



无人机专用智能电池管理系统

Smart Battery Management System for Drones

PRODUCT SPECIFICATION

产品名称 <i>Product Name</i>	12S 150A UAV BMS
产品型号 <i>Product Model</i>	EF-013
输出方式 <i>Output Mode</i>	MOS
产品工艺 <i>Product Technology</i>	PCBA 刷三防漆 / PCBA conformal coating
版本编号 <i>Version No.</i>	AYEF013-M000
尺寸 <i>Dimensions</i>	123.8 mm × 94.8 mm × 15 mm (±1 mm)
规格 <i>Configuration</i>	12S, common port, 20A charge, 150A discharge, CAN, BLE

客户确认 <i>Customer Confirmation</i>		
编制/日期 <i>Prepared by / Date</i>	审核/日期 <i>Reviewed by / Date</i>	批准/日期 <i>Approved by / Date</i>
客户签字/盖章 <i>Customer Signature / Company Seal</i>		

Shenzhen Ayaa Technology Co., Ltd.
<https://ayaaauavpower.com>
6M&6K&6L&15D Unit Maple Leaf Building, Nanshan Avenue, Nanshan District, Shenzhen, Guangdong,
China, 518052



Revision History



ISO 9001:2015



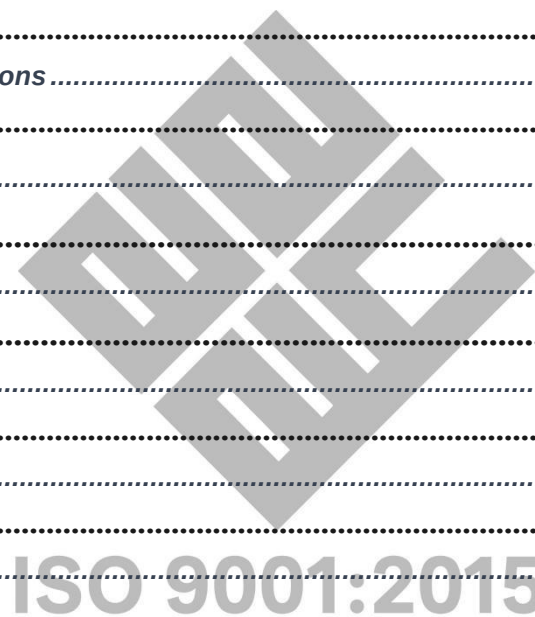
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1 产品概述

1 Product Overview

1.1 产品简介

1.1 Product Introduction

本产品为面向无人机锂电池组设计的 12S 150A 智能电池管理系统（BMS），采用 MOS 管输出与充放电共口结构，适用于单体电压范围为 3.0 V ~ 4.25 V 的锂电池组。板卡采用 PCBA 刷三防漆工艺，集成电芯电压采样、充放电控制、被动均衡、温度监测、CAN 通信及蓝牙功能。

This product is a 12S 150A smart Battery Management System (BMS) for drone lithium battery packs. It uses MOSFET output and a common charge/discharge port, is suitable for a cell-voltage range of 3.0 V to 4.25 V, and uses PCBA conformal coating. It integrates cell-voltage sampling, charge/discharge control, passive balancing, temperature monitoring, CAN communication, and BLE.

BMS 在地面工况下对电压、电流和温度异常执行保护；飞行工况下，相关异常以告警和通信数据形式提示，不产生保护作用。

The BMS provides protection against voltage, current, and temperature anomalies during ground operations; during flight operations, such anomalies are indicated through alarms and communication data but do not trigger protective actions.

1.2 功能配置

1.2 Functional Configuration

功能 Function	配置 Configuration	功能 Function	配置 Configuration
支持串数 Supported Series Cells	12S	输出方式 Output Type	MOS 管 MOSFET
持续放电电流 Continuous Discharge Current	150 A	持续充电电流 Continuous Charge Current	20 A
接口类型 Port Type	充放电共口 Common charge/discharge port	CAN 通信 CAN Communication	支持，带 120 Ω 终端电阻 Supported, with 120 Ω termination
蓝牙模块 BLE Module	标配 Standard	RS485 (隔离) RS485 (isolated)	不支持 Not supported
UART (隔离) UART (isolated)	不支持 Not supported	温度采样 Temperature Sensing	3 路电芯 + 1 路 MOS + 1 路连接器 3 cell + 1 MOS + 1 connector channel
均衡方式 Balancing Method	被动均衡 Passive balancing	蓝牙模块 BLE Module	标配 Standard
预放电功能 Pre-discharge Function	标配 Standard	开关功能 Switch Function	标配 Standard
充电限流功能 Charge Current Limit	不支持 Not supported	二次保护功能 Secondary Protection	未配置 Not configured
历史记录 History Storage	标配 Standard	电池组并联 Battery Packs in Parallel	标配 Standard
电池组串联 Battery Packs in Series	未配置 Not configured	LED 指示接口 LED Indicator Interface	未配置 Not configured
加热功能 Heating Function	/	GPS 接口 GPS Interface	未配置 Not configured
LCD 显示屏 LCD Display	不支持 Not supported	非隔离通信 Non-isolated Communication	不支持与充电器或负载通信 Not for charger/load communication



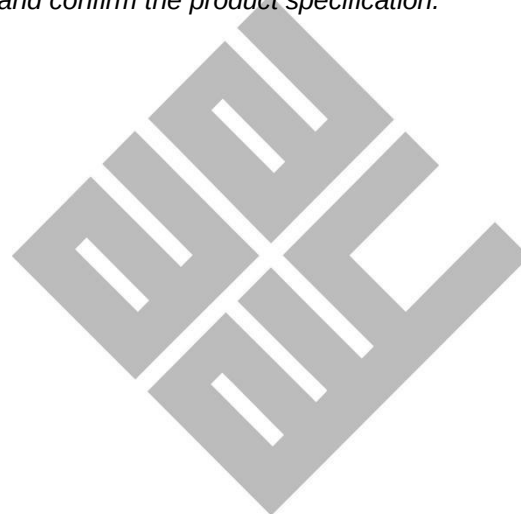
1.3 关键物料清单

1.3 Bill of Critical Materials

序号 No.	物料名称 Material	用途 Function	封装 Package	数量 Qty.
1	GD32F103RCT6	MCU Microcontroller	TQFP48	1
2	BQ7694003DBTR	电池采集与保护芯片 Battery monitor and protection IC	TSSOP44	1
3	JMSH1001PTL	MOS 管 MOSFET	TOLL	20

重点说明：为保障供应链的安全，所有 BMS 物料，尤其是关键器件我司都会有同品质同规格的替代方案，如有认证需求不允许更换或需经客户端确认才能更换物料，需通知我司业务重新送样方案，并确认规格书。

Note: To ensure the safety of the supply chain, we have alternative materials of the same quality and specifications for all Battery Management System (BMS) materials, particularly the key components. If there are certification requirements where replacement is not allowed, or if a client's approval is required for replacement, please notify our sales representatives to resend sample proposals and confirm the product specification.



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2 电气特性

2 Electrical Characteristics

2.1 基本参数

2.1 Basic Parameters

注：除非另有说明，以下参数在 25°C 环境温度下测试。

Note: Unless otherwise specified, the following parameters are tested at an ambient temperature of 25°C.

项目 Item	规格 Specification
电池包规格 Battery Pack Specification	12S
充电电压 Charging Voltage	50.4 V
单体电压范围 Cell Voltage Range	3.0 V ~ 4.25 V
持续充电电流 Continuous Charge Current	20 A
持续放电电流 Continuous Discharge Current	150 A
通信接口 Communication Interface	CAN , 波特率 1 Mbps , BMS ID : 1 CAN, baud rate 1 Mbps, BMS ID: 1
运行功耗 Operating Consumption	≤20 mA
休眠功耗 Sleep Consumption	≤2 mA
休眠条件 Sleep Conditions	无电流、无通信、无保护状态 No current, no communication, and no protection event
深度休眠功耗 Deep-sleep Consumption	≤300 μA (单体欠压状态) ≤300 μA (cell under-voltage state)
深度休眠条件 Deep-sleep Conditions	单体欠压状态 Cell under-voltage state
工作温度 Operating Temperature	-20°C ~ 70°C
板卡尺寸 (长×宽×高) Board Size (L×W×H)	123.8 mm × 94.8 mm × 15 mm , ±1 mm



2.2 保护与均衡参数

2.2 Protection and Balancing Parameters

注：以下保护参数为来源产品规格书列示值。

Note: The following protection parameters are values stated in the source product specification.

单体电压与均衡参数 Cell Voltage and Balancing Parameters				
项目 Item	最小 Min	典型 Typ	最大 Max	单位 Unit
单体过充保护电压 Cell Over-charge Protection Voltage	4.23	4.25	4.27	V
单体过充保护延时 Cell Over-charge Protection Delay	1	2	3	s
单体过充恢复电压 Cell Over-charge Recovery Voltage	4.08	4.10	4.12	V
单体欠压保护电压 Cell Under-voltage Protection Voltage	2.98	3.00	3.02	V
单体欠压保护延时 Cell Under-voltage Protection Delay	1	2	3	ms
单体欠压恢复电压 Cell Under-voltage Recovery Voltage	3.28	3.30	3.32	V
均衡开启电压 Balancing Start Voltage	3.98	4.00	4.02	V
均衡开启压差 Balancing Start Voltage Difference	0.03	0.05	0.07	V
均衡电流 Balancing Current	60	70	80	mA
均衡方式 Balancing Method	被动均衡 Passive balancing	被动均衡 Passive balancing	被动均衡 Passive balancing	/

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电流与短路保护参数

Current and Short-circuit Protection Parameters

项目 Item	最小 Min	典型 Typ	最大 Max	单位 Unit
充电过流保护电流 Charge Over-current Protection Current	30	34	38	A
充电过流保护延时 Charge Over-current Protection Delay	9	10	11	s
充电过流恢复 Charge Over-current Recovery	自动恢复 Automatic recovery	30 s	自动恢复 Automatic recovery	/
放电一级过流告警电流 Discharge Over-current Warning Current	215	220	225	A
放电一级过流告警延时 Discharge Over-current Warning Delay	9	10	11	s
放电二级过流保护电流 Discharge 2nd-level Over-current Protection	790	800	810	A
放电二级过流保护延时 Discharge 2nd-level Over-current Protection Delay	300	400	500	ms
放电过流恢复 Discharge Over-current Recovery	自动恢复 Automatic recovery	30 s	自动恢复 Automatic recovery	/
短路保护电流 Short-circuit Protection Current	1590	1600	1610	A
短路保护延时 Short-circuit Protection Delay	100	200	300	μs
短路保护恢复 Short-circuit Protection Recovery	延时自动恢复 Delayed automatic recovery	30 s	延时自动恢复 Delayed automatic recovery	/

短路电流的最小值与最大值为短路保护功能的有效作用范围；实际短路电流低于最小值或高于最大值均可能导致短路保护失效。进行短路测试前，应充分评估实际短路电流值或串联电阻。

The minimum and maximum short-circuit current values define the effective range of the short-circuit protection function. A current below the minimum or above the maximum may cause the function to fail. Assess the actual short-circuit current or series resistance before testing.



温度与总压保护参数

Temperature and Pack-voltage Protection Parameters

项目 Item	最小 Min	典型 Typ	最大 Max	单位 Unit
充电高温保护 / 恢复 Charge High-temperature Protection / Recovery	52 / 42	55 / 45	58 / 48	°C
充电低温保护 / 恢复 Charge Low-temperature Protection / Recovery	-3 / 0	0 / 3	3 / 6	°C
放电高温保护 / 恢复 Discharge High-temperature Protection / Recovery	72 / 52	75 / 55	78 / 58	°C
放电低温保护 / 恢复 Discharge Low-temperature Protection / Recovery	-33 / -23	-30 / -20	-27 / -17	°C
MOS 高温保护 / 恢复 MOS High-temperature Protection / Recovery	87 / 77	90 / 80	93 / 83	°C
总压过充保护电压 Pack Over-charge Protection Voltage	50.8	51.0	51.2	V
总压过充保护延时 Pack Over-charge Protection Delay	1	2	3	s
总压过充恢复电压 Pack Over-charge Recovery Voltage	49.0	49.2	49.4	V
总压欠压保护电压 Pack Under-voltage Protection Voltage	47.8	48.0	48.2	V
总压欠压保护延时 Pack Under-voltage Protection Delay	1	2	3	s
总压欠压恢复电压 Pack Under-voltage Recovery Voltage	39.4	39.6	39.8	V
加热开启温度 Heating Opening Temperature	-3	0	3	°C
加热停止温度 Heating Stop Temperature	7	10	13	°C
加热电流 Heating Current	/	/	/	A
加热方式 Heating Method	/	/	/	/

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注：以上保护参数仅适用于无人机在地面时；飞行过程中 BMS 产生告警信号，不产生保护动作。

Note: The above protection parameters apply only when the drone is on the ground. During flight, the BMS generates alarm signals without protective action.



3 工作模式与指示

3 Operating Modes and Indication

3.1 工作模式说明

3.1 Operating Mode Description

BMS 上电自检正常后进入正常工作模式，实时监测电芯电压、电流、温度、保护状态和通信状态。无电流、无通信且无保护动作时，BMS 可进入休眠；任一电芯进入欠压状态时，BMS 可进入深度休眠。

After passing power-on self-test, the BMS enters normal operating mode and monitors cell voltage, current, temperature, protection status, and communication status in real time. It may enter sleep when there is no current, no communication, and no protection event; it may enter deep sleep when any cell reaches the under-voltage state.

可通过外部开关、充电或放电动作唤醒休眠状态。

Sleep mode can be woken by the external switch, charging, or discharging.

3.2 指示灯说明

3.2 LED Indication

指示状态 Indication	含义 Meaning
约每秒闪烁 1 次 Approx. 1 flash per second	BMS 自检与运行正常 BMS self-test and operation are normal
约每秒闪烁 3 次 / 快闪 Approx. 3 flashes per second / fast flashing	存在告警或保护异常，请通过 CAN 或蓝牙读取状态 Alarm or protection abnormality; read status via CAN or BLE
约每 10 秒闪烁 1 次 Approx. 1 flash per 10 seconds	BMS 处于休眠状态 BMS is in sleep mode

3.3 均衡功能

3.3 Balancing Function

产品采用被动均衡。达到均衡开启电压且单体压差满足开启条件时，BMS 对最高电压单体进行均衡；均衡电流典型值为 70 mA。

The product uses passive balancing. When the balancing start voltage is reached and the cell-voltage difference meets the start condition, the BMS balances the highest-voltage cell. The typical balancing current is 70 mA.

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4 功能示意图

4 Functional Diagram

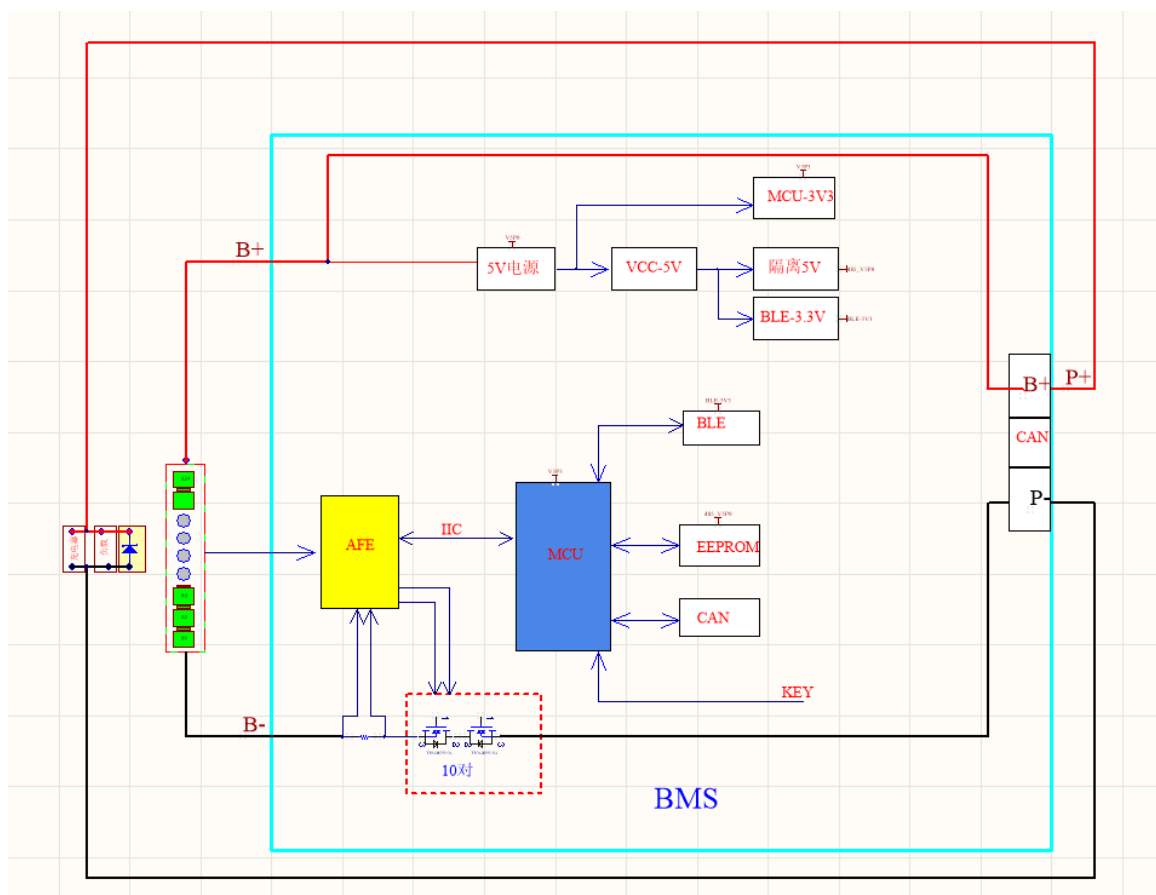


图 1 BMS 功能示意图

Figure 1 BMS Functional Block Diagram

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5 PCB、接口与尺寸

5 PCB, Interfaces and Dimensions

5.1 产品实物图

5.1 Product Photographs

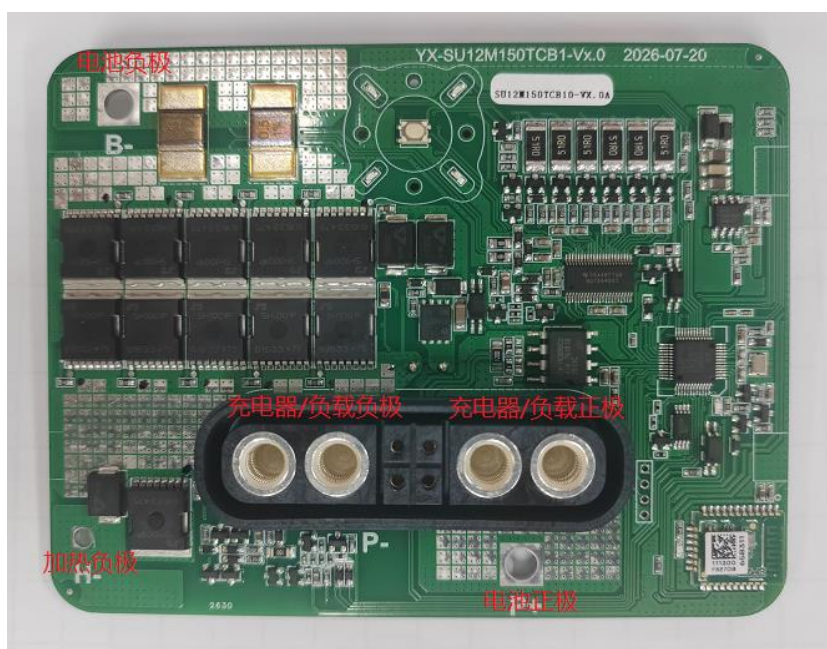


图 2 BMS 正面

Figure 2 BMS Front View

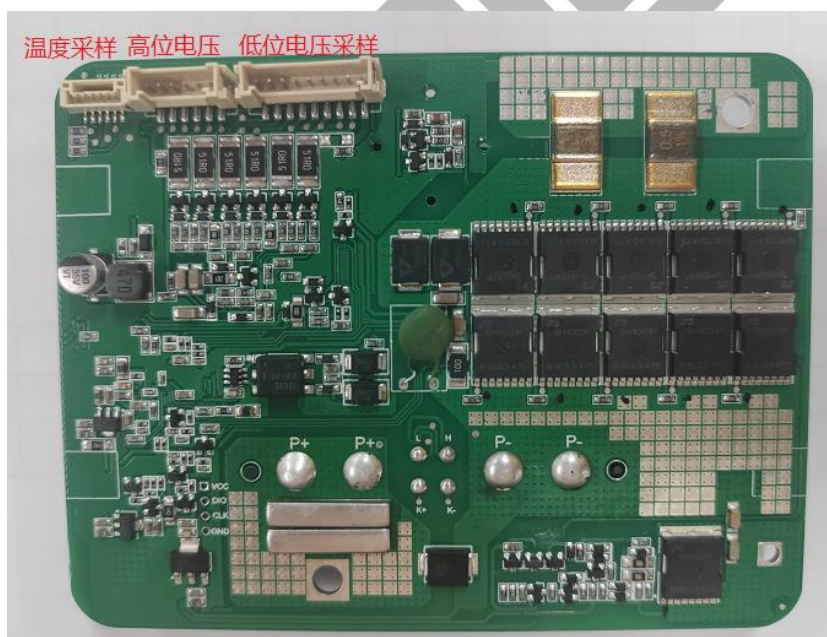


图 3 BMS 背面

Figure 3 BMS Rear View



5.2 电压采样接口定义

5.2 Cell Voltage Sampling Interface

低位序号 Low-position No.	引脚 Pin	定义 Pin Function
1	NC	预留 Reserved
2	B0	第 1 串电池负极 Negative side of Cell 1
3	B1	第 1 串电池正极 Positive side of Cell 1
4	B2	第 2 串电池正极 Positive side of Cell 2
5	B3	第 3 串电池正极 Positive side of Cell 3
6	B4	第 4 串电池正极 Positive side of Cell 4
7	B5	第 5 串电池正极 Positive side of Cell 5
8	B6	第 6 串电池正极 Positive side of Cell 6
9	B7	第 7 串电池正极 Positive side of Cell 7
高位序号 High-position No.	引脚 Pin	定义 Pin Function
1	B8	第 8 串电池正极 Positive side of Cell 8
2	B9	第 9 串电池正极 Positive side of Cell 9
3	B10	第 10 串电池正极 Positive side of Cell 10
4	B11	第 11 串电池正极 Positive side of Cell 11
5	B12	第 12 串电池正极 Positive side of Cell 12
6	B+	第 12 串电池正极 Positive side of Cell 12



5.3 温度与连接器接口

5.3 Temperature and Connector Interfaces

序号 No.	引脚 Pin	定义 Pin Function
1	T1-	温度传感器 1 负极 Temperature sensor 1 negative
2	T1+	温度传感器 1 正极 Temperature sensor 1 positive
3	T2-	温度传感器 2 负极 Temperature sensor 2 negative
4	T2+	温度传感器 2 正极 Temperature sensor 2 positive
5	T3-	温度传感器 3 负极 Temperature sensor 3 negative
6	T3+	温度传感器 3 正极 Temperature sensor 3 positive
序号 No.	引脚 Pin	定义 Pin Function
1	P+	充电器/负载正极 Charger/load positive
2	P+	充电器/负载正极 Charger/load positive
3	P-	充电器/负载负极 Charger/load negative
4	P-	充电器/负载负极 Charger/load negative
5	K-	GND 或 NC GND or NC
6	K+	唤醒输入 Wake-up input
7	GND	UART 电源负极 UART power negative
8	VCC	UART 电源正极 UART power positive

CAN 通信的 GND 应与外部设备 GND 可靠连接，以降低信号干扰和数据丢失风险。

The CAN GND shall be reliably connected to the external-device GND to reduce signal interference and data-loss risk.



5.4 产品尺寸

5.4 Product Dimensions

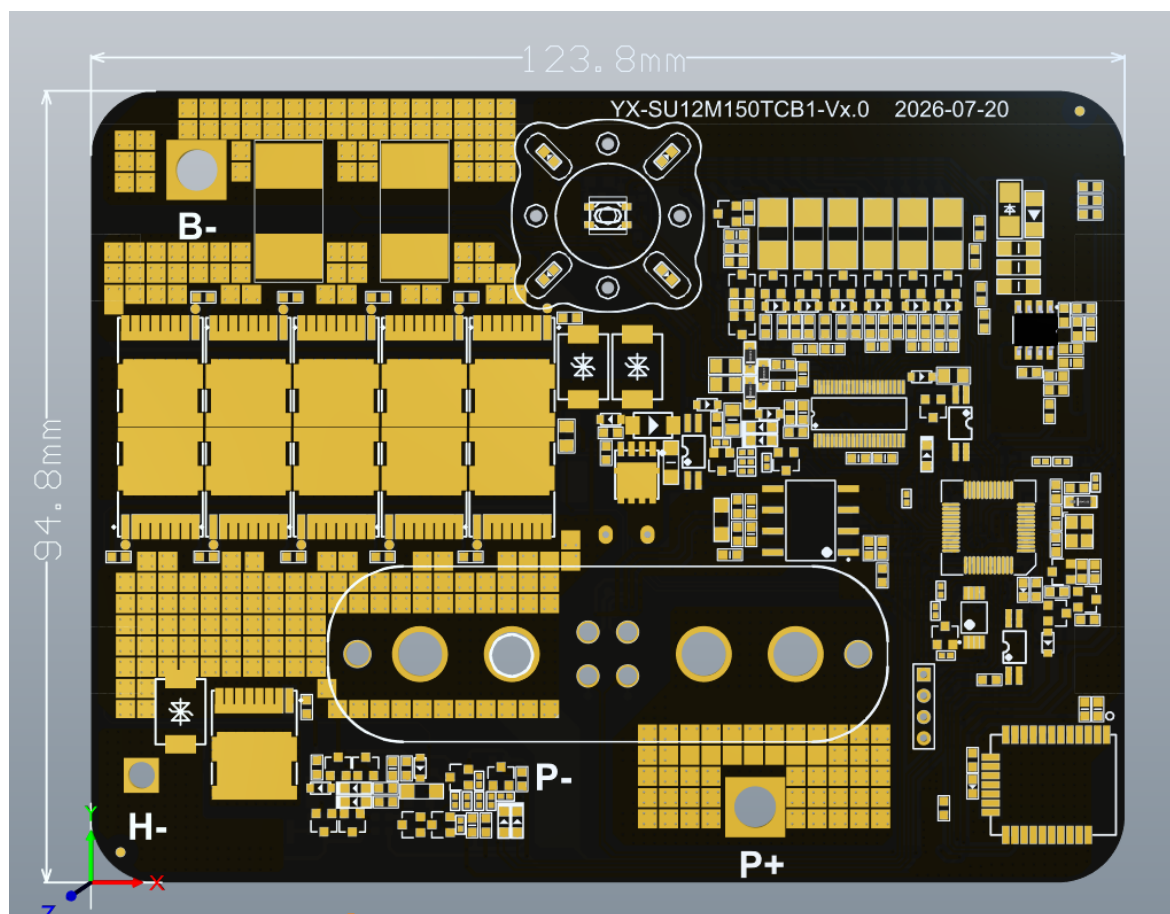


图 4 BMS 板尺寸图 (123.8 mm × 94.8 mm)

Figure 4 BMS Dimensions (123.8 mm × 94.8 mm)



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5.5 线束定义

5.5 Wiring Harness Definitions

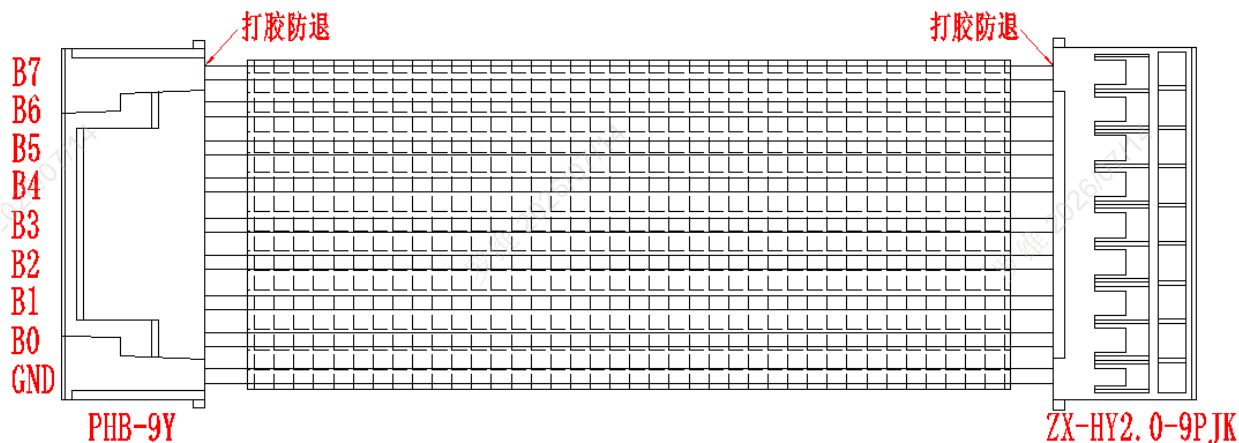


图 5 低位电池电压采样线束

Figure 5 Low-position Cell-voltage Sampling Harness

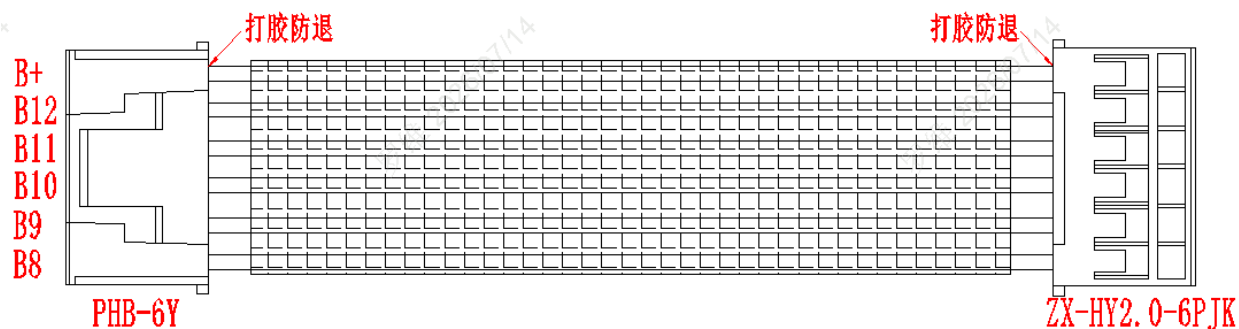


图 6 高位电池电压采样线束

Figure 6 High-position Cell-voltage Sampling Harness

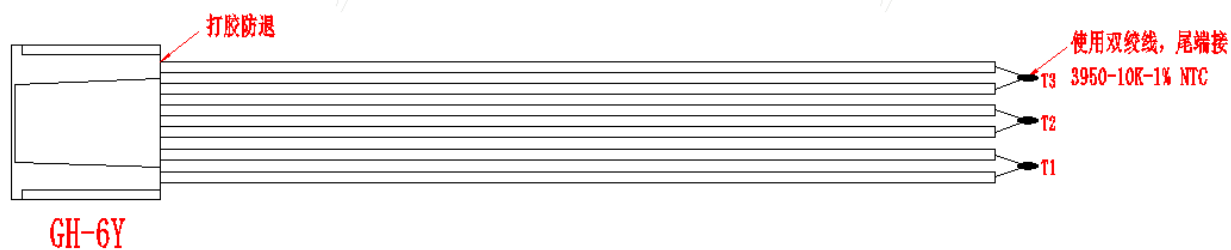


图 7 温度采样线束

Figure 7 Temperature Sampling Harness



6 通信说明

6 Communication

6.1 CAN 通信

6.1 CAN Communication

产品支持 CAN 通信，波特率为 1 Mbps，默认 BMS ID 为 1；CAN 接口带 120 Ω 终端电阻。

The product supports CAN communication with a baud rate of 1 Mbps and a default BMS ID of 1. The CAN interface includes a 120 Ω termination resistor.

6.2 上位机与蓝牙

6.2 Host Computer and BLE

通过 CAN 上位机或蓝牙可读取单体电压、总压、电流、温度、保护状态和历史记录，并可用于工程调试。参数变更应由具备权限的工程人员执行。

The CAN host computer or BLE can read cell voltage, pack voltage, current, temperature, protection status, and historical records, and can be used for engineering commissioning. Parameter changes shall be performed only by authorized engineering personnel.



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7 安装与接线

7 Installation and Wiring

7.1 充放电接线

7.1 Charge and Discharge Wiring

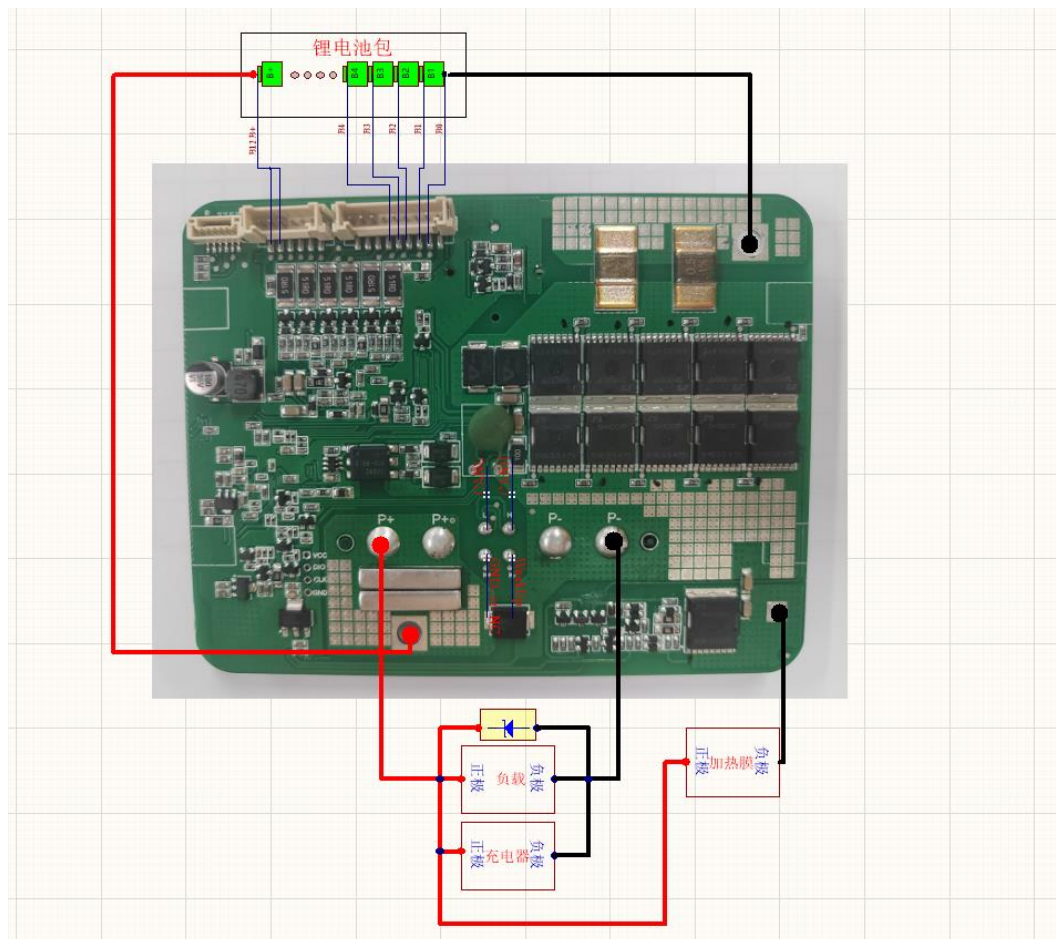


图 8 充放电接线示意图

Figure 8 Charge and Discharge Wiring Diagram

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7.2 上电与下电顺序

7.2 Power-up and Power-down Sequence

步骤 Step	上电操作 Power-up Action
步骤 1 Step 1	将 B- 连接至电池包总负极。 Connect B- to the battery pack negative terminal.
步骤 2 Step 2	接入温度、通信和开关等线束。 Connect the temperature, communication, switch, and other harnesses.
步骤 3 Step 3	按照 B0 至 B+ 的低位到高位顺序连接电压采样线束。 Connect the cell-voltage sensing harness from B0 to B+, low position to high position.
步骤 4 Step 4	连接 P- 至负载或充电器负极；P+ 从电池包总正极引出。 Connect P- to the load or charger negative; route P+ from the pack positive terminal.
步骤 5 Step 5	确认接线无误后按下开关或激活 BMS，观察指示灯状态。 After confirming correct wiring, press the switch or activate the BMS and observe the LED status.
步骤 Step	下电操作 Power-down Action
步骤 1 Step 1	断开充电器和负载。 Disconnect the charger and load.
步骤 2 Step 2	先断开高位、再断开低位电压采样线束。 Disconnect the high-position and then the low-position voltage-sensing harness.
步骤 3 Step 3	断开通信及其他低压线束。 Disconnect communication and other low-voltage harnesses.
步骤 4 Step 4	最后断开 B-。 Disconnect B- last.

7.3 电压采样线焊接

7.3 Voltage-sensing Harness Soldering

若电压采样线采用焊接方式，应先将 BMS 放置于防静电工作台，对待焊焊盘和线束预先加锡，以缩短带电焊接时间。

When voltage-sensing leads are soldered, place the BMS on an anti-static workbench and pre-tin the pads and leads to reduce live-soldering time.

焊接顺序为 B1 → B2 → ... → B+；确认无误后方可上电。焊接过程中避免触碰周边元器件和 PCB 线路。

The soldering order is B1 → B2 → ... → B+. Power on only after confirming the connections. Avoid contacting surrounding components and PCB traces during soldering.



7.4 温度传感器与电气接线

7.4 Temperature Sensor and Electrical Wiring

温度探头应紧贴电池组中部、热量最集中的单体表面。安装前确认电芯已匹配，电芯电压处于正常范围；已过充或过放的电芯应先调整至正常电压再连接 BMS。

Temperature probes shall be closely attached to cells near the center of the pack and at the most concentrated heat area. Before installation, confirm cells are matched and within the normal voltage range; correct overcharged or over-discharged cells before connecting the BMS.

连接 BMS 时，先将电池包总负极接至 B-，并确保电池包总负极至 B- 的动力线阻抗尽量低，建议控制在 0.1 mΩ 以内。

When connecting the BMS, first connect the battery-pack negative terminal to B-. Keep the power-line impedance from the pack negative terminal to B- as low as possible; 0.1 mΩ or less is recommended.

进行大于 50 A 的充放电测试时，B- 与 P- 动力线必须全部接通，以保证过流能力和功率器件均流。

For charge/discharge testing above 50 A, all B- and P- power leads must be connected to ensure over-current capability and even current sharing by power devices.



ISO 9001:2015



7.5 开箱检查与线束整理

7.5 Unpacking Inspection and Harness Organization

开箱前检查包装是否完好、有无撞击或破损；包装箱和 BMS 应轻拿轻放，尽量避免倒置。

Before opening, check the packaging for impact or damage. Handle the packaging and BMS gently, and avoid placing them upside down.

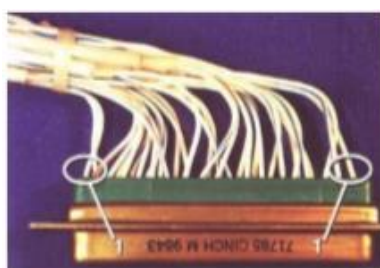
线束出线方向应与连接器设计相匹配并预留活动量。直向走线时，线束捆扎点宜位于与连接器宽度等长的位置；侧向走线时，弯曲点宜位于连接器约 1/3 宽度处。

Harness routing shall match the connector design and retain movement allowance. For straight routing, place the tie point about one connector width away; for lateral routing, place the bend point at about one-third of the connector width.



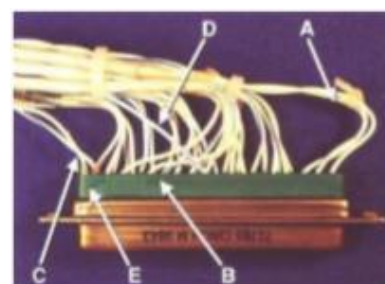
图A（1处为高应力区）

直向：目标



图B（1处所指为高应力区）

直向：合格



图C

直向：不合格



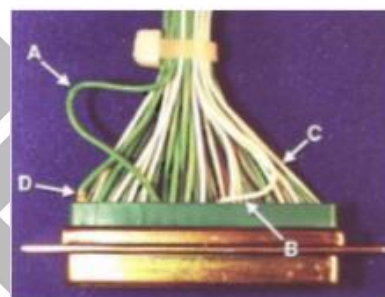
图B

侧向：目标



图A

侧向：合格



图C

侧向：不合格

线束需用卡扣或扎带固定在箱体或安装板上，要求布线整齐、固定牢靠、不可悬垂、不可干涉受力或摩擦破损。

连接器 30 ~ 50 mm 处必须有固定点，两固定点之间间距不得大于 200 mm；过拐角棱边两端 80 mm 内设置固定点

Secure the harness to the enclosure or mounting plate with clips or ties. Keep it tidy, stable, free of hanging, interference, stress, and abrasion. Provide a fixation point 30–50 mm from the connector, no more than 200 mm between fixation points, and within 80 mm of both sides of a sharp corner.



7.6 连接器固定与装配注意事项

7.6 Connector Fixing and Assembly Precautions

线束安装完成后，确认连接器卡扣到位；建议在线束胶壳与 BMS 连接器相交位置及卡扣四周使用阻燃红胶或黄胶（硬胶）固定，正反面均需点胶。

After harness installation, confirm the connector latch is fully seated. Apply flame-retardant red or yellow hard adhesive at the harness housing/BMS connector intersection and around the latch on both sides.

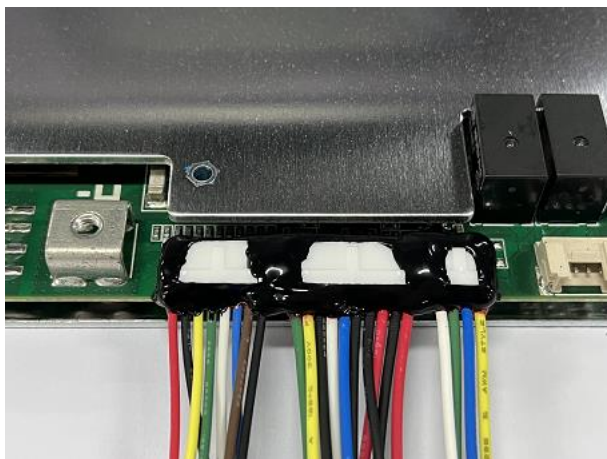


图 9 连接器点胶固定示例

Figure 9 Connector Adhesive Fixing Example

装配和使用中应防止静电；不得随意接触电路板导电区域。焊接烙铁及装配电动工具必须可靠接地，并避免电路板承受外力导致元器件或板卡失效。

Prevent static electricity during assembly and use. Do not touch conductive board areas. Soldering irons and electric tools must be reliably grounded, and the board must not be stressed in a way that can damage components or cause board failure.

7.7 测试、蓝牙与 GPS 模块

7.7 Test, BLE and GPS Module

使用大型充放电测试柜进行电池包放电测试时，为避免放电关断瞬间产生感应电压，测试柜输出端应并接续流保护二极管；来源规格书推荐 200 V / 100 A 肖特基二极管。

When a large charge/discharge test cabinet is used for battery-pack discharge testing, connect a flyback protection diode across the test-cabinet output to avoid induced voltage at discharge cut-off. The source specification recommends a 200 V / 100 A Schottky diode.

蓝牙/GPS 为独立模块时，应保证天线不被金属壳体屏蔽或遮挡，以保障信号强度。

When BLE/GPS is used as a standalone module, keep its antenna clear of metal enclosure shielding or obstruction to maintain signal strength.



8 常见故障诊断

8 Fault Diagnosis

故障现象 Fault Phenomenon	排查方法 Troubleshooting
采样线束插入后冒烟或有焦味 Smoke or burnt smell after connecting sensing harness	立即拔下线束；检查电芯端是否按 B0、B1、B2...最后一串的顺序连接，低位接口是否先接、高位接口是否后接；排除裸线短路、串序错误、虚焊和焊锡残留。 Disconnect the harness immediately. Check the cell-end order B0, B1, B2...to the final cell, connect the low-position harness before the high-position harness, and check for shorts, incorrect sequence, cold joints, and solder residue.
BMS 板无法上电 BMS board does not power on	尝试按键或充电激活。1 秒闪烁表示正常；约 200 ms 快闪表示告警/异常，应通过 CAN 或蓝牙读取状态；每 10 秒闪一次表示休眠；指示灯常亮通常为误入升级界面，可重新升级。 Try switch or charging activation. A 1-second flash is normal; about 200 ms fast flashing indicates alarm/abnormality and requires CAN or BLE diagnosis; a 10-second flash indicates sleep; constant light usually means an unintended firmware-upgrade state and requires re-upgrade.
电池包无法放电 Battery pack does not discharge	检查外部弱电开关；通过蓝牙或上位机确认放电 MOS 状态（1 为导通，0 为断开）。休眠无输出属正常，可用开关、充电或放电唤醒；快闪时检查电压、电流、温度保护及是否已达到恢复条件。 Check the external low-current switch and verify discharge MOS status by BLE or host software (1: on, 0: off). No output in sleep is normal; wake by switch, charge, or discharge. When fast flashing, check voltage/current/temperature protection and recovery conditions.
电池包无法充电 Battery pack does not charge	确认充电器匹配且输出电压不低于满充电压；协议充电器应能识别电池包。检查充电器输出是否约比当前电池包电压高 1.2 V、外部开关及充电保护状态；接近满电时个别型号不识别充电器属于正常现象。 Confirm a matched charger with output no lower than full-pack voltage; protocol chargers must identify the pack. Check whether charger output is about 1.2 V above current pack voltage, the external switch, and charge-protection status. Some models may not identify a charger near full charge.
采样线束发热 Voltage-sensing harness gets hot	检查线束与电芯的高低位顺序是否反接，线束串数是否与 BMS 出厂串数一致，以及是否存在短接；错误接线可能烧坏板内线路和器件。 Check reversed high/low cell order, whether harness series count matches the BMS, and whether there is a short circuit. Incorrect wiring can damage internal board traces and components.
单串电压随电流变化过大 One cell-string voltage changes excessively with current	检查该电芯与相邻电芯连接片焊接、该串采样线焊接是否牢固；检查连接片内阻。电池组之间优先采用软紫铜排连接，不建议仅用动力线连接。 Check welds of the cell interconnect and sensing lead for the affected string, and check interconnect resistance. Use flexible copper busbars for links between battery groups where applicable rather than only power cable.
接入负载或逆变器后断电 Power cuts off when load or inverter is connected	检查欠压、过流或短路保护；确认负载功率和浪涌电流未超过系统能力，尤其检查设备大电容造成的浪涌。 Check under-voltage, over-current, and short-circuit protection. Confirm load power and inrush current, especially inrush from large equipment capacitors, are within system capability.
加速或爬坡时断电 Power cuts off during acceleration or climbing	检查是否触发过流或欠压保护；通过上位机或蓝牙读取告警与运行数据，并检查动力线焊接是否牢固。 Check for over-current or under-voltage protection. Read alarms and operating data with host software or BLE, and check the integrity of power-lead welding.
蓝牙无法连接 BLE connection failed	确认 APP 可搜索到模块名称、模块绿灯闪烁且供电正常；确认 BMS 未处于休眠或欠压保护。若手机已配对但无数据，检查 ID（来源规格书列示 1 或 20）；安卓设备需开启蓝牙和定位服务并刷新搜索。 Confirm the app can find the module name, the module green LED flashes, and power is normal; make sure the BMS is not sleeping or under-voltage protected. If paired but without data, check ID (the source specifies 1 or 20); Android devices require Bluetooth and location service enabled and refreshed scanning.
CAN 通信无法连接 CAN communication failed	检查 CAN 盒驱动、拨码开关、H/L 信号对应和 CAN1 接口；关闭其他占用 CAN 的软件。上位机设置应匹配设备、波特率和 BMS ID；本型号为 1 Mbps、ID 1。 Check CAN-box driver, DIP switch, CAN H/L mapping, and CAN1 port; close other software using the CAN device. Host settings must match device, baud rate, and BMS ID; this model uses 1 Mbps and ID 1.
RS485 通信无法连接（适用配置版本） RS485 communication failed (configured versions)	检查 USB 驱动、A/B 信号对应和串口是否被其他软件占用；上位机选择正确 COM 口、波特率和 BMS ID。 Check USB driver, A/B signal mapping, and whether the serial port is occupied by other software; select the correct COM port, baud rate, and BMS ID in host software.
UART 通信无法连接（适用配置版本） UART communication failed (configured versions)	检查 USB 驱动、TXD/RXD/GND 定义和串口占用情况；部分机型 TXD/RXD 需要交叉连接，按项目接口定义设置 COM 口、波特率和 BMS ID。 Check USB driver, TXD/RXD/GND definitions, and serial-port occupation. Some versions require crossed TXD/RXD; set COM port, baud rate, and BMS ID according to the project interface definition.



故障现象 <i>Fault Phenomenon</i>	排查方法 <i>Troubleshooting</i>
CAN/RS485 与外部设备偶断 <i>CAN/RS485 intermittent external-device connection</i>	CAN 或 RS485 的地线必须与外部设备通信地线可靠连接，避免信号干扰和数据丢失。 <i>CAN or RS485 ground must be reliably connected to the external-device communication ground to avoid interference and data loss.</i>

9 保修条款

9 Warranty Terms

9.1 保修政策

9.1 Warranty Policy

本产品的保修期为 12 个月。在正常使用条件下发生的质量问题，由深圳市爱雅科技有限公司提供相应服务。

This product is covered by a 12-month warranty. Shenzhen Ayaa Technology Co., Ltd. provides applicable service for quality issues arising under normal use.

- 不正确的操作或使用
Incorrect operation or use
- 使用环境条件超过规格要求
Operating conditions exceeding the specification
- 擅自拆装、维修或人为损坏
Unauthorized disassembly, repair, or intentional damage
- 进水、受潮或不可抗力造成的损坏
Damage caused by water ingress, moisture, or force majeure
- PCB 条码损坏或撕毁
PCB barcode damaged or removed

9.2 重要通知

9.2 Important Notice

本规格书由深圳市爱雅科技有限公司负责更改和更新。客户应在下单前获取并确认最新版本信息是否满足当前使用需求。

This specification is revised and updated by Shenzhen Ayaa Technology Co., Ltd. Customers shall obtain and confirm the latest version before placing an order to ensure it meets the intended application.

9.3 重要说明

9.3 Important Notice

客户签字或盖章确认本产品规格书，即表示已充分阅读、理解并认可本规格书所载的产品技术参数、配置要求、质量标准及其他约定内容。

By signing or affixing a seal to confirm this Product Specification Sheet, the Customer acknowledges that it has fully read, understood, and accepted the product technical parameters, configuration requirements, quality standards, and other agreed terms stated herein.

双方签字和/或盖章确认后，本规格书构成合同的组成部分；如与合同约定不一致，以双方书面确认的补充协议或合同约定的优先条款为准。

After confirmation by signatures and/or seals of both parties, this specification forms part of the Contract. In the event of inconsistency with the Contract, the written supplementary agreement confirmed by both parties or the priority provisions of the Contract shall prevail.