

深圳旗首科技有限公司
Shenzhen Qishou Technology Limited

48V230AH电池组产品规格书

Product Specification for 48V 230AH Battery Pack



| | | |
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RS485 Communication Interface

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1. 产品概述

Product Overview

本产品由16串电芯组成的磷酸铁锂电池组（含BMS），本产品适用于工作电流在200A范围内的负载设备。

The lithium iron phosphate battery pack (including BMS) is composed of 16 strings of cells. It is applicable to load equipment with a working current of 200A or less.

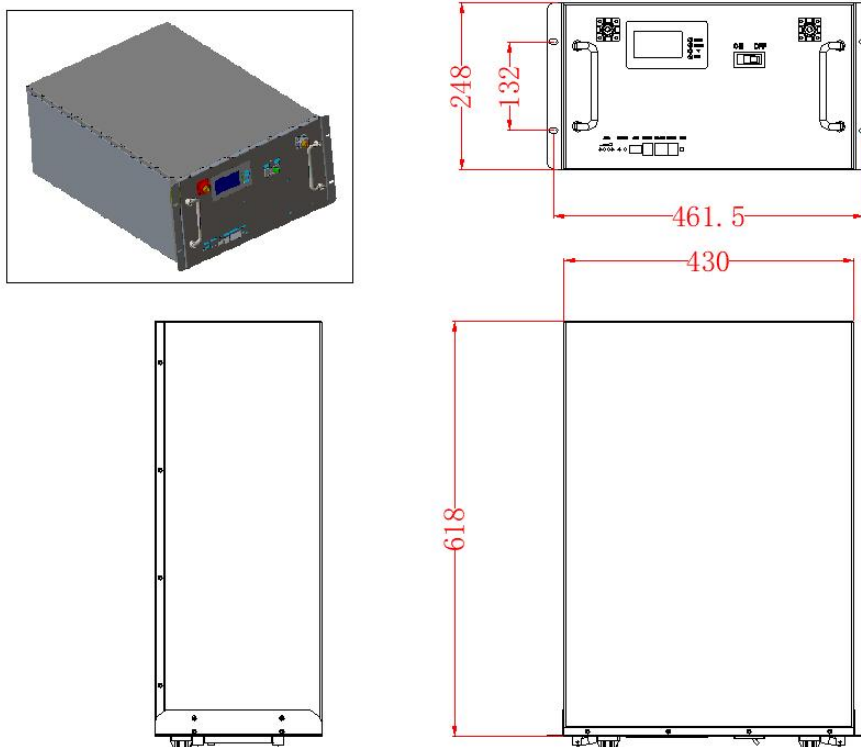
2. 产品技术规格

Product Technical Specifications

本产品型号为48V230Ah电池组，由16S1P电芯组成，最大持续充放电电流200A，带20A充电限流功能，带通讯功能（双RS485）带存储功能，带200A空开，机箱颜色为黑色。

This product model 48V230Ah battery pack is composed of 16S1P cells. The maximum continuous charge and discharge current is 200A, with 20A charging current limiting function, with communication function (dual RS485), with storage function, with 200A air switch, and the chassis color is black.

2.1 电池组产品结构图



2.2 电池系统技术参数

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| 序号 NO. | 项目名称 Project Name | 基本参数 Basic parameter | 备注 Notes |
|-----------|---|--|---|
| 1 | 产品型号 Product model | 48V230Ah | |
| 2 | 额定电压 Rated voltage | 51.2V | |
| 3 | 额定容量 Rated capacity | 230Ah | |
| 4 | 额定能量 Rated energy | 11776Wh | |
| 5 | 冷却方式 Cooling mode | 自然冷却 Natural Cooling | |
| 6 | 组合方式 Combination mode | 16串1并 16S1P | |
| 7 | 充放电端口 (共口或分口) Charge discharge port (common port or split port) | 共口 Coport | |
| 8 | 通讯端口 RS232/RS485/CAN Communication port RS232/RS485/CAN | RS232/RS485/CAN | |
| 9 | 显示屏 Screen | 带显示屏 With Screen | |
| 10 | 加热功能 Heating function | 默认无 Default None | 可先配 Optional |
| 11 | 电池组充电截止电压 Battery pack charging cut-off voltage | 57.6V | 充电保护电压 Charging protection voltage |
| 12 | 电池组放电截止电压 Battery pack discharge cut-off voltage | 43.2V | 放电保护电压 Discharging protection voltage |
| 13 | 单体充电截止电压 Cell charging cut-off voltage | 3.65 | |
| 14 | 单体放电截止电压 Cell discharging cut-off voltage | 2.7 | |
| 15 | 充电工作温度范围 Charging operating temperature range | -0 ~ 55℃ | |
| 16 | 放电工作温度范围 Discharge operating temperature range | -20 ~ 60℃ | |
| 17 | 标准充电 Standard charging | 0.2C电流持续充电至57.6V截止 Continuously charged at 0.2C current to 57.6V cut-off | |
| 18 | 标准放电 Standard discharging | 1C电流持续放电至43.2V截止 Continuously discharged at 1C current to 43.2V cut off | |
| 19 | 最大允许持续充电电流 | 200A | |

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| | | | | |
|----|--|---|---------------|----------|
| | | Maximum continuous charging current | | |
| 20 | | 最大允许持续放电电流 Maximum continuous discharge current | 200A | |
| 21 | | 放电保护电流 Discharge protection current | 220A | |
| 22 | | 电池箱尺寸(长*宽*高mm) Battery box size (L * W * H mm) | 618x430x248mm | 尺寸公差±2mm |
| 23 | | 电池箱重量公差(KG) Weight tolerance of battery box (KG) | 93 | 重量公差±3KG |

3. 电池管理 (BMS) 系统

Battery management system

3.1 BMS系统功能概述

Overview of BMS System Functions

3.1.1 提供单体和总压的过充、过放、短路、过流、高低温报警及保护功能。

Provide alarm and protection functions of overcharge, overdischarge, short circuit, over-current, high and low temperature for individual and total voltage.

3.1.2 具有10A充电限流功能。

With 10A charging current limiting function.

3.1.3 提供智能的均衡管理功能，充电均衡策略可灵活设置，能够有效提高电池的使用时间和循环寿命。

The intelligent balance management function is provided, and the charging balance strategy can be flexibly set, which can effectively improve the service time and cycle life of the battery.

3.1.4 两路RS485通讯,符合YD/T1363.3通讯规范，支持上位机对接，支持多组并联通讯。

Two RS485 communication channels, which comply with YD/T1363.3 communication specification, support upper computer docking and multiple groups of parallel communication.

3.1.5 提供多功能按键，实现复位、掉电、唤醒等功能。

Multi function keys are provided to realize reset, power down, wake-up and other functions.

3.1.6 具有待机休眠功能，使系统在非工作模式下保持低功耗。

With standby sleep function, the system can maintain low power consumption in non working mode.

3.1.7 BMS系统可以通过设置，使能系统进行运行数据的实时存储。用于系统的监控、分析与维护。

The BMS system can enable the system to store operation data in real time through setting. It

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is used for system monitoring, analysis and maintenance.

3.1.8 自带预充防短路功能。

It has the function of pre-charging and short circuit prevention function.

3.1.9 加热功能（选配）。

Heating is optional.

3.2 BMS系统参数设置

| 项目名称 Project name | 指标项目 Reference | 标准数值 Standard value |
|---|--|------------------------|
| 单体过充保护 Cell overcharge protection | 过充保护值 Overcharge protection value | 3.65±0.05V |
| | 过充告警值 Overcharge warning value | 3.55±0.05V |
| | 过充恢复值 Overcharge recovery value | 3.5±0.05V |
| 单体过放保护 Cell overdischarge protection | 过放保护值 Over discharge protection value | 2.7±0.05V |
| | 过放告警值 Over discharge alarm value | 2.8±0.05V |
| | 过放恢复值 Over discharge recovery value | 2.9±0.05V |
| 电池组过充保护 Battery pack overcharge protection | 过充保护值 Overcharge protection value | 57.6±0.05V |
| | 过充告警值 Overcharge warning value | 57±0.05V |
| | 过充恢复值 Overcharge recovery value | 56±0.05V |
| 电池组过放保护 Battery pack over-discharge protection | 过放保护值 Over discharge protection value | 43.2±0.05V |
| | 过放告警值 Over discharge alarm value | 46±0.05V |
| | 过放恢复值 Over discharge recovery value | 48±0.05V |
| 充电过流保护 Charge overcurrent protection | 充电过流1保护 Charge overcurrent 1 protection | 205A |
| | 充电过流1延时 Charging overcurrent 1 delay | 4000mS |
| | 充电过流2保护 Charge overcurrent 2 protection | 220A |

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| | | |
|--|---|---|
| | 充电过流2延时 Charging overcurrent 2 delay | 500mS |
| 放电过流保护 Discharge overcurrent protection | 放电过流1保护 Discharge overcurrent 1 protection | 205A |
| | 放电过流1延时 Discharging overcurrent 1 delay | 5000mS |
| | 放电过流2保护 Discharge overcurrent 2 protection | 220A |
| | 放电过流2延时 Discharging overcurrent 2 delay | 500mS |
| 短路保护 Short circuit protection | 短路保护电流 Short circuit protection current | 300A |
| | 短路保护延时 Short circuit protection delay | 300uS |
| | 短路保护解除 Short circuit protection release | 有充电时，短路保护解除 When charging, the short-circuit protection is released |
| | | 负载移除后，将自动解除 After the load is removed, it will be released automatically |
| 温度保护 Temperature protection | 充电高温保护 Charging high temperature protection | 60±2 °C |
| | 充电高温恢复 High temperature recovery in charging | 50±2 °C |
| | 充电低温保护 Charging low temperature protection | -5±2 °C |
| | 充电低温保护恢复 Charging low temperature protection recovery | 0±2 °C |
| | 放电高温保护 Discharge high temperature protection | 65±2 °C |
| | 放电高温恢复 Discharge high temperature recovery | 50±2 °C |
| | 放电低温保护 Discharge low temperature protection | -10±2 °C |
| | 放电低温保护恢复 Discharge low temperature protection recovery | 0±2 °C |
| | 均衡开启电压 Balancing start voltage | 3.5V |

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| | | |
|----------------------------------|---|------|
| 均衡功能 Equalization function | Equalization turn-on voltage | |
| | 均衡开启压差 Equalize opening voltage difference | 20mA |

3.3 LED指示灯说明

LED indicator description

LED 灯: 4 个绿色容量指示灯, 一个红色告警指示灯, 一个绿色运行指示灯

LED lights: 4 green capacity indicators, one red ALM(alarm) indicator and one green RUN indicator

| | | | | | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| SOC | | | | ALM | RUN |

3.4 容量指示说明

Capacity Indicator Description

| 状态 Status | 充电 Charge | | | | 放电 Discharge | | | |
|------------------------------|----------------|----------------|----------------|----------------|-----------------|----------|----------|----------|
| 容量指示灯 Capacity Indicator | L1 ● | L2 ● | L3 ● | L4 ● | L1 ● | L2 ● | L3 ● | L4 ● |
| 0-25% | 灭 Off | 灭 Off | 灭 Off | 闪烁2 Flash 2 | 灭 Off | 灭 Off | 灭 Off | 常亮 On |
| 25 ~ 50% | 灭 Off | 灭 Off | 闪烁2 Flash 2 | 常亮 On | 灭 Off | 灭 Off | 常亮 On | 常亮 On |
| 50 ~ 75% | 灭 Off | 闪烁2 Flash 2 | 常亮 On | 常亮 On | 灭 Off | 常亮 On | 常亮 On | 常亮 On |
| 75 ~ 100% | 闪烁2 Flash 2 | 常亮 On | 常亮 On | 常亮 On | 常亮 On | 常亮 On | 常亮 On | 常亮 On |
| 运行指示灯 ● Running Indicator | 常亮 On | | | | 闪烁3 Flash3 | | | |

3.5 状态指示说明

Status Indicator Description

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| 系统状态 System Status | 异常事件 Abnormal | RUN | ALM | 电量LED Capacity LED | | | | 说明 Instructions |
|-----------------------|---|----------------|----------------|---|---|---|---|--------------------|
| | | ● | ● | ● | ● | ● | ● | |
| 关机 Power Off | | 灭 Off | 灭 Off | 全灭 All off | | | | |
| 待机 Standby | 正常 Normal | 闪烁1 Flash 1 | 灭 Off | 全灭 All off | | | | |
| | 告警 Alarm | 闪烁1 Flash 1 | 闪烁2 Flash 2 | 全灭 All off | | | | |
| | 保护 Protection | 灭 Off | 常亮 On | 全灭 All off | | | | |
| 充电 Charge | 正常 Normal | 常亮 On | 灭 Off | 依据电量指示最高指示 LED闪烁2 LED Falsh 2 upon highest capacity indicator | | | | |
| | 过压告警 Overvoltage Alarm | 常亮 On | 灭 Off | 依据电量指示最高指示 LED闪烁2 LED Falsh 2 upon highest capacity indicator | | | | |
| | 过流、温度告警 Overcurrent / Temperature Alarm | 常亮 On | 闪烁2 Flash 2 | 依据电量指示最高指示 LED闪烁2 LED Falsh 2 upon highest capacity indicator | | | | |
| | 过压保护 Overvoltage Protection | 闪烁1 Flash 1 | 灭 Off | 常亮 On | | | | |
| | 过流保护 Overcurrent Protection | 常亮 On | 灭 Off | 依据电量指示最高指示 LED闪烁2 LED Falsh 2 upon highest capacity indicator | | | | |

| | | | | | | | |
|-----------------|--|----------------|----------------|---|--|--|--|
| 放电 Discharge | 正常 Normal | 闪烁3 Flash 3 | 灭 Off | 依据电量指示 According to capacity indicator | | | |
| | 告警 Alarm | 闪烁3 Flash 3 | 闪烁2 Flash 2 | 依据电量指示,最高指示 LED闪烁3 Flash 3 upon highest capacity indicator | | | |
| | 欠压保护 Undervoltage | 闪烁1 Flash 1 | 闪烁2 Flash 2 | 依据电量指示 According to capacity | | | |
| | 过流、短路、温度、 反接、保护 过流、短路、温度、 反接、保护 Overcurrent, short circuit, temperature, reverse connection, protection | 灭 Off | 常亮 On | 全灭 All off | | | |

3.6 LED灯闪烁说明

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LED Indicator Flashing Description

| 闪动方式 Flash mode | 亮 On | 灭 Off |
|--------------------|---------|----------|
| 闪1 Flash 1 | 0.25 S | 3.75 S |
| 闪2 Flash 2 | 0.5 S | 0.5 S |
| 闪3 Flash 3 | 0.5 S | 1.5 S |

3.7 复位键按键说明

RST Button Description

BMS 处于休眠状态时，按下按键 1S 后松开，保护板被激活，LED 指示灯从“L4”开始依次点亮 0.5 秒。

BMS 处于激活状态时，按下按键 3S 后松开，保护板被休眠，LED 指示灯从“RUN”依次点亮 0.5 秒。

When the BMS is in the sleep state, press the key for 1s and release it. The BMS is activated, and the LED indicator lights up in order for 0.5 seconds from "L4".

When the BMS is in the sleep state, press the key for 3s and release it. The BMS is in sleep state, and the LED indicator lights up in order for 0.5 seconds from "RU".

3.8 休眠与唤醒功能

Sleep and Wake Functions

3.8.1 休眠

Sleep

当满足以下任意一条件时，系统进入低功耗模式：

- ① 单体欠压保护或总体欠压保护 30 分钟内仍未解除。
- ② 按下按键达 3 秒钟后松开按键。
- ③ 最低单体电压低于休眠设定电压（默认值 3300mV），并且持续时间达到休眠延迟时间（默认值 1440 分钟）（同时满足无通讯、无充放电流）。
- ④ 通过上位机软件强制关机。

进入休眠前，需确保 P-端未接入外部电压，否则将无法进入低功耗模式。

When any of the following conditions is met, the system enters the low power consumption mode:

- ① The cell undervoltage protection or overall undervoltage protection has not been removed within 30 minutes.
- ② Press the key for 3 seconds and then release the key.
- ③ The minimum cell voltage is lower than the sleep setting voltage (default value 3300mV), and the duration reaches the sleep delay time (default value 1440 Minutes) (at the same time, no communication, no charge and discharge current).
- ④ Forced shutdown through the upper computer software.

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Before entering the sleep mode, make sure that the P - terminal is not connected to the external voltage, otherwise it will not be able to enter the low power consumption mode.

3.8.2 唤醒

Wake

当系统处于低功耗模式，满足以下任意一条件时，系统将退出低功耗模式，进入正常运行模式：

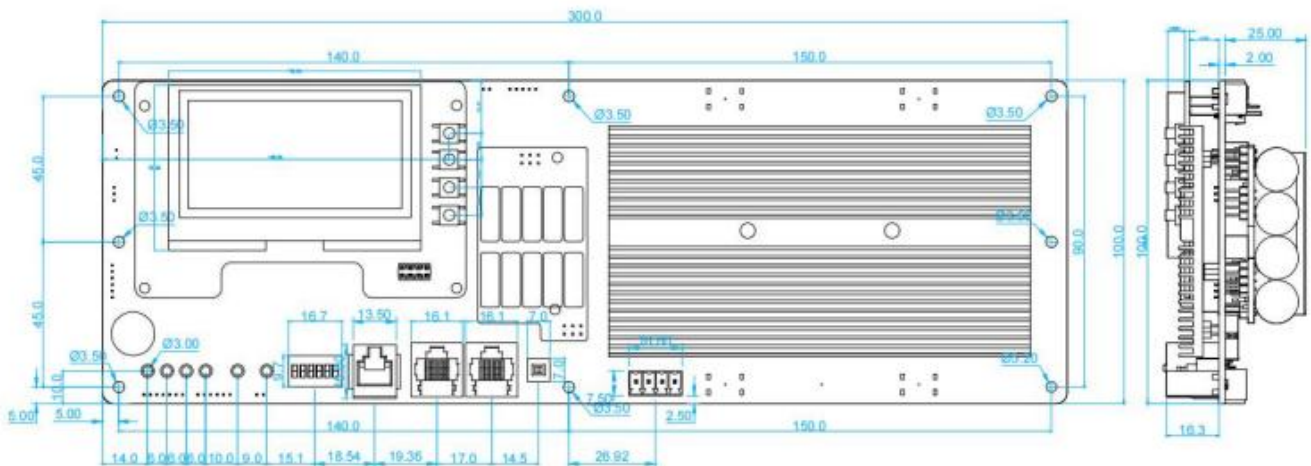
- ①接入充电器，充电器输出电压需大于等于 48V。
- ②按下按键 1S，松开按键后。
- ③接入 RS485 通讯线，开启上位机软件。

When the system is in the low power consumption mode and any of the following conditions are met, the system will exit the low power consumption mode and enter the normal operation mode:

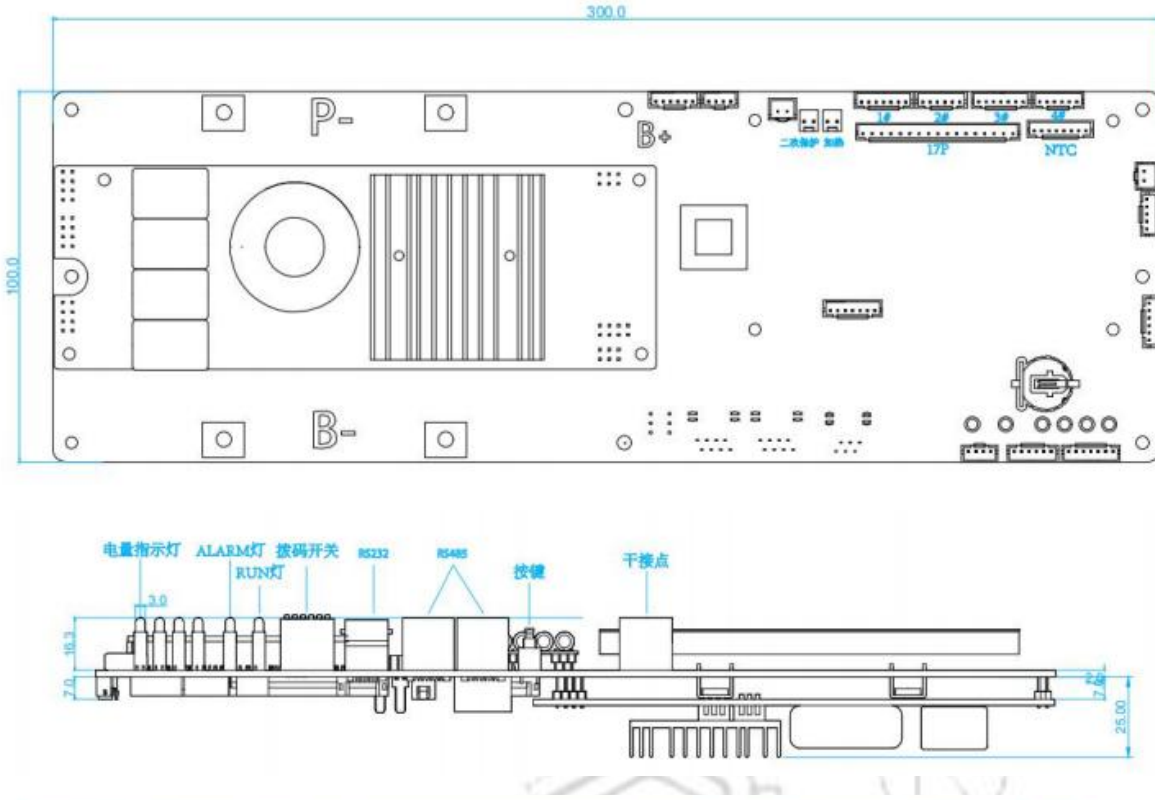
- ① When connected to the charger, the output voltage of the charger must be greater than or equal to 48V.
- ② Press the key 1S and release the key.
- ③ Connect RS485 communication line and start the upper computer software.

3.9 保护板尺寸实物图

BMS Physical Dimension Drawing



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L.2 反面实物图



备注：实物图仅供参考，以实物为准

Notes: For Reference only. The product may be a bit different from the picture.

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4. 通讯

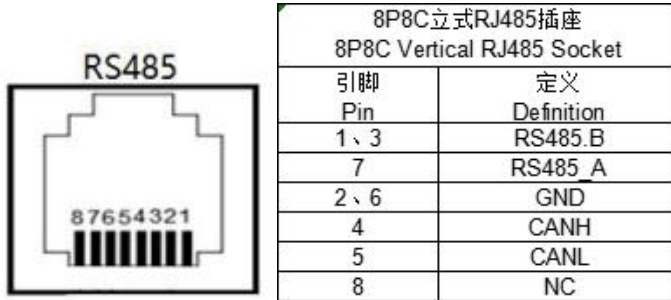
Communication

具有 RS485通讯接口，可以进行多机并联通讯，通讯规范需参考通讯协议说明书。

With RS485 communication interface, it can conduct multi battery parallel communication. For communication specifications, please refer to the communication protocol specification.

4.1 RS485通讯接口

RS485 communication interface

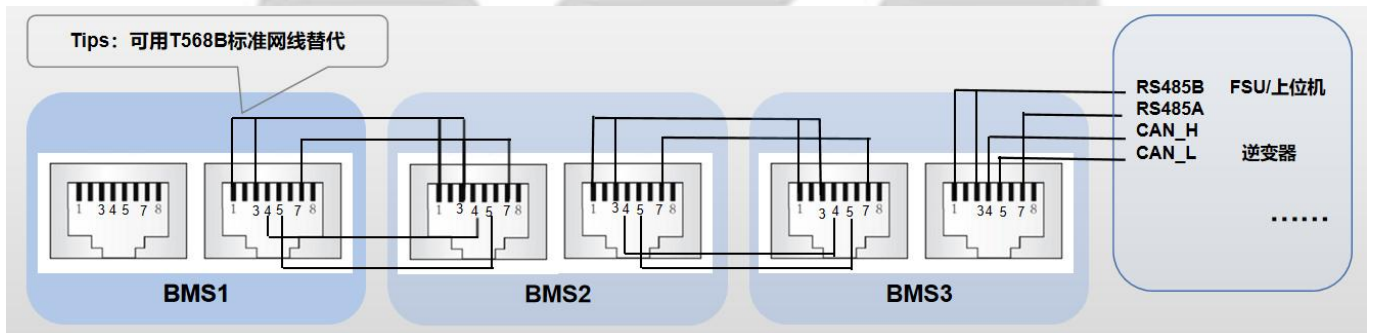


4.2 并机接口

Interface for parallel connections

BMS 电池包间通过 RS485 总线并联通讯，亦可与具有 RS485 总线的设备通讯，而 CAN 接口实现与 PC 或者其他智能终端通讯，人机交互 RS485 总线所并联的任一电池包信息，多机并联总线接口见下图所示。

The BMS batteries can communicate with each other through RS485 bus in parallel, and can also communicate with the equipment with RS485 bus. The CAN interface makes it communicate with PC or other intelligent terminal communication or man-machine interaction RS485 bus parallel connection of any battery pack information through RS485 interface. Multi batteries in parallel connection has bus interface shown in the figure below.



4.3 地址拨码开关

Address dial switch

4.3.1 拨码设置


Dial setting

在进行多机并联通讯操作时，需要先进行各 PACK 的拨码地址配置。拨码采用 BCD 码格式，

地址为 0 的定义为 (黑点是 OFF 状态，空白是 ON 状态，以下同) 地址 0，地址 1


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地址2  , 二进制, 其他地址以此类推。

When multiple batteries are in parallel connections for communication, the dial address needs to be set for each battery pack. The address adopts BCD code and define address 0 as



(Black signifies OFF, Empty means ON, Same as below), address 1 is  , address 2



, binary system, and so on.

4.3.2 上位机通讯地址拨码设置

Upper computer communication address dial setting

通讯在上位机的系统参数中输入当前要通讯的主或从机的码制, 通讯即可检测并通讯。

BMS 配置为单机工作模式, 拨码地址可为任意地址; BMS 配置为级联工作模式, 拨码地址从 1 至 15 拨选不同的地址。

Input the current master or slave code system in the system parameters of the upper computer, and the communication can be detected and made. The BMS is configured as a stand-alone operating mode, and the dial address can be any address; The BMS is configured to operate in cascade mode, and the dialling address is selected from 1 to 15.

4.3.3 从机设置

Slave Settings

根据设备顺序进行设置, 从机地址范围 0 到 15, 15 台并机。(如表 1)

Set according to the equipment sequence, and the slave address range is 0 to 15, with 15 paralleled batteries. (See Table 1)



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| 从机设置 (表1) | | | | | | | |
|-------------------------|--------|-----|-----|-----|-----|-----|-------------------------------|
| Slave setting (Table 1) | | | | | | | |
| 地址 | 拨码开关位置 | | | | 预留 | 主机 | 说明 |
| | #1 | #2 | #3 | #4 | #5 | #6 | |
| 0 | OFF | OFF | OFF | OFF | OFF | OFF | (从机) Pack0 (Slave) Pack0 |
| 1 | ON | OFF | OFF | OFF | OFF | OFF | (从机) Pack1 (Slave) Pack1 |
| 2 | OFF | ON | OFF | OFF | OFF | OFF | (从机) Pack2 (Slave) Pack2 |
| 3 | ON | ON | OFF | OFF | OFF | OFF | (从机) Pack3 (Slave) Pack3 |
| 4 | OFF | OFF | ON | OFF | OFF | OFF | (从机) Pack4 (Slave) Pack4 |
| 5 | ON | OFF | ON | OFF | OFF | OFF | (从机) Pack5 (Slave) Pack5 |
| 6 | OFF | ON | ON | OFF | OFF | OFF | (从机) Pack6 (Slave) Pack6 |
| 7 | ON | ON | ON | OFF | OFF | OFF | (从机) Pack7 (Slave) Pack7 |
| 8 | OFF | OFF | OFF | ON | OFF | OFF | (从机) Pack8 (Slave) Pack8 |
| 9 | ON | OFF | OFF | ON | OFF | OFF | (从机) Pack9 (Slave) Pack9 |
| 10 | OFF | ON | OFF | ON | OFF | OFF | (从机) Pack10 (Slave) Pack10 |
| 11 | ON | ON | OFF | ON | OFF | OFF | (从机) Pack11 (Slave) Pack11 |
| 12 | OFF | OFF | ON | ON | OFF | OFF | (从机) Pack12 (Slave) Pack12 |
| 13 | ON | OFF | ON | ON | OFF | OFF | (从机) Pack13 (Slave) Pack13 |
| 14 | OFF | ON | ON | ON | OFF | OFF | (从机) Pack14 (Slave) Pack14 |
| 15 | ON | ON | ON | ON | OFF | OFF | (从机) Pack15 (Slave) Pack15 |

5. 测试条件

Test conditions

特殊情况除外，所有测试条件都以标准测试条件为准：

环境温度：25±5 °C；环境湿度40%-80%RH

“标准充电”即在环境温度为 25°C±5°C 的条件下，先以恒定电流 0.2C 充电至57.6V，再以 57.6V 的恒压充电至电流小于 0.02C。

“标准放电”即在环境温度为 25°C±5°C 的条件下，以恒定电流 0.2C 放电到43.2V。

Except for special cases, all test conditions are based on standard test conditions:

Ambient temperature: 25±5 °C; Ambient humidity 40%-80%RH

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"Standard charging" means that under the condition of an ambient temperature of $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$, first charge the battery with a constant current of 0.2C to 57.6V, and then charge it with a constant voltage of 57.6V until the current is less than 0.02C.

"Standard discharge" means discharge to 43.2V at a constant current of 0.2C at an ambient temperature of $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$.

6. 电气性能、安全性能测试

Electrical performance & safety performance test

6.1 电气性能测试

Electrical performance test

| 测试项目 Test items | 测试标准 Test standard | 技术要求 Technical requirement |
|--|--|--|
| 25°C常温放电容量 Discharge Capacity under 25°C normal temperature | <p>电池组在标准测试条件下先以0.2C电流进行充满电后，再以0.2C电流进行放电，记录电池组的放电容量。</p> <p>The battery pack is fully charged with 0.2C current under standard test conditions, and then discharged with 0.2C current, and the discharge capacity of the battery pack is recorded.</p> | <p>$\geq 100\%$标称容量</p> <p>$\geq 100\%$ nominal capacity</p> |
| -10°C低温放电容量 Discharge Capacity under -10°C low temperature | <p>电池组在标准测试条件下先以0.2C电流进行充满电后，在-10°C低温环境温度存储10H，以0.2C电流进行放电至终止电压，记录电池组的放电容量。</p> <p>The battery pack is fully charged with 0.2C current under standard test conditions, stored for 10H at -10°C low temperature ambient temperature, discharged with 0.2C current to the termination voltage, and the discharge capacity of the battery pack is recorded.</p> | <p>$\geq 75\%$标称容量</p> <p>$\geq 75\%$ nominal capacity</p> |
| 55°C高温放电容量 Discharge Capacity under 55°C high temperature | <p>电池组在标准测试条件下先以0.2C电流进行充满电后，在55°C高温环境温度存储5H，以0.2C电流进行放电至终止电压，记录电池组的放电容量。</p> <p>The battery pack was fully charged with 0.2C current under standard test conditions, stored at 55°C high temperature ambient temperature for 5H, discharged with 0.2C current to the termination voltage, and the discharge capacity of the battery pack was recorded.</p> | <p>$\geq 95\%$标称容量</p> <p>$\geq 95\%$ nominal capacity</p> |
| | <p>电池组在标准测试条件下先以0.2C电流进行充放电后，记录初始容量，在标准测试条件下充满电，在$25^{\circ}\pm 5^{\circ}\text{C}$环</p> | <p>荷电保持率$\geq 95\%$;</p> |

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| | | |
|--|--|--|
| <p>荷电保持能力和容量恢复能力</p> <p>Charge retention and capacity recovery</p> | <p>环境温度下搁置30d, 以0.2C电流进行放电至终止电压测试保持容量, 以0.2C进行充电, 再以0.2C进行放电, 循环3次, 第三次为恢复容量</p> <p>The battery pack is first charged and discharged with 0.2C current under standard test conditions. The initial capacity is recorded. Fully charge it under standard test conditions, left for 30d at 25°±5C ambient temperature, and discharged with 0.2C current to the termination voltage. Test the maintain capacity. Charge at 0.2C, discharge at 0.2C, cycle 3 times, the third time is recovery capacity.</p> | <p>容量恢复率≥95%</p> <p>Charge retention rate ≥ 95%;</p> <p>Capacity recovery rate≥95%</p> |
| <p>25°C常温循环寿命</p> <p>Cycle life under 25°C normal temperature</p> | <p>电池组在标准测试条件下先以0.2C电流进行充满电后, 以0.2C电流进行放电, 25°C±5°C环境温度持续充放电测试, 当放电容量≤初始容量的80%时终止循环寿命测试</p> <p>The battery pack is fully charged with 0.2C current under standard test conditions, and then discharged with 0.2C current. Continuous charge-discharge test at 25°C±5°C ambient temperature, the cycle test is terminated when the discharge capacity is ≤80% of the initial capacity.</p> | <p>≥3000次</p> <p>≥3000 cycles</p> |
| <p>55°C高温循环寿命</p> <p>Cycle life under 55°C high temperature</p> | <p>电池组在标准测试条件下先以0.2C电流进行充满电后, 以0.2C电流进行放电, 55°C±5°C环境温度持续充放电测试, 当放电容量≤初始容量的80%时终止循环寿命测试</p> <p>The battery pack is fully charged with 0.2C current under standard test conditions, and then discharged with 0.2C current. Continuous charge and discharge test at 55°C±5°C ambient temperature. The cycle test is terminated when the discharge capacity is less than or equal to 80% of the initial capacity.</p> | <p>≥1500次</p> <p>≥1500 cycles</p> |

6.2 安全性能测试

Safety performance test

| 测试项目 | 测试标准 | 技术要求 |
|------------|---------------|-----------------------|
| Test items | Test standard | Technical requirement |

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| | | |
|---------------------------------------|---|----------------------------------|
| 外部短路测试 External short circuit test | <p>电池组在标准测试条件下进行充电，将充满电的电池组放置在防爆箱中，用内阻小于 100mΩ的导线短路于电池组外部的正负极，试验过程中记录电池表面温度，短路持续时间 10min，即完成测试。</p> <p>The battery pack is charged under standard test conditions. The fully charged battery pack is placed in an explosion-proof box, and the positive and negative electrodes outside the battery pack are short-circuited with wires with an internal resistance of less than 100mΩ. During the test, record the battery surface temperature and short-circuit duration. 10min to complete the test.</p> | 不起火、不爆炸 No fire, no explosion |
| 过充电测试 Overcharge test | <p>电池组在标准测试条件下进行充电后，用恒流恒压源对电池组某一单节进行 0.2C 充电，恒流充电至 5V 后转为恒压充电，直到截止电流到0A，结束试验。</p> <p>After the battery pack is charged under the standard test conditions, use a constant current and constant voltage source to charge a single cell of the battery pack at 0.2C, and then switch to constant voltage charging until the cut-off current reaches 0A, and the test is ended.</p> | 不起火、不爆炸 No fire, no explosion |
| 过放电测试 Over discharge test | <p>电池组在标准测试条件下进行充电后，用负载设备对电池组进行0.5C持续放电，直到某一单节电池电压到达 0~0.5V 时，结束试验。</p> <p>After the battery pack is charged under the standard test conditions, the battery pack is continuously discharged at 0.5C with the load device, and the test ends when the voltage of a single cell reaches 0~0.5V.</p> | 不起火、不爆炸 No fire, no explosion |

7. 产品包装要求

Product Package Requirement

7.1 电池箱外观良好，不能有掉漆、划伤、变形、破损等不良现象。

The appearance of the battery is good, and there should be no bad phenomena such as paint peeling, scratches, deformation, damage, etc.

7.2 包装前，电池要处于关机休眠状态。

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Before packaging, the battery should be in a power-off hibernation state.

7.3 电池外观要检验合格后，才能进行装箱。

The appearance of the battery must be inspected and qualified before packing.

7.4 外包装采用木箱包装，木箱上信息要清晰，木箱四周打钉处理，增加木箱强度和硬度，保证运输中安全。

The outer packaging is packed in wood case. The information on the case should be clear, and nailing shall be done around the wooden box to increase the strength and hardness of the wooden box to ensure that the battery box will not be scratched during transportation.

7.5 木箱内部要增加防护包材，以确保电池箱在运输中不被划伤。

Protective packaging materials shall be added inside the wooden box to ensure that the battery box will not be scratched during transportation.

7.6 木箱内部附有装箱清单。

The packing list is attached inside the wooden case.

8. 产品贮存与运输

Product storage and transportation

8.1 产品贮存

产品长期存放不使用时，应贮存在10℃~35℃干燥、清洁及通风良好的仓库内，避开易燃易爆物品；每三个月定期对电池组进行充点电维护，确保电池处于最佳性能状态。

Product storage

When the product is not in use for a long time, it should be stored in a dry, clean and well-ventilated warehouse at 10℃~35℃, avoiding inflammable and explosive materials; the battery pack should be charged and maintained regularly every three months to ensure that the battery best performance state.

8.2 产品运输

电池组应经过外部包装后才能运输，在运输过程中应防止剧烈震荡、冲击或挤压，防止日晒雨淋。

Product transportation

The battery pack can only be transported after external packaging. During transportation, it should be prevented from violent shock, impact or extrusion, and protected from the sun and rain.

9. 电池使用时警告及注意事项

Warnings and Precautions When Using Batteries

为防止电池可能发生泄漏、发热、爆炸，请注意以下预防措施

To prevent possible battery leakage, heat generation, and explosion, please observe the

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following precautions

警告！

- ① 严禁将电池浸入海水或水中,保存不用时,应放置于阴凉干燥的环境中
- ② 严禁颠倒正负极使用电池;
- ③ 禁止用金属直接连接电池正负极短路;
- ④ 禁止将电池与金属,如发夹、项链等一起运输或贮存;
- ⑤ 禁止敲击或抛掷、踩踏电池等;
- ⑥ 禁止直接焊接电池和用钉子或其它利器刺穿电池;

Warning !

- ① It is strictly forbidden to immerse the battery in seawater or water. When not in use, it should be placed in a cool and dry environment
- ② It is strictly forbidden to reverse the positive and negative poles to use the battery;
- ③ It is forbidden to use metal to directly connect the positive and negative electrodes of the battery to short circuit;
- ④ It is forbidden to transport or store batteries together with metals, such as hairpins, necklaces, etc.;
- ⑤ It is forbidden to knock or throw, step on the battery, etc.;
- ⑥ It is forbidden to directly weld the battery and pierce the battery with nails or other sharp objects;

注意！

- ① 禁止在高温下（炙热的阳光下或很热的汽车中）使用或放置电池，否则可能会引起电池过热、起火或功能失效、寿命减短；电池长期储存建议最佳温度为10-45℃。
- ② 禁止将电池丢于火或加热器中以防起火、爆炸及污染环境；报废电池应退回供应商或电池回收点处理。
- ③ 禁止在强静电和强磁场的地方使用，否则易破坏电池安全保护装置，带来不安全的隐患。
- ④ 若电池发生泄露，电解液进入眼睛，千万不可揉擦，应立即用清水冲洗眼睛，并立即送医院治疗，否则会伤害眼睛。如果电池发出异味，发热、变色、变形或使用、贮存、充电过程中出现任何异常，应立即将电池从装置或充电器中移离并停用。
- ⑤ 禁止将电池正负极直接插入电源插座中，必须选用锂离子电池专用充电器。
- ⑥ 安装前需检查电池电压和连接件，一切正常后方可使用。
- ⑦ 电池半电存贮，若电池三个月没有用过，需进行补充电一次。
- ⑧ 若电极弄脏，使用前应用干布抹净，否则可能会导致接触不良、功能失效。

Notice !

- ① It is forbidden to use or place the battery under high temperature (in the hot sun or in a very hot car), otherwise it may cause the battery to overheat, catch fire or fail to function, and shorten its life;

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the recommended temperature for long-term battery storage is 10-45°C .

- ② It is forbidden to throw batteries into fire or heaters to prevent fire, explosion and environmental pollution; scrapped batteries should be returned to the supplier or battery recycling point for disposal.
- ③ Do not use it in places with strong static electricity and strong magnetic fields, otherwise it will easily damage the battery safety protection device and bring unsafe hidden dangers.
- ④ If the battery leaks and the electrolyte enters the eyes, do not rub it. Immediately rinse the eyes with clean water and send them to the hospital for treatment, otherwise the eyes will be hurt. If the battery emits odor, heats up, discolors, deforms, or has any abnormality during use, storage, or charging, immediately remove the battery from the device or charger and stop using it.
- ⑤ It is forbidden to insert the positive and negative poles of the battery directly into the power socket, and a special charger for lithium-ion batteries must be used.
- ⑥ Before installation, check the battery voltage and connectors, and use it only after everything is normal.
- ⑦ The battery is stored in half power. If the battery has not been used for three months, it needs to be recharged once.
- ⑧ If the electrode is dirty, it should be wiped with a dry cloth before use, otherwise it may cause poor contact and function failure.

