temperature	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+86)	R	系统一化霜温 度	Defrosting temperature 1	Defrosting temperature 1	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+87)	R	系统二化霜温 度	Defrosting temperature 2	Defrosting temperature 2	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+88)	R	系统一排气温 度	Discharge temperature 1	Discharge temperature 1	0	150	/	0	1	1	℃	Uint1 6		√	√		

Word (70*X+89)	R	系统二排气温度	Discharge temperature 2	Discharge temperature 2	0	150	/	0	1	1	℃	Uint1 6		√	√	模块 Unit s10(X=9)
Word (70*X+90)	R	系统一壳管进 管感温包	Shell-and-tube inlet temperature 1	Shell-and-tub e inlet-T 1	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s11(X=1 1)
Word (70*X+91)	R	系统一壳管出 管温度	Shell-and-tube outlet temperature 1	Shell-and-tub e outlet-T 1	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s12(X=1 2)
Word (70*X+92)	R	系统二壳管进 管感温包	Shell-and-tube inlet temperature 2	Shell-and-tub e inlet-T 2	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s13(X=1 3)
Word (70*X+93)	R	系统二壳管出 管温度	Shell-and-tube outlet temperature 2	Shell-and-tub e outlet-T 2	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s14(X=1 4)
Word (70*X+94)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√	模块 Unit s15(X=1 5)
Word (70*X+95)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√	模块 Unit s15(X=1 5)
Word (70*X+96)	R	系统一压力传 感器高压	High pressure sensor 1	High pressure sensor 1	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s15(X=1 5)
Word (70*X+97)	R	系统二压力传 感器高压	High pressure sensor 2	High pressure sensor 2	-30	70	/	-30	10	0.1	℃	Int16		√	√	模块 Unit s15(X=1 5)
Word (70*X+98)	R	过热度一	Super-heating degree 1	Super-heatin g degree 1	-30	70	/	0	10	0.1	℃	Int16		√	√	模块 Unit s15(X=1 5)
Word (70*X+99)	R	过热度二	Super-heating degree 2	Super-heatin g degree 2	-30	70	/	0	10	0.1	℃	Int16		√	√	模块 Unit s15(X=1 5)
Word (70*X+10 0)	R	系统一电子膨 胀阀一步数	Opening angle of electrostatic expansion valve 1 of system 1	Opening angle of EXV 1 SYS 1	0	480	/	0	1	1	/	Uint1 6		√	√	模块 Unit s15(X=1 5)
Word (70*X+10 1)	R	系统二电子膨 胀阀一步数	Opening angle of electrostatic expansion valve 1 of system 2	Opening angle of EXV 1 SYS 2	0	480	/	0	1	1	/	Uint1 6		√	√	模块 Unit s15(X=1 5)

Word (70*X+10 2)	R	压机一运行频率	Frequency of compressor 1	Frequency of compressor 1	0	120	/	0	1	1	H z	Uint1 6		√	√	Unit s16(X=1 6)	
Word (70*X+10 3)	R	压机二运行频率	Frequency of compressor 2	Frequency of compressor 2	0	120	/	0	1	1	H z	Uint1 6		√	√		
Word (70*X+10 4)	R	风机一运行频率	Frequency of fan 1	Frequency of fan 1	0	120	/	0	1	1	H z	Uint1 6		√	√		
Word (70*X+10 5)	R	风机二运行频率	Frequency of fan 2	Frequency of fan 2	0	120	/	0	1	1	H z	Uint1 6		√	√		
Word (70*X+10 6)	R	节能模式目标水温	Water temperature for the energy saving mode	Water-T for energy saving	-30	70	/	-30	10	0.1	℃	Int16		√	√		
Word (70*X+10 7)	R	系统一电子膨胀阀二步数	Opening angle of electrostatic expansion valve 2 of system 1	Opening angle of EXV 2 SYS 1	0	480	/	0	1	1	/	Uint1 6		√	√		
Word (70*X+10 8)	R	系统二电子膨胀阀二步数	Opening angle of electrostatic expansion valve 2 of system 2	Opening angle of EXV 2 SYS 2	0	480	/	0	1	1	/	Uint1 6		√	√		
Word (70*X+10 9)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 0)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 1)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		

Word (70*X+11 2)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 3)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 4)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 5)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 6)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 7)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 8)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+11 9)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+12 0)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word (70*X+12 1)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		
Word	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√		

(70*X+12 2)																		
Word (70*X+12 3)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 4)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 5)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 6)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 7)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 8)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+12 9)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 0)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 1)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			

2)																		
Word (70*X+13 3)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 4)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 5)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 6)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 7)	R	预留	Reserved	Reserved	/	/	/	/	/	/	/	/		√	√			
Word (70*X+13 8)	R	机组条码第一位、第二位	Unit bar code 1, 2	Unit bar code 1, 2	/	/	/	0x5F5F	1	1	/	Uint16	采用 ASCII 码格式进行发送。 第 x 位对应条形码 x*****中的 x 位。 第一个 word 中高八位为条码第一位，低八位为条码第二位，依次类推。 Is transmitted in ASCII format. The xth bit corresponds to the x bit in the barcode x*****. The upper eight digits of the first word are the first digit of the barcode, the lower eight digits are the	√	√			
Word (70*X+13 9)	R	机组条码第三位、第四位	Unit bar code 3, 4	Unit bar code 3, 4	/	/	/	0x5F5F	1	1	/	Uint16		√	√			
Word (70*X+14 0)	R	机组条码第五位、第六位	Unit bar code 5, 6	Unit bar code 5, 6	/	/	/	0x5F5F	1	1	/	Uint16		√	√			
Word (70*X+14 1)	R	机组条码第七位、第八位	Unit bar code 7, 8	Unit bar code 7, 8	/	/	/	0x5F5F	1	1	/	Uint16		√	√			
Word (70*X+14 2)	R	机组条码第九位、第十位	Unit bar code 9, 10	Unit bar code 9, 10	/	/	/	0x5F5F	1	1	/	Uint16		√	√			

Word (70*X+14 3)	R	机组条码第十一 位、第十二位	Unit bar code 11, 12	Unit bar code 11, 12	/	/	/	0x5F5F	1	1	/	Uint1 6	second digit of the barcode, and so on.	√	√		
Word (70*X+14 4)	R	机组条码第十三 位、第十四位	Unit bar code 13, 14	Unit bar code 13, 14	/	/	/	0x5F5F	1	1	/	Uint1 6		√	√		
Word (70*X+14 5)	R	机组条码第十 五位	Unit bar code 15	Unit bar code 15	/	/	/	0x5F00	1	1	/	Uint1 6		√	√		
Word (70*X+14 6)	R	压缩机一累计 运行时间	Compressor 1 cumulative running time	Compressor 1 cumulative running time	0	6553 5	/	0	1	1	h	Uint1 6	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word (70*X+14 7)	R	压缩机二累计 运行时间	Compressor 2 cumulative running time	Compressor 2 cumulative running time	0	6553 5	/	0	1	1	h	Uint1 6	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word (70*X+14 8)	R	压缩机一累计 启动次数	Compressor 1 cumulative starting times	Compressor 1 cumulative starting times	0	6553 5	/	0	1	1	T	Uint1 6	显示板记忆状态参数。 Display board memory status parameters.	√	√		
Word (70*X+14 9)	R	压缩机二累计 启动次数	Compressor 2 cumulative starting times	Compressor 2 cumulative starting times	0	6553 5	/	0	1	1	T	Uint1 6	显示板记忆状态参数。 Display board memory status parameters.	√	√		

2. 数据状态量的数据和地址分布 : (Bit 0 ~ Bit3535)

2. Data and Address Distribution of Switching Value: (Bit0 ~ Bit3535)

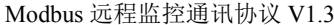
注：

Notices:

- 1) 表格中“X”值为0~15,表示模块1到模块16。例如:模块三的主板的总故障标志位位置计算:X值为3-1=2,所以位置为Bit (216*X+80) = Bit (216*2+80) = Bit512。
- 1) The “X” value in the table is 0~15, indicating module 1 to module 16. For example, the total fault flag position of the mainboard of module 3:The X value is 3-1=2, so the position is Bit (216*X+80) = Bit (216*2+80) = Bit512.

线圈 (读 0x01, 多个写 0x0f, 单个写 0x05) Coil(read: 0x01, multiple write: 0x0f; single write: 0x05)															
地址 Add.	位地址 Bit	访问 类型 Access Type	数据名称 Meaning	英文全称 Full Name	英文简称 Short Name	1 代表 含义 “1” Mean ling	0 代表含 义 “0” Mean ling	默 认 值 D e f a u l t	参 数 类 别 Data Type	参数类 型 Data Sub-t ype	备注 1Notices1 (★)	含 义 meanin gs	备 注 2Noti ces2 (★)	机 型 一 U n i t 1	机 型 二 U n i t 2
Byte 0	Bit 0	W/R	按键声音设定	Key tone	Key tone	开启 On	关闭 Off	1	设置参数 Set	Bool		显示通 用设置 Control Panel commo n settings	显示板 Contr ol Panel	√	√
	Bit 1	W/R	液晶背光设定	Back light	Back light	开启 On	关闭 Off	0	设置参数 Set	Bool				√	√
	Bit 2	W/R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit 3	W/R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit 4	W/R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit 5	W/R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit 6	W/R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit 7	W	外部复位请求	External reset request	External reset request	复位 Reset	不复位 Not reset	0	设置参数 Set	Bool	显示板复位 (机组不会复 位) Display board reset (the unit will not reset)	显示板 控制标 志位 1		√	√
Byte 1	Bit 8	W/R	干触点开关机使能	Contact-control ON/OFF	Contact-control ON/OFF	开启 On	关闭 Off	0	设置参数 Set	Bool	开机状态下不可设。 This setting is unavailable under the			√	√

unit running!												Control Panel control flag 1		
Bit 9	W	是否取消排气感温包的锁定	Whether to cancel the lock of the exhaust temperature sensor	Whether to cancel the lock of the exhaust temperature sensor	是 Yes	否 No	0	设置参数 Set	Bool					
Bit 10	W/R	开关机记忆	ON/OFF memory	ON/OFF memory	开启 On	关闭 Off	0	设置参数 Set	Bool					
Bit 11	W/R	预留	Reserved	Reserved	/	/	/	/	Bool					
Bit 12	W/R	预留	Reserved	Reserved	/	/	/	/	Bool					
Bit 13	W/R	预留	Reserved	Reserved	/	/	/	/	Bool					
Bit 14	W/R	预留	Reserved	Reserved	/	/	/	/	Bool					
Bit 15	W/R	预留	Reserved	Reserved	/	/	/	/	Bool					
Byte 2	Bit 16	W	清除故障	Clear error	清除 Clear	不清除 Not clear	0	设置参数 Set	Bool			显示板 控制标 志位 2 Control Panel control flag 2		
	Bit 17	W/R	节能模式	Energy-saving mode	节能 On	非节能 Off	0	设置参数 Set	Bool					
	Bit 18	W/R	静音模式	Quiet mode	静音 On	非静音 Off	0	设置参数 Set	Bool					
	Bit 19	W/R	辅热使能	Electric heating	使能 On	关闭 Off	0	设置参数 Set	Bool					
	Bit 20	W/R	冬天防冻使能	Auto anti-freezing	使能 On	关闭 Off	0	设置参数 Set	Bool					
	Bit 21	W/R	预留	Reserved	/	/	/	/	Bool					
	Bit 22	W/R	预留	Reserved	/	/	/	/	Bool					
	Bit 23	W/R	预留	Reserved	/	/	/	/	Bool					
Byte 3	Bit 24	R	机组系统二排气感温包失灵锁定	Unit system 2 exhaust temperature sensor failure lock	锁定 Lock	不锁定 Unlock	0	状态参数 Status	Bool			显示板 状态标 志位 1 Control Panel status flag 1		
	Bit 25	R	机组系统一排气感温包失灵锁定	Unit system 1 exhaust temperature sensor failure lock	锁定 Lock	不锁定 Unlock	0	状态参数 Status	Bool					
	Bit 26	R	机组总故障标志位	Unit total fault flag	有	无	0	状态参数	Bool					



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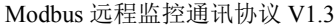
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Byte 7	Bit 50	R	预留	Reserved	Reserved	/	/	/	/	Bool		志位 4 Control Panel status flag 4	√	√
	Bit 51	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit 52	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit 53	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit 54	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit 55	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
Byte 7	Bit 56	R	模块一有无	Module 1 with or without	Module 1 with or without	有 With	无 Without	0	状态参数 Status	Bool		显示板 状态标 志位 5 Control Panel status flag 5	√	√
	Bit 57	R	模块二有无	Module 2 with or without	Module 2 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 58	R	模块三有无	Module 3 with or without	Module 3 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 59	R	模块四有无	Module 4 with or without	Module 4 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 60	R	模块五有无	Module 5 with or without	Module 5 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 61	R	模块六有无	Module 6 with or without	Module 6 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 62	R	模块七有无	Module 7 with or without	Module 7 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 63	R	模块八有无	Module 8 with or without	Module 8 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
Byte 8	Bit 64	R	模块九有无	Module 9 with or without	Module 9 with or without	有 With	无 Without	0	状态参数 Status	Bool		显示板 状态标 志位 6 Control Panel status flag 6	√	√
	Bit 65	R	模块十有无	Module 10 with or without	Module 10 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 66	R	模块十一有无	Module 11 with or without	Module 11 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 67	R	模块十二有无	Module 12 with or without	Module 12 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√
	Bit 68	R	模块十三有无	Module 13 with or without	Module 13 with or without	有 With	无 Without	0	状态参数 Status	Bool			√	√

	Bit 69	R	模块十四有无	Module 14 with or without	Module 14 with or without	有 With	无 Without	0	状态参数 Status	Bool				√	√
	Bit 70	R	模块十五有无	Module 15 with or without	Module 15 with or without	有 With	无 Without	0	状态参数 Status	Bool				√	√
	Bit 71	R	模块十六有无	Module 16 with or without	Module 16 with or without	有 With	无 Without	0	状态参数 Status	Bool				√	√
Byte 9	Bit 72	R	预留	Reserved	Reserved	/	/	/	/	Bool		显示板		√	√
	Bit 73	R	预留	Reserved	Reserved	/	/	/	/	Bool		预留		√	√
	Bit 74	R	预留	Reserved	Reserved	/	/	/	/	Bool		Control		√	√
	Bit 75	R	预留	Reserved	Reserved	/	/	/	/	Bool		Panel		√	√
	Bit 76	R	预留	Reserved	Reserved	/	/	/	/	Bool		reservat		√	√
	Bit 77	R	预留	Reserved	Reserved	/	/	/	/	Bool		ion		√	√
	Bit 78	R	预留	Reserved	Reserved	/	/	/	/	Bool		Mother		√	√
	Bit 79	R	预留	Reserved	Reserved	/	/	/	/	Bool		board status		√	√
Byte (27*X+10)	Bit (216*X+80)	R	总故障标志位	Total fault flag	Total fault flag	有故障 With	无故障 Without	0	状态参数 Status	Bool	任意系统有需停机的故障、保护 Unit has faults and protections that need to be shut down.	主板状态 1 Mainboard status 1	模块 Unit 1(X=0)	√	√
	Bit (216*X+81)	R	总报警标志位	Total alarm flag	Total alarm flag	有报警 With	无报警 Without	0	状态参数 Status	Bool	任意系统有不停机的报警 Unit has an alarm that does not stop.		模块 Unit 2(X=1)	√	√
	Bit (216*X+82)	R	机组开关机状态	Unit state	Unit state	开机 On	关机 Off	0	状态参数 Status	Bool	机组有开机命令后置 1，有关机命令且压缩机关闭后清零 The unit has a power-on command and is set to 1. After the machine command is issued and the compressor is turned		模块 Unit 3(X=2)	√	√
													模块 Unit 4(X=3)		
													模块		

											off, it is cleared.		Unit 5(X=4)	√	√
	Bit (216*X+83)	R	预留	Reserved	Reserved	/	/	/	/	Bool)	√	√
	Bit (216*X+84)	R	预留	Reserved	Reserved	/	/	/	/	Bool			模块	√	√
	Bit (216*X+85)	R	预留	Reserved	Reserved	/	/	/	/	Bool			Unit	√	√
	Bit (216*X+86)	R	预留	Reserved	Reserved	/	/	/	/	Bool			6(X=5)	√	√
	Bit (216*X+87)	R	预留	Reserved	Reserved	/	/	/	/	Bool)	√	√
Byte (27*X +11)	Bit (216*X+88)	R	预留	Reserved	Reserved	/	/	/	/	Bool		主板状 态 2 Mainbo ard status 2	模块	√	√
	Bit (216*X+89)	R	预留	Reserved	Reserved	/	/	/	/	Bool			Unit	√	√
	Bit (216*X+90)	R	预留	Reserved	Reserved	/	/	/	/	Bool			7(X=6)	√	√
	Bit (216*X+91)	R	预留	Reserved	Reserved	/	/	/	/	Bool)	√	√
	Bit (216*X+92)	R	预留	Reserved	Reserved	/	/	/	/	Bool			模块	√	√
	Bit (216*X+93)	R	预留	Reserved	Reserved	/	/	/	/	Bool			Unit	√	√
	Bit (216*X+94)	R	预留	Reserved	Reserved	/	/	/	/	Bool			8(X=7)	√	√
Byte (27*X +12)	Bit (216*X+95)	R	预留	Reserved	Reserved	/	/	/	/	Bool		主板状 态 3 Mainbo ard status 3)	√	√
	Bit (216*X+96)	R	预留	Reserved	Reserved	/	/	/	/	Bool			模块	√	√
	Bit (216*X+97)	R	预留	Reserved	Reserved	/	/	/	/	Bool			Unit	√	√
	Bit (216*X+98)	R	预留	Reserved	Reserved	/	/	/	/	Bool			9(X=8)	√	√
	Bit (216*X+99)	R	预留	Reserved	Reserved	/	/	/	/	Bool)	√	√
	Bit (216*X+100)	R	预留	Reserved	Reserved	/	/	/	/	Bool			模块	√	√
	Bit (216*X+101)	R	预留	Reserved	Reserved	/	/	/	/	Bool			Unit	√	√
Byte (27*X +13)	Bit (216*X+102)	R	化霜标志	Defrosting sign	Defrosting sign	正在化霜 With	没有化霜 Without	0	状态参数 Status	Bool		主板状 态 4 Mainbo ard status 4	10(X=9)	√	√
	Bit (216*X+103)	R	系统一排气感温包失灵锁定	Temperature sensor failure lock of system 1	Temperature sensor failure lock of system 1	锁定 Lock	不锁定 Unlock	0	状态参数 Status	Bool			模块	√	√
	Bit (216*X+104)	R	系统二排气感温包失灵锁定	Temperature sensor failure lock of system 2	Temperature sensor failure lock of system 2	锁定 Lock	不锁定 Unlock	0	状态参数 Status	Bool			Unit	√	√
Byte (27*X +13)	Bit (216*X+105)	R	系统一有无故障	System 1 failure	System 1 failure	有 With	无 Without	0	状态参数 Status	Bool		主板状 态 4 Mainbo ard status 4	12(X=11)	√	√
	Bit (216*X+106)	R	系统二有无故障	System 2 failure	System 2 failure	有 With	无 Without	0	状态参数 Status	Bool)	√	√

	Bit (216*X+107)	R	预留	Reserved	Reserved	/	/	/	/	Bool			模块 13(X=12) 模块 Unit	√	√
	Bit (216*X+108)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+109)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+110)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+111)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
Byte (27*X+14)	Bit (216*X+112)	R	水泵一状态	Water pump 1	Water pump 1	开启 On	关闭 Off	0	状态参数 Status	Bool		主板状态 5 Mainboard status 5	14(X=13) 模块 Unit 15(X=14) 模块 Unit 16(X=15)	√	√
	Bit (216*X+113)	R	水泵二状态	Water pump 2	Water pump 2	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+114)	R	辅助电加热一状态	Electric heater 1	Electric heater 1	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+115)	R	辅助电加热二状态	Electric heater 2	Electric heater 2	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+116)	R	风机一状态	Fan 1	Fan 1	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+117)	R	风机二状态	Fan 2	Fan 2	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+118)	R	压缩机一状态	Compressor 1	Compressor 1	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+119)	R	压缩机二状态	Compressor 2	Compressor 2	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
Byte (27*X+15)	Bit (216*X+120)	R	预留	Reserved	Reserved	/	/	/	/	Bool		主板状态 6 Mainboard status 6		√	√
	Bit (216*X+121)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+122)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+123)	R	预留	Reserved	Reserved	/	/	/	/	Bool				√	√
	Bit (216*X+124)	R	四通阀一状态	Four-way valve 1	Four-way valve 1	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+125)	R	四通阀二状态	Four-way valve 2	Four-way valve 2	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+126)	R	电磁阀一状态	Electromagnetic valve 1	Electromagnetic valve 1	开启 On	关闭 Off	0	状态参数 Status	Bool				√	√
	Bit (216*X+127)	R	电磁阀二状态	Electromagnetic valve 2	Electromagnetic valve	开启	关闭 Off	0	状态参数	Bool				√	√



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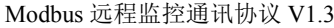
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											turned on, and when the disconnection is dry, the dry contact is disconnected. Dry contacts cannot be turned on in manual defrosting mode.			
Byte (27*X+19)	Bit (216*X+152)	R	预留	Reserved	Reserved	/	/	/	/	Bool		主板预留 Mainboard reservation	√	√
	Bit (216*X+153)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+154)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+155)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+156)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+157)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+158)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+159)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
Byte (27*X+20)	Bit (216*X+160)	R	跳线帽错误	Jumper error	Jumper error	有 With	无 Without	0	故障参数 Error	Bool		主板故障1 Mainboard error 1	√	√
	Bit (216*X+161)	R	空调水流开关故障	Air conditioning water flow switch error	Air-Con Water-FS	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+162)	R	系统一排气高温保护	Protection against high discharge temperature of system 1	Sys1 H-discharge-T	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+163)	R	系统二排气高温保护	Protection against high discharge temperature of system 2	Sys2 H-discharge-T	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+164)	R	系统一排气感温包失灵	Discharge temperature sensor error of system 1	Dis-TS1 malfunction	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+165)	R	系统二排气感温包失灵	Discharge temperature sensor error of system 2	Dis-TS2 malfunction	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+166)	R	系统一高压保护	Protection against high pressure of system 1	Sys1 high pressure	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+167)	R	系统二高压保护	Protection against high	Sys2 high pressure	有	无	0	故障参数	Bool			√	√

				pressure of system 2		With	Without		Error																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</
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	Bit (216*X+183)	R	系统二吸气感温包故障	Suction temperature sensor error of system 2	Suction TSE2	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X+23)	Bit (216*X+184)	R	系统一压力传感器故障	Pressure sensor error of system 1	Pressure TSE1	有 With	无 Without	0	故障参数 Error	Bool		主板故障 4 Mainboard error 4	√	√
	Bit (216*X+185)	R	系统二压力传感器故障	Pressure sensor error of system 2	Pressure TSE2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+186)	R	压缩机一驱动板通讯故障	Communication error of the drive board of compressor 1	Commu-E comp1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+187)	R	压缩机二驱动板通讯故障	Communication error of the drive board of compressor 2	Commu-E comp2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+188)	R	风机一驱动板通讯故障	Communication error of the drive board of fan 1	Commu-E fan1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+189)	R	风机二驱动板通讯故障	Communication error of the drive board of fan 2	Commu-E fan2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+190)	R	预留	Reserved	Reserved	/	/	/	/	Bool	曾使用：四通阀一异常保护 Protection against failure of four-way valve 1		√	√
	Bit (216*X+191)	R	预留	Reserved	Reserved	/	/	/	/	Bool	曾使用：四通阀二异常保护 Protection against failure of four-way valve 2		√	√
Byte (27*X+24)	Bit (216*X+192)	R	系统一壳管出管感温包故障	Shell-and-tube outlet temperature sensor error of system 1	Shell&tube outlet TSE1	有 With	无 Without	0	故障参数 Error	Bool		主板故障 5 Mainboard error 5	√	√
	Bit (216*X+193)	R	系统二壳管出管感温包故障	Shell-and-tube outlet temperature sensor error of system 2	Shell&tube outlet TSE2	有 With	无 Without	0	故障参数 Error	Bool			√	√

	Bit (216*X+194)	R	水泵一异常	Failure of pump1	Failure of pump1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+195)	R	水泵二异常	Failure of pump2	Failure of pump2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+196)	R	风机一故障	Fan1 error	Fan1 error	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+197)	R	风机二故障	Fan2 error	Fan2 error	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+198)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+199)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
Byte (27*X +25)	Bit (216*X+200)	R	压缩机一直流母线 电压过低或电压跌 落故障	DC busbar under-voltage or voltage drop error of compressor 1	DC under-voltageC1	有 With	无 Without	0	故障参数 Error	Bool		驱动板 故障 1 Driver board error 1	√	√
	Bit (216*X+201)	R	压缩机一直流母线 电压过高	DC busbar over-voltage or voltage drop error of compressor 1	DC over-voltageC1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+202)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+203)	R	压缩机一 IPM 异常	IPM failure of compressor 1	IPM errorC1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+204)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+205)	R	压缩机一启动失败	Startup failure of compressor 1	Startup failureC1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+206)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+207)	R	压缩机一驱动模块 复位	Drive module resetting of compressor 1	Dri-Mod resettingC1	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X +26)	Bit (216*X+208)	R	压缩机一过流	Over-current of compressor 1	Comp-Over-currentC1	有 With	无 Without	0	故障参数 Error	Bool		驱动板 故障 2 Driver board error 2	√	√
	Bit (216*X+209)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+210)	R	压缩机一电流检测 电路故障或电流传 感器故障	Current sensing circuit error or current sensor error of compressor 1	Current circuit SEC1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+211)	R	压缩机一失步	Desynchronizing of	DesynchronizingC1	有	无	0	故障参数	Bool			√	√



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	Bit (216*X+231)	R	压缩机二驱动模块复位	Drive module resetting of compressor 2	Dri-Mod resettingC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X+29)	Bit (216*X+232)	R	压缩机二过流	Over-current of compressor 2	Comp-Over-currentC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+233)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+234)	R	压缩机二电流检测电路故障或电流传感器故障	Current sensing circuit error or current sensor error of compressor 2	Current circuit SEC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+235)	R	压缩机二失步	Desynchronizing of compressor 2	DesynchronizingC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+236)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+237)	R	压缩机二驱动通讯故障	Communication error to the drive of compressor 2	Comp-Dri-Comm-EC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+238)	R	压缩机二散热片或IPM 模块或 PFC 模块温度温度过高	Heat sink or IPM or PFC over-temperature of compressor 2	HS-IPM-PFC over-TC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+239)	R	压缩机二散热片或IPM 模块或 PFC 模块温度传感器异常	Heat sink or IPM or PFC temperature sensor error of compressor 2	HS-IPM-PFC SEC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X+30)	Bit (216*X+240)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+241)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+242)	R	压缩机二充电回路故障	Charging circuit error of compressor 2	Charging circuit-EC2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+243)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+244)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+245)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+246)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+247)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
Byte (27*X+31)	Bit (216*X+248)	R	风机一直流母线电压过低或电压跌落故障	DC busbar under-voltage or voltage drop error of fan 1	DC under-voltageF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+249)	R	风机一直流母线电	DC busbar over-voltage or	DC over-voltageF1	有	无	0	故障参数	Bool			√	√

			压过高	voltage drop error of fan 1		With	Without		Error			error 7		
	Bit (216*X+250)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+251)	R	风机—IPM 异常	IPM failure of fan 1	IPM errorF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+252)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+253)	R	风机—启动失败	Startup failure of fan 1	Startup failureF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+254)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+255)	R	风机—驱动模块复位	Drive module resetting of fan 1	Dri-Mod resettingF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X +32)	Bit (216*X+256)	R	风机—过流	Over-current of fan 1	Fan-Over-currentF1	有 With	无 Without	0	故障参数 Error	Bool		驱动板 故障 8 Driver board error 8	√	√
	Bit (216*X+257)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+258)	R	风机—电流检测电路故障或电流传感器故障	Current sensing circuit error or current sensor error of fan 1	Current circuit SEF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+259)	R	风机—失步	Desynchronizing of fan 1	DesynchronizingF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+260)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+261)	R	风机—驱动通讯故障	Communication error to the drive of fan 1	Fan-Dri-Comm-EF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+262)	R	风机—散热片或 IPM 模块或 PFC 模块温度过高	Heat sink or IPM or PFC over-temperature of fan 1	HS-IPM-PFC over-TF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+263)	R	风机—散热片或 IPM 模块或 PFC 模块温度传感器异常	Heat sink or IPM or PFC temperature sensor error of fan 1	HS-IPM-PFC SEF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X +33)	Bit (216*X+264)	R	预留	Reserved	Reserved	/	/	/	/	Bool		驱动板 故障 9 Driver board error 9	√	√
	Bit (216*X+265)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+266)	R	风机—充电回路故障	Charging circuit error of fan 1	Charging circuit-EF1	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+267)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√

	Bit (216*X+268)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+269)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+270)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+271)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
Byte (27*X +34)	Bit (216*X+272)	R	风机二直流母线电压过低或电压跌落故障	DC busbar under-voltage or voltage drop error of fan 2	DC under-voltageF2	有 With	无 Without	0	故障参数 Error	Bool		驱动板 故障 10	√	√
	Bit (216*X+273)	R	风机二直流母线电压过高	DC busbar over-voltage or voltage drop error of fan 2	DC over-voltageF2	有 With	无 Without	0	故障参数 Error	Bool		Driver board error 10	√	√
	Bit (216*X+274)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+275)	R	风机二 IPM 异常	IPM failure of fan 2	IPM errorF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+276)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+277)	R	风机二启动失败	Startup failure of fan 2	Startup failureF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+278)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+279)	R	风机二驱动模块复位	Drive module resetting of fan 2	Dri-Mod resettingF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X +35)	Bit (216*X+280)	R	风机二过流	Over-current of fan 2	Fan-Over-currentF2	有 With	无 Without	0	故障参数 Error	Bool		驱动板 故障 11	√	√
	Bit (216*X+281)	R	预留	Reserved	Reserved	/	/	/	/	Bool		Driver board error 11	√	√
	Bit (216*X+282)	R	风机二电流检测电路故障或电流传感器故障	Current sensing circuit error or current sensor error of fan 2	Current circuit SEF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+283)	R	风机二失步	Desynchronizing of fan 1	DesynchronizingF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+284)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+285)	R	风机二驱动通讯故障	Communication error to the drive of fan 2	Fan-Dri-Comm-EF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+286)	R	风机二散热片或 IPM 模块或 PFC 模块温度温度过高	Heat sink or IPM or PFC over-temperature of fan 2	HS-IPM-PFC over-TF2	有 With	无 Without	0	故障参数 Error	Bool			√	√

	Bit (216*X+287)	R	风机二散热片或 IPM 模块或 PFC 模 块温度传感器异常	Heat sink or IPM or PFC temperature sensor error of fan 2	HS-IPM-PFC SEF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
Byte (27*X +36)	Bit (216*X+288)	R	预留	Reserved	Reserved	/	/	/	/	Bool		驱动板 故障 12 Driver board error 12	√	√
	Bit (216*X+289)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+290)	R	风机二充电回路故 障	Charging circuit error of fan 2	Charging circuit-EF2	有 With	无 Without	0	故障参数 Error	Bool			√	√
	Bit (216*X+291)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+292)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+293)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+294)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√
	Bit (216*X+295)	R	预留	Reserved	Reserved	/	/	/	/	Bool			√	√

六. 工程接线注意事项

6. Wiring Notices

- 1) 确保通讯线接入正确的接口，否则将通讯故障。
- 1) Make sure the communication cord is plugged into the right port; otherwise it would cause communication failure.
- 2) 用焊锡加固连接通讯线后，应使用绝缘胶布保护，以免氧化、短路。
- 2) Reinforce the stability of the communication cord through soldering and insulate it with the insulating tape to prevent oxidation and short circuit.
- 3) 在工程安装中，推荐使用的通讯线为由格力提供的双绞线。部分线路用户需自备五类屏蔽双绞线。
- 3) During the installation, it is strongly recommended to use the twisted pairs provided by GREE, and the user also should prepare some type V Shielded

Twisted Pair.

- 4) 工程接线长度数量根据工程需求而定，通讯距离每超过 800 米需要增加一个中继器，或者机组数量每超过 30 个也需要增加一个中继器。
- 4) The wiring length depends on the actual project. A repeater is required for every 800m communication distance or every 30 units.

七. BMS 系统常见故障排查

7. Common Failures of BMS System

故障现象 Failures	可能原因 Possible Causes	排除方法 Corrective Actions
BMS 系统根据提供的协议显示有通讯故障警告，某些或所有机组的运行状态显示不出来也无法进行控制 Based on the provided protocol BMS shows there is	通讯配置不正确 The communication settting is incorrect.	参照本指南第 4.3 点“硬件接口”重新配置通讯参数 Refer to Section 4.3 for resetting.
	RS485 接口 AB 通讯线接反 The communication lines to the RS485 interfaces are connected reversely.	参照本指南第三点“局域网接线”重新接线 Refer to Section 3 LAN Connection.

	通讯线有断线或接口接触不良 The communication line is broken or the communication interface is in poor contact.	焊接好断开的线路或重新接线 Repair or reconnect the broken line.
	通讯线短路 The communication line is shortcut.	维修短路的部分 Repair the shortcut communication line.
	双绞线与电源线太靠近 (小于 5CM) ,干扰太大造成通讯故障 The twisted pairs are too close to the power line (less than 5cm), resulting in too much interference which causes the communication failure.	将两种线分开走线, 如果无法分开大于 5CM 可以考据加屏蔽钢管 Separate the twisted pairs and the power line. If impossible, it is recommended to shield them with the steel pipe.
	BMS 接线错误 The BMS lines are connected incorrectly.	参照机组接线图 Refer to the wiring diagram.
	线缆不符合规范 The lines do not comply with reltive regulations.	参照本指南第六点 “工程接线注意事项” 选材 Refer to Section 6 Wring Notices
线路检查正常, 但所有机组或某些机组没有信息显示, 上位机设备上仍然有通讯故障 Although the communication line is in good condition, no information is displayed for some or all units. There is still communication failure with the master unit.	机组地址重复 The unit address is the same as the other.	检查机组显示器上 “远程监控地址” 参数, 并重新设置。 Check the “Modbus Address” setting through the control panel and reset it.
	通讯软件使用的串口和计算机连接的串口号不符 The serial port of the communication software fails to match with that of the PC.	换串口或更改软件上的串口设置 Replace the serial port or modify the setting of the serial port of the software.
	软件上添加的机组地址和实际机组的地址不相符 The unit address of the software does not match with the actual unit address.	修改软件机组地址设置 The unit address of the software does not match with the actual unit address.
	机组没有上电 The unit is not powered on.	给机组上电 Power on the unit.
	机组 BMS 接口故障 The BMS interface is faulty.	针对该机组进行单独通讯口测试 Test this communication interface separately.

附 录 A

Annex A

A.1 冗余循环码(CRC)的计算方法

A.1 CRC Calculation Method

CRC 码的计算方法是：先预置 16 位寄存器全为 1。再逐步把每 8 位数据信息进行处理。在计算 CRC 码时，8 位数据与寄存器的数据相异或，得到的结果向低位移一字节，用 0 填补最高位。再检查最低位，如果最低位为 1，把寄存器的内容与预置数相异或，如果最低位为 0，不进行异或运算。这个过程一直重复 8 次。第 8 次移位后，下一个 8 位数据再与现在寄存器的内容相异或，这个过程与以上一样重复 8 次。当所有的数据信息处理完后，最后寄存器的内容即为 CRC 码值。CRC 码中的数据发送、接收时低字节在前。

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 generation of 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 was 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 more 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 计算 CRC 码的程序步骤

A.2 How to Calculate the CRC

- 1) 寄存器为十六进制 FFFF (即全为 1)。称此寄存器为 CRC 寄存器。
- 1) Preload a 16-bit register with FFFF hex (all 1's). Call this the CRC register.

- 2) 把第一个 8 位数据与 16 位 CRC 寄存器的低位相异或，把结果放于 CRC 寄存器。
- 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) 把寄存器的内容右移一位（朝低位方向），用 0 填补最高位，移位前先检查最低位。
- 3) Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
- 4) 如果最低位为 0 则重复第 3 步(再次移位)；
- 4) If the lowest bit is 0, repeat step 3 (shift again);
- 5) 如果最低位为 1 则 CRC 寄存器与多项式 A001(1010 0000 0000 0001)进行异或运算。
- 5) (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).
- 6) 重复步骤 3 和 4，直到右移 8 次，这样整个 8 位数据全部进行了处理。
- 6) Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8-bit byte will have been processed.
- 7) 重复步骤 2 到步骤 5，进行下一个 8 位数据的处理。
- 7) Repeat Steps 2 and 5 to process the next 8-bit data.
- 8) 最后得到的 CRC 寄存器即为 CRC 码。
- 8) The final obtained CRC register is CRC.

A.3 CRC 实例程序（仅供参考）

A.3 CRC Example

参数：Data（数据块起始地址）、DataSize（数据块 Byte 的个数）

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

返回： CRC 计算结果：

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 为预置多项式, 常量值 //0xA001 is a preset multinomial, a constant.
            }
        }
    }
    return CRCode;
}
```


参考文献

References

- 1、 中华人民共和国国家标准化指导性技术文件中 GB/Z 19582.2-2004 《基于 Modbus 协议的工业自动化网络规范》。
1. GB/Z 19582.2-2004 Industrial Automation Network Regulation Based on Modbus Protocol.