珠海市希望电子有限公司

产 品 规 格 书

Product specification

客户名（CUSTOMER）：		
产品名（SAMPLE NAME）：	8~16 串 100A 家庭储能板 （8 to 16 S 100A Home energy storage board）	
产品型号（MODEL NAME）：	TOPBMS-V1.2	
呈送日期（DATE）：	2023-02-28	
版本（VERSION）：	A2201	
客户签名盖章（SIGNATURES）：		
编制（compiler）	审核（Reviewer）	批准（Approver）
曾工	徐工	许名珍

特别说明：

1、客户收到样品后请及时组织测试，并将测试结果以传真回复我公司（邮箱：XUMINGZHEN@KHTBMS.COM；联系电话：18682482863）.以便我公司安排本项目的后续工作.**5 天之内未作任何答复的，公司默认为客户测试合格，**本项目正常结束.

2、客户测试合格，请在客户确认栏中填写贵公司该产品的名称以及产品代码，并盖章签名确认，否则请在客户确认栏中反馈问题，提出改进建议.

3、我公司在收到客户盖章签名后的原件和产品详细功能说明后，才能接收订单.

special version

1.After receiving the sample, please organize the test in time, and send the test result to our company by fax (email:zhxiwangdianzi@126.com; Tel: 17841591535) so that our company can arrange the follow-up work of the project. If there is no reply within 5 days, the company will assume that the customer has passed the test and the project will end normally.

2. If the customer has passed the test, please fill in the product name and product code of your company in the customer confirmation bar, seal and sign for confirmation, otherwise, please feedback the problem and put forward improvement suggestions in the customer confirmation bar.

3. Our company can receive the order only after receiving the original and detailed function description of the product sealed and signed by the customer.

修正记录(Correction record)

版本号 Version number	页码 Page number	修订人 Reviser	修订日期 Revision date	修订内容 Revised content	备注 remarks
A01	全文	**MingzhenXu**	**2023.02.28**	全新拟制	

● 产品使用前请仔细阅读规格书，并请妥善保管。

我们一直致力于优化我们的产品，这或许会导致一些零件的改变，这是正常的，优化后的产品在可靠性及稳定性都会有提升，如果贵司有产品安规认证等要求时请在客户确认栏的确认意见中注明，如有使用中的疑问请与我们的售后中心联系获取帮助。

Please read the specification carefully before use and keep it properly。

We have been committed to optimizing our products, which may lead to some changes in parts, which is normal. The reliability and stability of the optimized products will be improved. If your company has requirements such as product safety certification, please indicate it in the confirmation comments in the customer confirmation column

● 使用注意事项

1. 产品使用过程中一定要遵循本规格书规定的使用条件，如违反本规格书，易损坏保护板，进而损坏电池组。
2. 在测试、安装、使用、接触该保护板时，须做好相应的防静电措施。
3. 请使用符合本规格书规定的的充电器，如使用高于充电口最高可承受的直流电压的充电器，易造成保护板损坏，充电器应优先选择具备充电电流末端涓流关闭功能的产品（双保险）。不具备涓流关闭功能的充电器是为铅酸电池设计的，不适合锂电池使用。
4. 使用中注意引线头，电烙铁，锡渣等不要碰到电路板上的元器件，否则易损坏本保护板。
5. 保护板和电池组组装作业时，勿将散热铝板靠近电芯表面，否则，热量会传递给电芯，影响电池组安全。
6. 使用过程中如出现异常情况，请立即停止使用，送回原厂或请专业维修人员进行维修。
7. 本保护板已经做了大量的可靠性试验，可靠性远远高于市面上的一般保护板，但为尽可能的减少事故的发生，请使用合格的电芯。

matters need attention

1. The product must comply with the operating conditions specified in this specification during use. If the product violates this specification, the protection plate may be damaged and the battery pack may be damaged.
2. Take appropriate ESD measures when testing, installing, using, or touching the protective plate.
3. Please use the charger that meets the requirements of this specification. If the charger is higher than the maximum DC voltage of the charging port, it will easily cause damage to the protection board. Chargers without trickle-off features are designed for lead-acid batteries and are not suitable for lithium batteries.
4. In use, pay attention to the lead, soldering iron, tin slag, etc., do not touch the components on the circuit board, otherwise it is easy to damage the protection board.
5. When assembling the protection plate and battery pack, do not place the radiating aluminum plate near the surface of the battery cell. Otherwise, heat will be transferred to the battery cell, affecting the safety of the battery pack.
6. If there is any abnormal situation during use, please stop using immediately and return to the original factory or ask professional maintenance personnel for maintenance.
7. This protection board has done a lot of reliability tests, the reliability is much higher than the general protection board on the market, but in order to reduce the occurrence of accidents, please use qualified cell.

● 安全注意事项

本公司致力于品质，可靠性的提高，但是一般来说，所有电气产品都可能发生一定概率的故障，使用环境，条件不同，耐久性会有一定的不同，使用时应采用冗长设计，避免因过载使用引起的异常发热，冒烟，甚至是人身事故，火灾事故，社会性损害等的发生。

safety precautions

The company is committed to the improvement of quality and reliability, but generally speaking, all electrical products may have a certain probability of failure, the use of the environment, different conditions, durability will have a certain difference, should be used in the long design, to avoid the use of overload caused by abnormal heating, smoke, even personal accidents, fire accidents, social damage.

目录(catalog)

1 简介(brief introduction)

随着锂电池在各行业的广泛应用，市场对锂电池管理系统也提出了高性能、高可靠性及高性价比等要求。本产品是专门针对 48V 低压锂电池系统设计的 BMS，采用集成化的设计，将采集、管理、通信等功能集成于一体。

本产品具备电压采集、电流采集、温度采集及相应保护功能、智能充电被动均衡功能、电量估算功能、串行通讯功能、LED 显示和显示屏等基本功能。此外还提供如下选配功能：数据存储，充电限流、智能加热膜控制等。

本产品可应用在家用储能、智慧路灯、通信基站等锂电储能应用场景。

With the wide application of lithium battery in various industries, the market has put forward the requirements of high performance, high reliability and high cost performance of lithium battery management system. This product is specially designed for 48V low-voltage lithium battery system BMS, using integrated design, collection, management, communication and other functions integrated into one.

This product has voltage collection, current collection, temperature collection and corresponding protection functions, intelligent charging passive balancing function, power estimation function, serial communication function, LED display and display screen and other basic functions. In addition, it also provides the following optional functions: data storage, charging current limiting, intelligent heating film control, etc.

This product can be used in household energy storage, intelligent street lamp, communication base station and other lithium energy storage application scenarios.

2 环境要求(functional configuration)

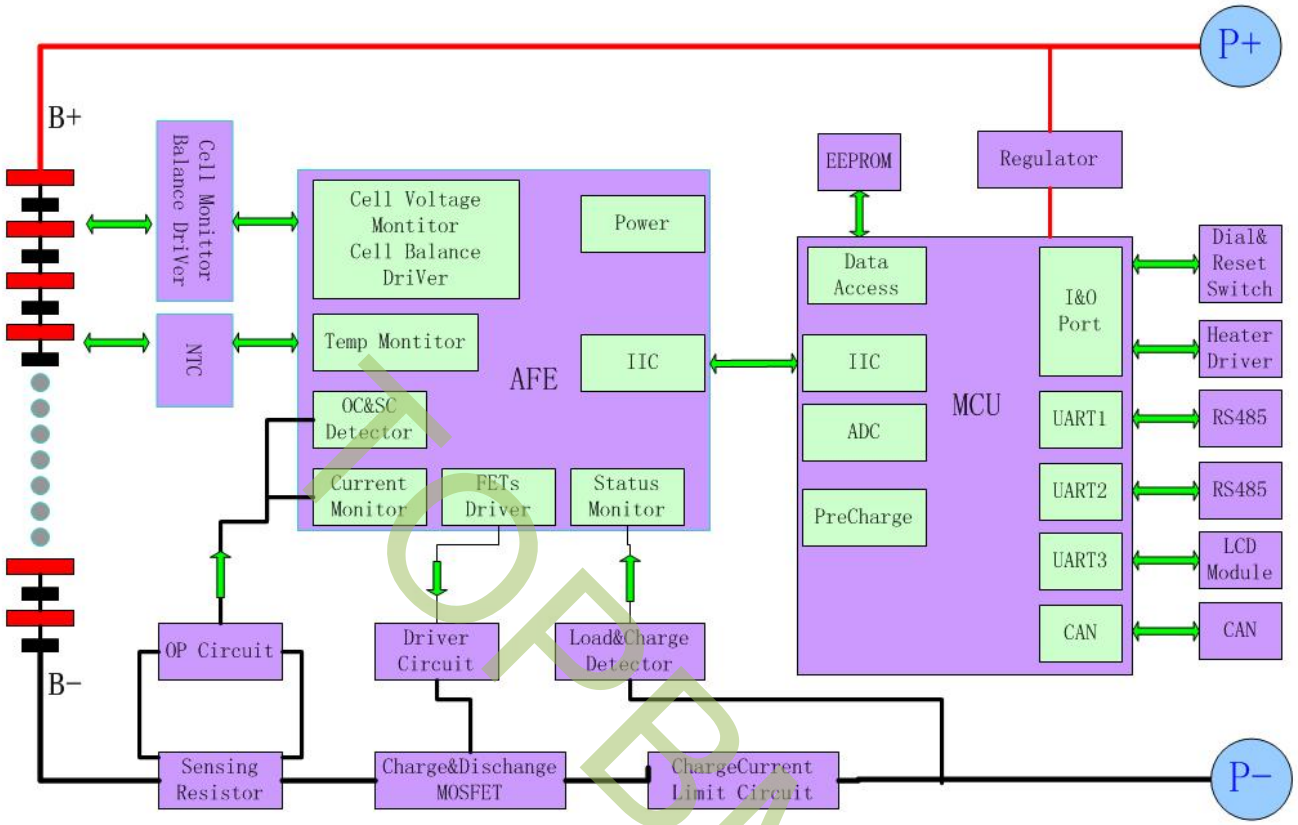
项目(items)	参数(parameter)	单位(unit)
工作温度(operating temperature range)	－30～95	℃
储存温度(storage temperature)	－30～95	℃
工作湿度(operating humidity)	5 ～ 95	%RH
存储湿度(Storage humidity)	5 ～ 95	%RH

3 功能配置 (functional configuration)

功能(Function)	配置(Configuration)	功能(Function)	配置(Configuration)
支持串数 (Number of strings supported)	8~16S	外部 485 通讯（隔离） external 485 communication (isolated)	标配 (Standard option)
持续电流 (Continuous current)	100A	并联 485 通讯（隔离） parallel connection 485 communication (isolated)	标配 (Standard option)
NTC 数量 (Number of NTCs)	1 路内置，3 路外置 (1built-in, 3 external)	CAN 通讯 (CAN communication)	标配 (Standard option)
均衡功能 (Balance Function)	被动均衡 (Passive balance)	开关功能 (Switch function)	标配 (Standard option)
充电限流功能 (Charging current limit)	标配 10A (Standard option 10A)	预放电功能 (Pre-discharge function)	标配 (Standard option)
电池组并联 (Battery packs in parallel)	标配 (Standard option)	LED 指示灯接口 (LED indicator interface)	标配 (Standard option)
LCD 显示屏 (LCD display)	选配 (Optional)	加热膜功能 (Heating function)	选配 (Optional)
2 路干接点 (2 dry contact)	标配 (Standard option)	蓝牙模块 (Module of Bluetooth)	选配 (Optional)

		GPS 接口 (interface)	选配 (Optional)

3.1 功能示意框图(functional configuration)



3.2 电气特性(operating characteristic of electric apparatus)

3.2.1 基本参数设置（Basic parameter setting）

注：1、以下参数除特殊注明以外，25℃环境温度下测试。

2、该方案能支持磷酸铁锂、三元锂电池,本规格书的参数以铁锂为例，具体参数根据项目实际情况，与客户商议确定。

Note: 1. The following parameters shall be tested at 25℃ ambient temperature unless otherwise indicated.

2. The scheme can support lithium iron phosphate and ternary lithium batteries. The parameters of this specification take lithium iron as an example.

序号	指标项目(Index item)		出厂默认参数 (Factory default parameter)	是否可设(Set)	备注
1	单体过充保护 (Overvoltage protection)	单体过充告警电压 (Over alarm voltage)	3550mV	可设(Yes)	
		单体过充保护电压(Over protection voltage)	3650mV	可设(Yes)	
		单体过充保护延时(Over protection delay)	1.0S	可设(Yes)	
	单体过压保护解除	单体过充保护解除电压(Over voltage release)	3500mV	可设(Yes)	
		放电解除(Discharge release)	放电电流 ＞1A		

	(Overvoltage protection release				
2	单体过放保护(undervoltage protection)	单体过放告警电压(Under Alarm voltage)	2800mV	可设(Yes)	单体电压低于休眠电压持续 300 秒后，仍无法恢复时，将进入休眠模式(If the cell voltage remains below the sleep voltage for 300 seconds and cannot recover, the cell enters the sleep mode)
		单体过放保护电压(Under protection voltage)	2700mV	可设(Yes)	
		单体过放保护延时(Under protection Delay)	1.0S	可设(Yes)	
	单体过放保护解除(undervoltage protection relieve)	单体过放保护解除电压(Under voltage release)	2850mV	可设(Yes)	
		有充电时解除(Charge release)	接入充电器可激活 (It can be activated by connecting the charger)		
5	充电过流保护(Overcurrent Charge)	充电过流告警值(Overcurrent Charge Alam value)	110A	可设(Yes)	
		充电过流保护值(Overcurrent Charge protection value)	120A	可设(Yes)	
		充电过流保护延时	1.0S	可设(Yes)	
	充电过流保护解除 (Overcurrent Charge relieve)	自动解除(Automatic release)	移除充电器 (Disconnect charger)		
		放电解除(Discharge Relieve)	放电电流 ＞1A (discharge current > 1A)		
6	放电过流 1 保护 (1th Overcurrent Discharge)	放电过流 1 告警电流(Alam value)	100A	可设(Yes)	
		放电过流 1 保护电流(protection value)	110A	可设(Yes)	
		放电过流 1 保护延时(1th Overcurrent Discharge Delay)	1.0S	可设(Yes)	
	放电过流 1 保护解除(1th Overcurrent Discharge Relieve)	自动解除(Automatic release)	移除负载(Off Load)		
		充电解除(Charge Relieve)	充电电流 ＞1A (Charge current > 1A)		
7	放电过流 2 (2th Overcurrent Discharge)	放电过流 2 保护电流(Alam value)	≥150A	可设(Yes)	
		放电过流 2 保护延时(2th Overcurrent Discharge Delay)	100mS	可设(Yes)	
	放电过流 2 保护解除(1thOvercurrentDischargeRelieve)	自动解除(Automatic release)		移除负载	
		充电解除(Charge Relieve)		充电电流 ＞1A(Charge current > 1A)	
8	短路保护(short-circuit protection)	短路保护电流(Short CircuitProtectionCurrent)		≥900A	
		短路保护延时(Short CircuitProtection Delay Time)		100μS	
		短路保护解除(Short CircuitProtectionRecovery)		有充电时，短路保护解除	

			(Charge current > 1A)		
			负载移除后，将自动解除(Off Load)		
9	MOS 高温保护(MOS High Temperature Protection)	MOS 过温告警温度(Alarm)	90℃	不可设(NO)	
		MOS 过温保护温度(Protection)	110℃	不可设(NO)	
		MOS 保护解除温度(Relieve)	85℃	不可设(NO)	
10	电芯温度保护 (Batt High Temperature Protection)	充电低温告警温度(Charge low temperature alarm)	6℃	可设(Yes)	
		充电低温保护温度(Charge low temperature Protection)	5℃	可设(Yes)	
		充电低温保护解除温度(Charge low temperature Relieve)	10℃	可设(Yes)	
		充电高温告警温度(Charge High temperature alarm)	50℃	可设(Yes)	
		充电高温保护温度(Charge High temperature Protection)	55℃	可设(Yes)	
		充电高温保护解除温度(Charge High temperature Relieve)	45℃	可设(Yes)	
		放电低温告警温度(Low TemperatureDischarge Alarm)	0℃	可设(Yes)	
		放电低温保护温度(Low TemperatureDischarge Protection)	-20℃	可设(Yes)	
		放电低温保护解除(Low TemperatureDischarge Relieve)	-10℃	可设(Yes)	
		放电高温告警温(High TemperatureDischarge Alarm)	60℃	可设(Yes)	
		放电高温保护温(High TemperatureDischarge Protection)	65℃	可设(Yes)	
		放电高温保护解除(HighTemperatureDischarge Relieve)	55℃	可设(Yes)	
11	消耗电流(power dissipation)	工作时自耗电电流(Operating power consumption)	≤20mA（不带显示屏）		
		低功耗模式电流(Sleep power consumption)	≤300μA		
12	均衡功能(balance)	均衡开启电压(cut-in voltage)	3400mV	可设(Yes)	
		开启压差(Opening pressure difference)	30mV	可设(Yes)	
13	容 量	低电量告(Low power alarm)	SOC＜20%	不可设	充电时不告警

	默认设置(Capacity default setting)			(NO)	
		剩余容量设置(state of charge)	50AH	可设(Yes)	
		满容量设置(Full Charge Capacity)	100AH	可设(Yes)	
14	休眠功能(sleep mode)	休眠电压(Sleep Voltage)	2500mV	可设(Yes)	
		延迟时间(Delay)	5min	可设(Yes)	

3.2.2 LED 指示说明(LED Instructions)

表 1 LED 工作状态指示

状态	正常/告警/保护	RUN	ALM	电量指示 LED				说明
		●	●	●	●	●	●	
关机	休眠	灭	灭	灭	灭	灭	灭	全灭
待机	正常	闪 1	灭	依据电量指示				待机状态
	告警	闪 1	闪 3					模块低压
充电	正常	常亮	灭	依据电量指示				最高电量 LED 闪动（闪 2），过充告警时 ALM 不闪烁
	告警	常亮	闪 3	(电量指示最高 LED 闪 2)				
	过充保护	常亮	灭	常亮	常亮	常亮	常亮	若无市电，指示灯转为待机状态
	温度、过流、失效保护	灭	常亮	灭	灭	灭	灭	停止充电
放电	正常	闪 3	灭	依据电量指示				
	告警	闪 3	闪 3					
	欠压保护	灭	灭	灭	灭	灭	灭	停止放电
	温度、过流、短路、反接、失效保护	灭	常亮	灭	灭	灭	灭	停止放电
失效		灭	常亮	灭	灭	灭	灭	停止充、放电

表 2 容量指示说明

状态		充电				放电			
容量指示灯		L4●	L3●	L2●	L1●	L4●	L3●	L2●	L1●
电量（%）	0～25%	灭	灭	灭	闪 2	灭	灭	灭	常亮
	25～50%	灭	灭	闪 2	常亮	灭	灭	常亮	常亮
	50～75%	灭	闪 2	常亮	常亮	灭	常亮	常亮	常亮
	75～100%	闪 2	常亮	常亮	常亮	常亮	常亮	常亮	常亮
运行指示灯●		常亮				闪烁(闪 3)			

表 3 LED 闪动说明

闪动方式	亮	灭
闪 1	0.25S	3.75S
闪 2	0.5S	0.5S
闪 3	0.5S	1.5S

备注： 可通过上位机使能或禁止 LED 指示灯告警，出厂默认为使能的。

3.2.3 按键说明(button instruction)

BMS 处于休眠状态时，按下按键（3~6S）后松开，保护板被激活，LED 指示灯从“RUN”开始依次点亮 0.5 秒。BMS 处于激活状态时，按下按键（3~6S）后松开，保护板被休眠，LED 指示灯从最低电量灯开始依次点亮 0.5 秒。 BMS 处于激活状态时，按下按键（6~10S）后松开，保护板被复位，LED 灯全部同时点亮 1.5 秒。BMS 被复位后仍保留通过上位机设置的参数和功能，如果需要恢复到初始参数可以通过上位机的“恢复默认值”来实现，但相关运行记录和存储数据保持不变（如电量、循环次数、保护记录等）。

When the BMS is in hibernation state, press the button for 3 to 6S and release it. The protection board is activated and the LED indicator lights up successively for 0.5 seconds from "RUN". When the BMS is activated, press the button for 3 to 6S and release it. The protection board is put to sleep and the LED indicator lights up successively for 0.5 seconds from the lowest power indicator. When the BMS is activated, press the button (6-10s) and release it. The protection board is reset and all LED lights are on at the same time for 1.5 seconds. After the BMS is reset, the parameters and functions set by the upper computer are still retained. If the initial parameters need to be restored, they can be realized by "restoring default values" of the upper computer, but the relevant running records and stored data remain unchanged (such as power, cycle times, protection records, etc.).

3.3 休眠及唤醒(Sleep and Wake up)

3.3.1 休眠(Sleep)

当满足以下任意一条件时，系统进入低功耗模式：

1） 按下按键达 10 秒钟后松开按键。

2） 最低单体电压低于休眠电压，并且持续时间达到休眠延迟时间（同时满足无通信、无保护、无均衡、无电流）。

3） 弱点开关断开强制关机。

进入休眠前，需确保输入端未接入外部电压，否则将无法进入低功耗模式。

When any of the following conditions are met, the system enters the low-power mode:

1) Press the button for 10 seconds and release the button.

2) The minimum cell voltage is lower than the sleep voltage, and the duration reaches the sleep delay time (while satisfying no communication, no protection, no balance, no current).

3) The weak spot switch is disconnected and forced to shut down.

Before hibernation, ensure that no external voltage is connected to the input terminal. Otherwise, the low-power mode cannot be entered.

3.3.2 唤醒(Wake Up)

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 48V。

2） 按下按键 3S，松开按键后。

3） 接入通信线，开启上位机软件（因过放保护而进入休眠状态，此方法不能唤醒保护板）。

When the system is in low power mode and any of the following conditions are met, the system exits the low power mode and enters the normal mode:

1) Connect the charger, and the output voltage of the charger should be greater than 48V.

2) Press the button for 3S and release the button.

3)Connect the communication cable and start the upper computer software (the protection board cannot be awakened by this method because it is in hibernation state due to over-release protection).

3.4 通信说明(Description of communication)

3.4.1 RS485 通信(外部)和 CAN 通讯(RS485 Communication (External) And CAN)

1、BMS 可以通过 RS485 接口与上位机进行通讯，从而可通过上位机监控电池的各种信息，包括电池电

压、电流、温度、状态、SOC、SOH 及电池生产信息等，默认波特率为 9600bps。

2、BMS 可以通过外部 RS485 和 CAN 与逆变器进行通讯，逆变器获取 BMS 充电数据后，充电更加智能和安全。

1, BMS can communicate with the upper computer through RS485 interface, so that the upper computer can monitor various information of the battery, including battery voltage, current, temperature, state, SOC, SOH and battery production information, the default baud rate is 9600bps.

2. BMS CAN communicate with the inverter through external RS485 and CAN. After the inverter obtains the charging data of BMS, charging is more intelligent and safe.

3.4.2 RS485 通信(内部)(RS485 Communication (Internal))

具有 RS485 接口，在电池组作并联使用时，主 Pack 通过 RS485 接口与从 Pack 进行通讯，从而可以通过主 Pack 的对外的 RS485 查看所有 Pack 的信息，RS485 接口无法进行参数设置及相应可控制操作。

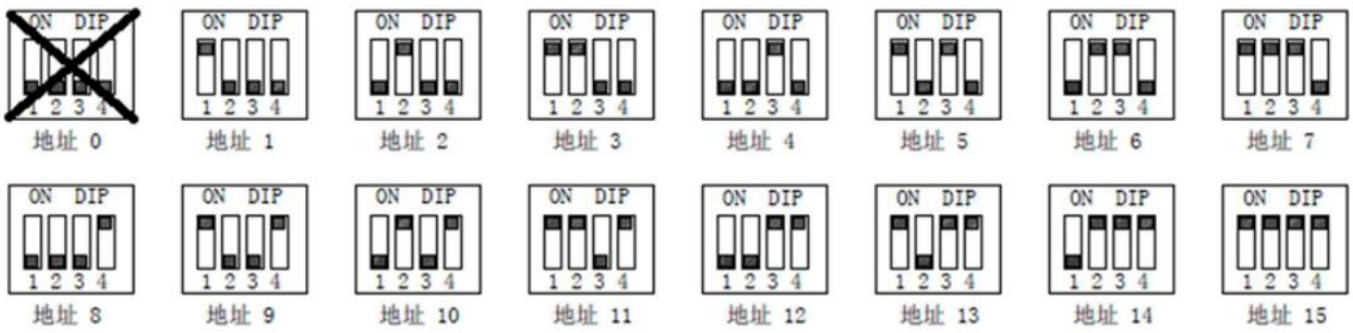
It has an RS485 port. When the battery strings are used in parallel, the master Pack communicates with the slave Pack through the RS485 port, so that all Pack information can be viewed through the external RS485 of the master Pack. Parameter setting and corresponding control operations cannot be performed on the RS485。

3.4.3 拨码开关设置(Addresss switch Set)

在电池组作并联使用时，可通过硬件地址区分不同 PACK，且整个电池堆中每个 PACK 的硬件地址是唯一的，硬件地址可通过板上的拨码开关进行依次设置，开关的定义参照下表。

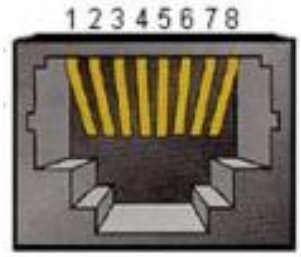
When battery strings are used in parallel, different packs can be distinguished by their hardware addresses. The hardware addresses of each PACK in the entire battery stack are unique. The hardware addresses can be set by using DIP switches on the board.

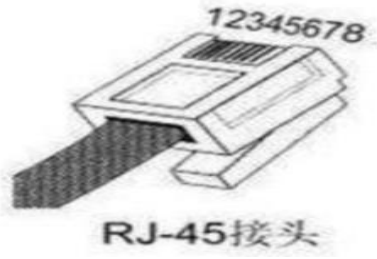
	拨码开关位置				说明
	#1	#2	#3	#4	
0	OFF	OFF	OFF	OFF	无级联，单机使用
1	ON	OFF	OFF	OFF	设置为 Pack1（主）
2	OFF	ON	OFF	OFF	设置为 Pack2
3	ON	ON	OFF	OFF	设置为 Pack3
4	OFF	OFF	ON	OFF	设置为 Pack4
5	ON	OFF	ON	OFF	设置为 Pack5
6	OFF	ON	ON	OFF	设置为 Pack6
7	ON	ON	ON	OFF	设置为 Pack7
8	OFF	OFF	OFF	ON	设置为 Pack8
9	ON	OFF	OFF	ON	设置为 Pack9
10	OFF	ON	OFF	ON	设置为 Pack10
11	ON	ON	OFF	ON	设置为 Pack11
12	OFF	OFF	ON	ON	设置为 Pack12
13	ON	OFF	ON	ON	设置为 Pack13
14	OFF	ON	ON	ON	设置为 Pack14
15	ON	ON	ON	ON	设置为 Pack15

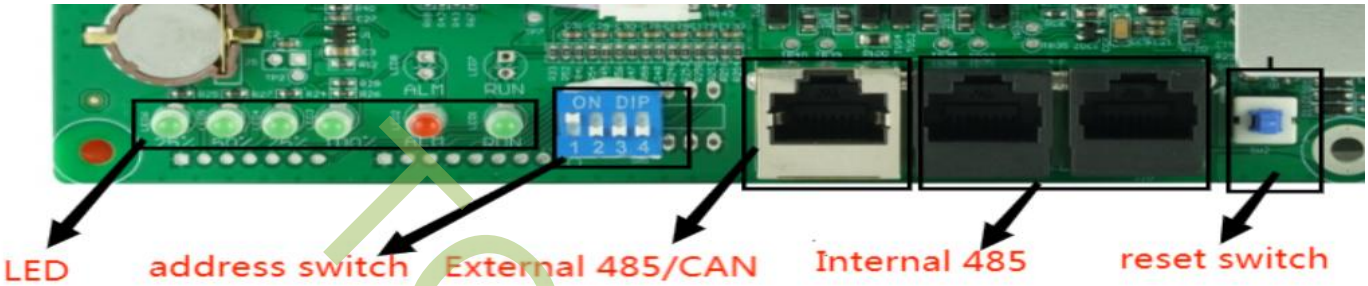


4 接口定义

4.1.1 接口图示







S485(外部)通信接口(RS485(external) communication port)		RS485(内部)通信接口(RS485(internal) communication port)	
RS485(对外)--采用 8P8C 立式 RJ45 插座		RS485(并机)--采用 8P8C 立式 RJ45 插座	
RJ45 引脚	定义说明	RJ45 引脚	定义说明
1、8	P-RS485-B	1、8	RS485-B
2、7	P-RS485-A	2、7	RS485-A
3、6	GND	3、6	GND
4	CAN-H	4	
5	CAN-L	5	

4.1.2 电气接口定义(Electrical Interface Definition)

接口	说明
B+	电芯、PACK 正极，用来给 BMS 供电；功率正极 P+直接接电芯正极 (Battery, PACK positive electrode, used to supply power to BMS; The power positive terminal P+ is directly connected to the positive terminal of the cell)
B-	电池包负极(Battery pack negative electrode)
P-	电池包负极，即既是充电负极也是放电负极（充放电同口） (The negative electrode of the battery pack is both the negative electrode of charging and the negative electrode of discharging (the same port of charging and discharging).)
J9（外部 RS485）	Pin1、Pin8：P-RS485-B Pin2、Pin7：P-RS485-A Pin3、Pin6：GND Pin4：CAN-H Pin5：CAN-L

J13 J10（内部 RS485）	Pin1、Pin8：RS485-B Pin2、Pin7：RS485-A Pin3、Pin6：GND Pin4：NC Pin5：NC
J12 (CELL0~CELL4) **7P-编号 1**	Pin1：NTC1+ **黑色** Pin2：NTC1- Pin3：CELL1- Pin4：CELL1+ Pin5：CELL2+ Pin6：CELL3+ Pin7：CELL4+
J11 (CELL5~CELL8) **6P-编号 2**	Pin1：NTC2+ **黑色** Pin2：NTC2- Pin3：CELL5+ Pin4：CELL6+ Pin5：CELL7+ Pin6：CELL8+
J7 (CELL9~CELL12) **7P-编号 3**	Pin1：NTC1+ **黑色** Pin2：NTC1- Pin3：NC 不要接线 Pin4：CELL9+ Pin5：CELL10+ Pin6：CELL11+ Pin7：CELL12+
J6 (CELL13~CELL16) **6P-编号 4**	Pin1：NC **黑色** Pin2：NC Pin3：CELL13+ Pin4：CELL14+ Pin5：CELL15+ Pin6：CELL16+
J8	弱电开关
J3	加热膜

4.1.3 安装连接说明(Installing Connections)

保护板上电有严格的顺序要求，安装时，先拔掉充电器或负载，**先焊接 B-、依次由低到高的顺序插接电池采样线连接器、B+、P-、P+，**连接线安装好后才能加负载或充电器。

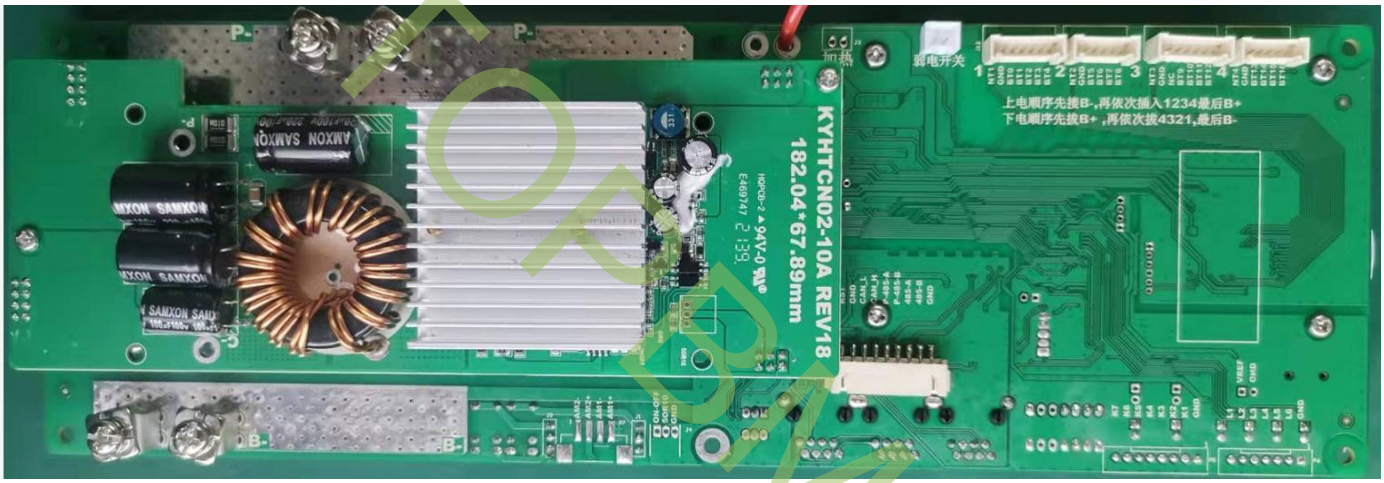
拆除时，先拔掉充电器或负载，先拆卸 B+、P+、P−、**依次由高到低的顺序拆卸电池采样线连接器，最后拆卸 B-。**

When installing the protection board, unplug the charger or load first, weld B-, and plug the battery sampling cable connector, B+, P-, and P+ in descending order. Load or charger can only be added after the cable is installed.

To remove the battery, remove the charger or the load, remove the battery sampling cable connectors B+, P+, and P- from high to low, and then remove B-.

5 实物图和尺寸图(Physical drawings and dimensional drawings)

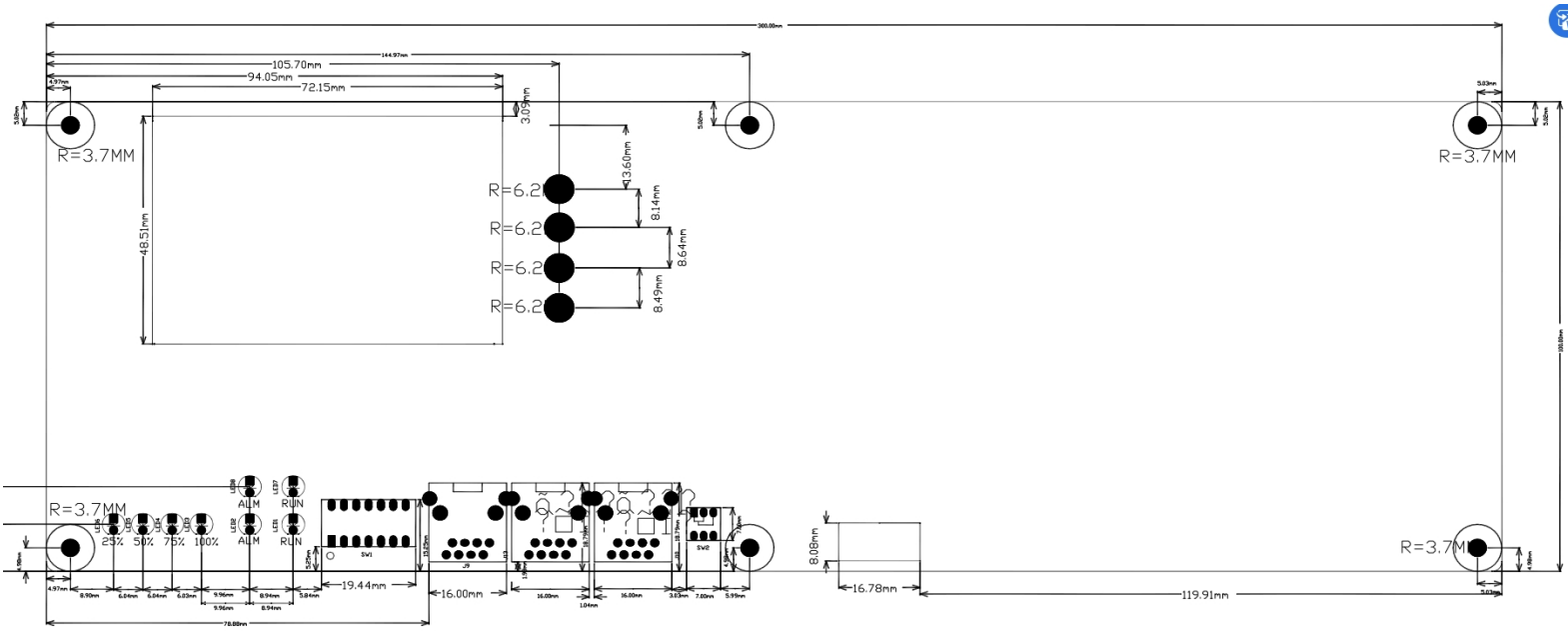
5.1 实物图(**Physical drawings**)



备注：实际产品与上述参考实物图可能存在一定差异；

Remarks: There may be some differences between the actual product and the above reference drawings;

5.2 尺寸图(dimensional drawing)



6 使用注意事项(matters need attention)

- 焊接电池电压采样引线时，一定不可有错接或反接。如果确实已接错，这块电路板可能已损坏，需要重新测试合格后才可使用。
- 装配时保护板不要直接接触到电芯表面，以免损坏电芯。装配要牢固可靠。
- 使用中注意引线头、烙铁、焊锡等不要碰到电路板上的元器件，否则有可能损坏本电路板。
- 使用过程要注意防静电、防潮、防水等。
- 使用过程中请遵循设计参数及使用条件，不得超过本规格书中的值，否则有可能损坏保护板。
- 将电池组和保护板组合好以后，初次上电如发现无电压输出或充不进电，请检查接线是否正确。
- **必须严格按照章节 4.1.3 的说明进行接线安装。**

●When welding the battery voltage sampling lead, do not misconnect or reverse connect. If it has been incorrectly connected, the circuit board may be damaged and needs to be retested before it can be used.

● When assembling the protection plate do not directly contact the surface of the cell, so as not to damage the cell. The assembly should be firm and reliable.

● In use, pay attention to the lead, soldering iron, solder and so on do not touch the components on the circuit board, otherwise it may damage the circuit board.

● Use process should pay attention to anti-static, moisture-proof, waterproof and so on.

● During use, please follow the design parameters and use conditions, do not exceed the value in this specification, otherwise it may damage the protection plate.

● After combining the battery pack and the protection plate, if no voltage output or no charge is found during the initial power-on, please check whether the connection is correct.

● Cables must be connected and installed in strict accordance with the instructions in Section 4.1.3.