ES-512100/512200/512300

ES 系列家庭储能使用说明书

ES Series Home Energy Storage User Manual

Version 1.0.0

请严格遵守本手册中的所有警告和操作说明。 在正确安装本产品之前，请妥善保存本手册并仔细阅读以下说明。在仔细阅读所有安全信息和操作说明后，方可操作。

Please strictly follow all warnings and operating instructions in this manual. Before installing this product properly, please keep this manual and read the following instructions carefully.Do not operate the machine until you have read all safety information and operating instructions carefully.

安全预防措施

safety precautions

使用电池时 When Using Battery

高压危险 High Voltage Danger：
高压电源提供设备电源，湿物体直接或间接接触高压电源，会造成致命危险。 The high-voltage power supply provides power to the equipment. Direct or indirect contact with the high-voltage power supply by wet objects can pose a lethal danger.
使用特殊工具 Using special tools:：
在高压和交流电源下工作，请确保使用专用工具。 When working under high voltage and AC power supply, please make sure to use specialized tools.
无静电 Antistatic：
在接触插入式，电路板或芯片之前，请确保使用正确的静电防护措施，以防静电敏感组件上的绝缘膜受损。 Before handling plug-ins, circuit boards, or chips, please ensure the correct use of electrostatic protection measures to prevent damage to insulation films on electrostatic-sensitive components.
在操作中断开电源 Disconnect power during operation:：
操作电源时，必须首先切断电源，否则电源操作将被禁止。 When operating the power supply, it is essential to first disconnect the power; otherwise, power operations will be prohibited.
直流短路危险 Direct Current Short Circuit Hazard：
电源系统提供直流稳压电源。 直流短路可能会对设备造成致命伤害。 The power supply system provides a direct current (DC) stabilized power source. A DC short circuit may cause fatal damage to the equipment.

充电时 When charging Battery

警告 Warning
电池可充电的温度范围是 0°C 至 50°C。 在此范围之外的温度下给电池充电可能会导致电池变热或破裂。 在此温度范围以外给电池充电也可能会损害电池的性能或缩短电池的预期寿命。 The rechargeable battery's temperature range for charging is from 0°C to 50°C. Charging the battery outside this range may cause the battery to become hot or rupture. Charging the battery beyond this temperature range may also damage the battery's performance or shorten its expected lifespan.

电池放电时 When discharging battery

警告 Warning
请勿使用除指定设备以外的任何设备给电池放电。 在指定设备以外的设备中使用电池时，可能会损坏电池性能或缩短其使用寿命，并且如果设备导致异常电流流过，则可能导致电池变热并造成严重伤害。

Translation to English: Please do not discharge the battery using any device other than the specified one. Using the battery in devices other than the designated one may damage battery performance or shorten its lifespan. If the device causes abnormal current flow, it may result in the battery heating up and causing serious injury.
警告 Warning
电池放电的温度范围是-20°C 至 55°C。 在此温度范围以外使用电池可能会损坏电池性能或缩短其使用寿命。 The temperature range for discharging the battery is -20°C to 55°C. Using the battery outside this temperature range may damage the **battery's** performance or shorten its lifespan.

符号说明 Symbol description

符号 Symbol	描述 Description
	设备运行后存在潜在危险。操作设备时，请做好防护。 There are potential hazards after the device is started. Please take precautions when operating equipment.
	高电压危险。逆变器运行时存在 高压，对逆变器进行操作时，请确保逆变器已断电。 High voltage hazard. There is high voltage when the inverter is running. Please make sure that the inverter is powered off when operating the inverter.
	请合理使用设备，极端情况下使用，设备有爆炸风险。 Please use the equipment properly. If used under extreme circumstances, the equipment may explode.
	设备中含有腐蚀性电解液。请避免接触泄漏的电解液或挥发气体。 The equipment contains corrosive electrolytes. Please avoid contact with leaking electrolyte or volatile gases.
	操作设备前，请详细阅读产品说明书。 Please read the product user manual carefully before operating the equipment.
	在安装，操作和维护过程中要注意个人防护。 Pay attention to personal protection during installation, operation and maintenance.
	设备应远离明火或着火源。 The equipment should be kept away from open flames or sources of ignition.
	设备应远离儿童可接触区域。 The equipment should be kept away from areas accessible to children.
	禁止用水灭火。 It is prohibited to use water to extinguish fire.
	设备不可当做生活垃圾处理，请根据当地的法律法规处理设备，或者寄回给设备厂商。 The equipment cannot be disposed of as domestic waste. Please dispose of the equipment according to local laws and regulations, or send it back to the equipment manufacturer.
	设备应放在正确的地方，并按照当地的环境法规进行回收。 Equipment should be placed in the proper place and recycled in accordance with local environmental regulations.
	保护接地标志，用于指示保护地线连接位置。 Protective Ground Symbol, used to indicate the location of the protective ground connection。

目录 Contents

一、产品概述 Product Overview

本系列为广东恩欣恺新能源科技有限公司设计制造的磷酸铁锂电池组（含BMS）。它由 16 串电芯组成，该系列型号为 ES-512100/512200/512300 电池组，适用于工作电流小于 100A（ES-512100)/200A（ES-512200 和 ES-512300）的负载设备，带(RS485/CAN)通讯功能。

This Series is designed and manufactured by Guangdong Enxinkai New Energy Technology Co., Ltd , which consists of 16 series of core. The series model is ES-512300/512200/512100 battery pack, It is suitable for load equipment with working current less than 100A (ES-512100) / 200A (ES-512200 & 512300), with（RS485/CAN）communication function.

本规格书描述了设计相配套的锂离子电池的技术规格需求。包括电池的标称参数、电气特性、安全性能、环境适应性及其实验和判定、使用说明和安全规则、质量评定及包装、标志、贮存、运输等。规格书中的图片可能与样品存在一定差异，本公司有权保留最终解悉权。

The product specification describes the requirements on technical specifications of Li-Ion battery designed. Including the battery's nominal parameters, electrical characteristics, safety performances, environmental adaptation, testing method and decision rule, operating instruction and safety regulations, quality decision and packaging, marks, storage, and transportation etc.The picture of specification may be some differences with the sample and Our company reserves the right to the interpretation.

图 1 电池包效果图

Figure 1: Schematic diagram of the battery pack.

（一）基本参数 Basic Parameters

型号 Model	ES-512100	ES-512200	ES-512300
标称能量 Nominal energy(kwh)	5.12	10.24	14.84
标称容量 Nominal capacity(Ah)	100Ah	200Ah	280Ah （Actual 290Ah)
标称电压/Nominal voltage	51.2V		
电池类型/Chemistry	磷酸铁锂/LiFePO4		
工作电压范围 Operating voltage range	40V-58.4V		
最大充/放电电流 Max charge/ discharge current	100A	200A	200A
推荐充/放电电流 Recommended charge/discharge current	50A	100A	140A
通讯方式 Communication method	CAN，RS485		
循环寿命/Cycle life	>6000 Cycles		
工作温度范围 Operating temperature range	充电:0-50℃,放电-20-55℃ Charging: 0-50℃, Discharging:-20-55℃		
防护等级/Protection level	IP20		
颜色/Color	白/white		
电量显示/Battery display	显示屏/Display screen		
L*W*H 尺寸 Dimension (mm)	480*238*600	742*270*730	845*270*783
重量 Weight	56±1kg	99.5±2kg	132±2kg
安装方式 Installation method	壁挂/落地式 Wall-mounted / Floor-standing	落地式（带脚轮） Floor-standing (With caster)	落地式（带脚轮） Floor-standing (With caster)
湿度/Humidity	≤95% (无冷凝)/≤95% non-condensing		
海拔/Altitude	＜2000 m		
冷却方式/Cooling method	自然冷却/Free Cooling		

（二）电池成品图片 Battery Pack Picture

成品图 Product map	
	
正面视图 Front view	侧面视图 Side view
	
右视图 Right view	左视图 Left view
	
顶部视图 Top view	底部视图 Bottom view

二、功能简要描述 Function Characteristic

- 选用稳定成熟的 3.2V100Ah（ES-512100/512200）/ 3.2V280Ah（ES-512300） 磷酸铁锂电芯。

  Stable and mature 3.2V100Ah（ES-512100/512200）/ 3.2V280Ah（ES-512300） lithium iron phosphate cell was selected.

- 提供过充电、过放电、过电流、短路等各种保护，保障系统安全稳定运行。

  Provide over charge, over discharge, over current, short circuit and other protection to ensure the safe and stable operation of the system.

- 温度检测功能

  Temperature detection function

- 具有对电芯、环境、功率 MOS 温度检测，并能在高温、低温充放电时告警与保护。4 路电芯温度检测，1 路环境温度检测，1 路功率 MOS 温度器检测，共 6 路 NTC。

  It can detect the temperature of battery cell, environment and power MOS, and can make alarm and protection actions when charging or discharging at high or low temperature. There are 6 channels of NTC, 4 channels of battery cell temperature detection, 1 channel of ambient temperature detection, and 1 channel of power MOS temperature detection.

- 带 SOC 电量显示

  With SOC power display

- 具备 RS485 通讯，CAN 通讯功能。

  With RS485 communication, CAN communication function

- 电池充电均衡功能

  充电均衡策略可灵活设置（开启电压、均衡电压），能够有效提高电池的使用时间和循环寿命。

  The charge balance strategy can be flexibly set (turn-on voltage, balance voltage), which can effectively improve the battery's use time and cycle life.

- 上位机控制功能

  具有对单体电池过欠压、电池总压过欠压、充电过流、放电过流、电芯高低温、环境高低温、均衡策略、电池串联节数、电池容量等各项电池管理参数进行设定，可打开和关闭放电 MOS，充电 MOS，限流功能开关，蜂鸣器告警开关，强制休眠开关以及实现系统软件的在线升级功能等。

  It has the ability to perform various battery management parameters such as cell overvoltage and undervoltage, pack total voltage over and undervoltage, charging overcurrent, discharging overcurrent, cell high and low temperature, environmental high and low temperature, balancing strategy, battery series connection number, battery capacity, etc. It can

be set to turn on and off the discharge MOS, charge MOS, current-limiting function switch, buzzer alarm switch, forced sleep switch and online upgrade function of the system software.

- 历史数据存储功能

  具有历史记录存储功能，存储容量不小于 400 条记录，方便系统的监控、分析与维护。

  With historical record storage function, the storage capacity is not less than 400 records, which is convenient for system monitoring, analysis and maintenance

- 并联通信功能

  可以通过 RS485/CAN 接口实现并联通信功能，在显示屏设置地址码，并联后上位机可以循环监控电池组数据。

  The parallel communication function CAN be realized through RS485/CAN interface, and the address code can be set on the display screen. After the parallel connection, the upper computer can monitor the battery pack data in cycles.

三、机械特性 Mechanical Characteristic

（一）端口定义 Terminal Definition

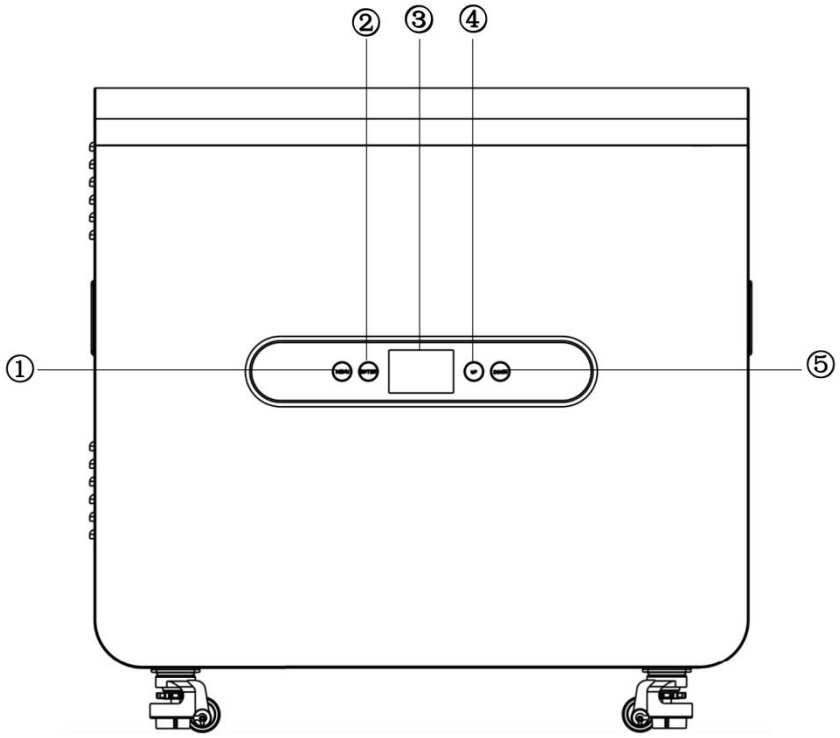


图 2：适用于 ES-512100/512200/512300
Figure 2:Applicable to ES-512100/512200/512300

序号 No.	接口位号 Interface	接口用途 Function of Interface	位置 Position
①	MENU	菜单按钮/MENU	正面 Front
②	ENTER	确认按钮/Enter Button	正面 Front
③	Screen	显示屏/ Display Screen	正面 Front
④	UP	向上按钮/UP	正面 Front
⑤	DOWN	向下按钮/DOWN	正面 Front

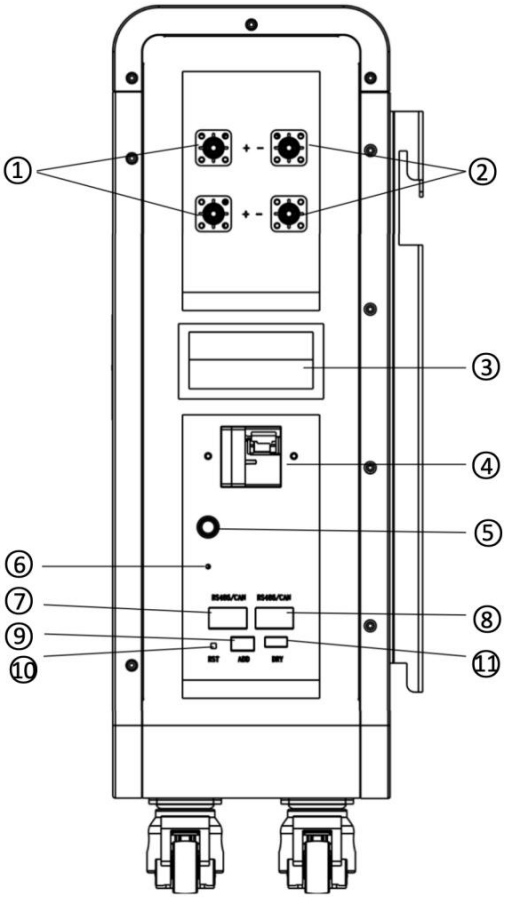


图 3：适用于 ES-512100
Figure 3:Applicable to ES-512100

序号 No.	接口位号 Interface	接口用途 Function of Interface	位置 Position
①	B+	电池正极/Output positive pole	右侧 Right side
②	B-	电池负极/Output negative pole	右侧 Right side
③	提手 Handle	方便电池组安装时搬动/For lifting and moving the battery	右侧 Right side
④	ON/OFF	输出/输入开关/Output/Input switch	右侧 Right side
⑤	ON/OFF	启动开关/Start switch	右侧 Right side
⑥	⏚	保护接地标志，用于指示保护地线连接位置。 Protective ground symbol, used to indicate the location of the protective ground connection	右侧 Right side
⑦	RS485/CAN	RS485/CAN 通讯（升级用）/RS485/CAN communication (for system update)	右侧 Right side
⑧	RS485/CAN	并联 485/CAN 通讯（与逆变器通信） Parallel 485 communication (communication with the inverter)	右侧 Right side
⑨	ADD	拨码开关，并机时设置通讯地址 Dip switch to set communication address during parallel connection	右侧 Right side
⑩	RST	开关重置按钮(复位) Switch reset button (Reset)	右侧 Right side
⑪	DRY	干接点/Dry contact	右侧 Right side

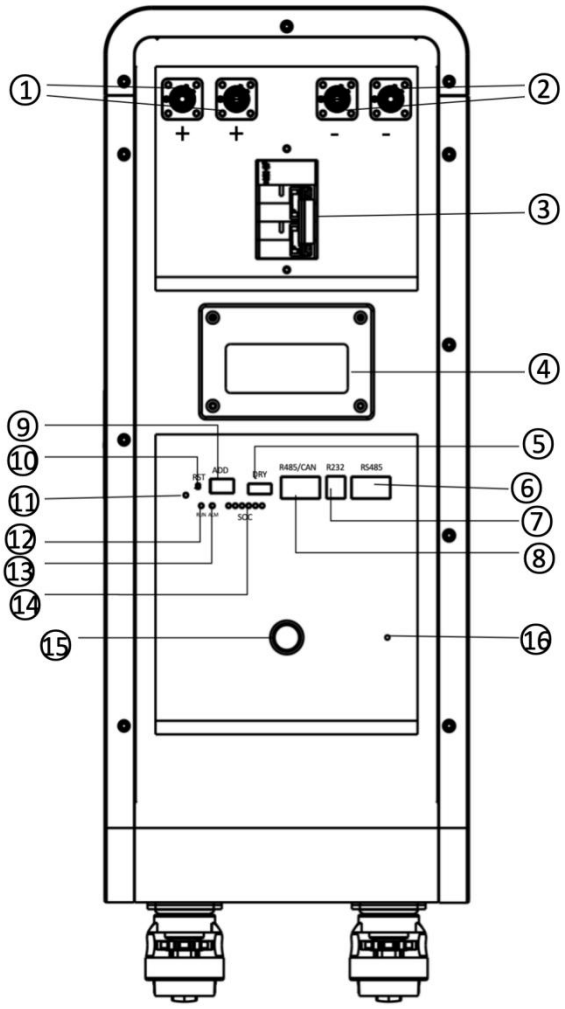


图 4：适用于 ES-512200/512300
Figure 4:Applicable to ES-512200/512300

序号 No.	接口位号 Interface	接口用途 Function of Interface	位置 Position
①	B+	电池正极/Output positive pole	右侧 Right side
②	B-	电池负极/Output negative pole	右侧 Right side
③	ON/OFF	输出/输入开关/Output/Input switch	右侧 Right side
④	提手 Handle	方便电池组安装时搬动/For lifting and moving the battery	右侧 Right side
⑤	DRY	干接点/Dry contact	右侧 Right side
⑥	RS485_2	并联 485 通讯（与逆变器通信） Parallel 485 communication (communication with the inverter)	右侧 Right side
⑦	RS232	232 通讯（升级用）/232 communication (for system update)	右侧 Right side
⑧	RS485/CAN	RS485/CAN 通讯（升级用）/RS485/CAN communication (for system update)	右侧 Right side
⑨	ADD	拨码开关，并机时设置通讯地址 Dip switch to set communication address during parallel connection	右侧 Right side
⑩	RST	开关重置按钮(复位) Switch reset button (Reset)	右侧 Right side
⑪	LED	按键开关运行指示灯/Switch running light indicator	右侧 Right side
⑫	RUN	电池系统运行 Battery system running indicator	右侧 Right side
⑬	ALM	故障报警指示灯 failure alarm indicator	右侧 Right side
⑭	SOC	容量显示灯 /Capacity indicator light	右侧 Right side
⑮	ON/OFF	启动开关/Start switch	右侧 Right side
⑯	⏚	保护接地标志，用于指示保护地线连接位置。 Protective ground symbol, used to indicate the location of the protective ground connection	右侧 Right side

（二）显示屏设置 Display Screen Setting

图 5：显示屏首页界面
Figure 5:Home page

序号 No.	功能 Feature	描述 Description
①	SOC	电池包的容量 Battery capacity
②	电流/Current	电池包的电流 Battery current
③	电压/Voltage	电池包的电压 Battery voltage
④	工作状态 Working Condition	电池包的充放电状态 The charging and discharging state of the battery
⑤	地址码 Address code	电池包的地址码 The address code of the battery
⑥	序列号 SN code	电池包的序列号 Battery SN code

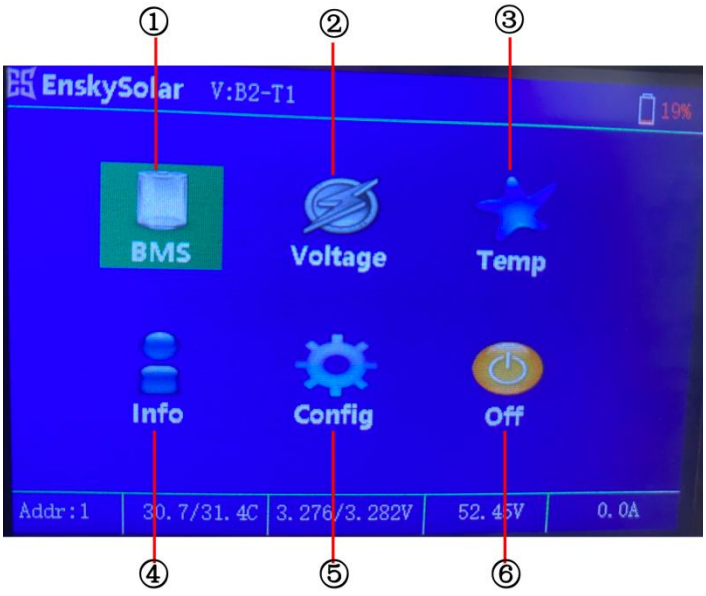
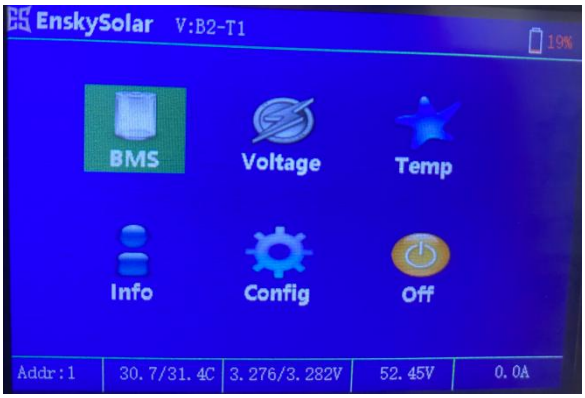
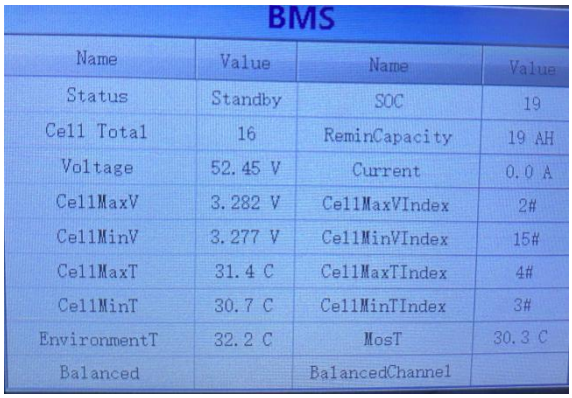


图 6：菜单界面
Figure 6:Menu page

序号 No.	功能 Feature	描述 Description
①	电池管理系统 BMS	查看 BMS 状态：电压、电流、温度等信息 Check BMS status:voltage, current, and temperature
②	电压 Voltage	查看电芯电压状态 Check the battery voltage status
③	温度 TEMP	查看温度状态 Check temperature status
④	Info 信息	查看告警和保护信息 Check alarm and protection information
⑤	配制 Config	设置地址码、BMS、语言、协议 Set the address code, BMS, language, and protocol
⑥	关机/OFF	电池关机 Battery off

BMS 界面/BMS Page

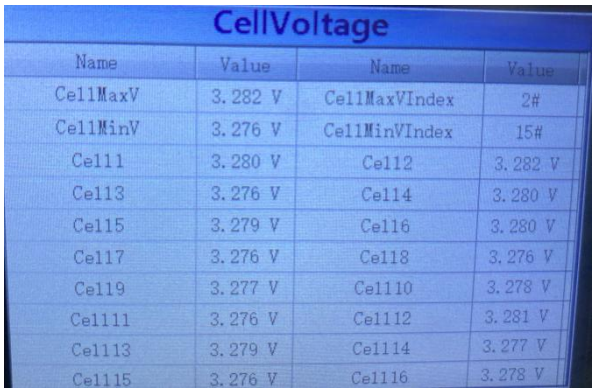




BMS

Name	Value	Name	Value
Status	Standby	SOC	19
Cell Total	16	ReminCapacity	19 AH
Voltage	52.45 V	Current	0.0 A
CellMaxV	3.282 V	CellMaxVIndex	2#
CellMinV	3.277 V	CellMinVIndex	15#
CellMaxT	31.4 C	CellMaxTIndex	4#
CellMinT	30.7 C	CellMinTIndex	3#
EnvironmentT	32.2 C	MosT	30.3 C
Balanced		BalancedChannel	

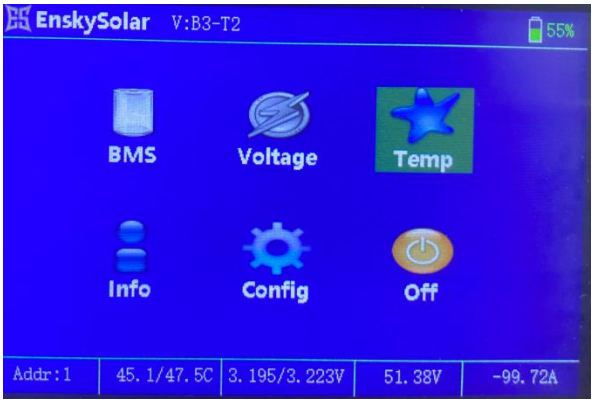
电压界面 Voltage Page

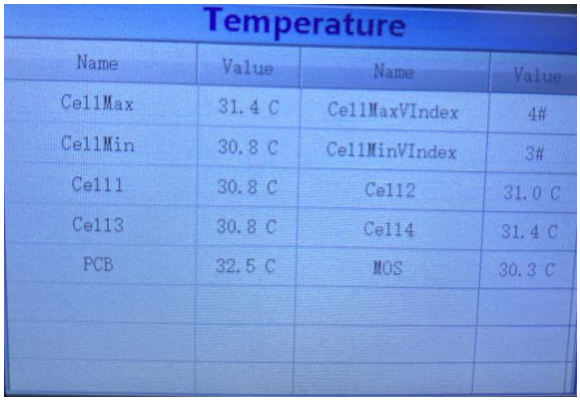


CellVoltage

Name	Value	Name	Value
CellMaxV	3.282 V	CellMaxVIndex	2#
CellMinV	3.276 V	CellMinVIndex	15#
Cell1	3.280 V	Cell2	3.282 V
Cell3	3.276 V	Cell4	3.280 V
Cell5	3.279 V	Cell6	3.280 V
Cell7	3.276 V	Cell8	3.276 V
Cell9	3.277 V	Cell10	3.278 V
Cell11	3.276 V	Cell12	3.281 V
Cell13	3.279 V	Cell14	3.277 V
Cell15	3.276 V	Cell16	3.278 V

温度界面/TEMP Page

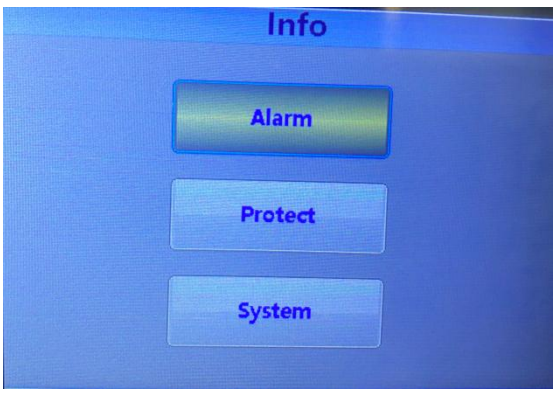




Temperature

Name	Value	Name	Value
CellMax	31.4 C	CellMaxVIndex	4#
CellMin	30.8 C	CellMinVIndex	3#
Cell1	30.8 C	Cell2	31.0 C
Cell3	30.8 C	Cell4	31.4 C
PCB	32.5 C	MOS	30.3 C

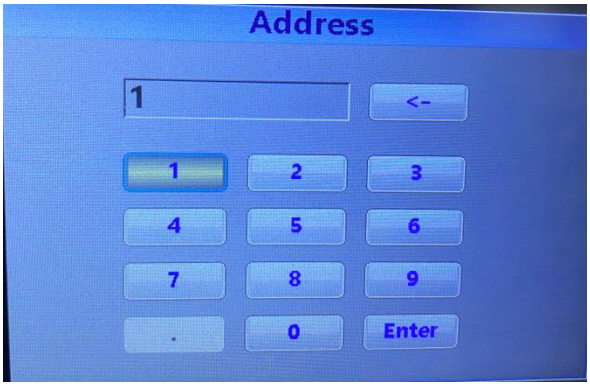
信息界面 Info Pag



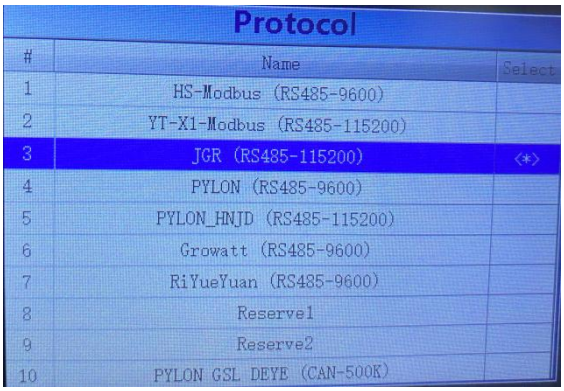
配制界面 Config Page

地址码设置界面 Address Code Setting Page

语言设置界面 Language Setting Page



协议设置界面 Protocol Page



关机界面 OFF Page

（三）线束说明 Wiring Cables Description

图片 Pictures	用途 Function
	通讯线束:用于电池和逆变器之间的通讯连接。 Communication Cables: Used for communication connections between the battery and the inverter.
	正极外部动力线束,用于外部设备的连接 The positive power cable is connected to the positive pole of the external device.
	负极外部动力线束,用于外部设备的连接 The negative power cable is connected to the negative pole of the external device.

（四）接线示意图 Wiring Diagram

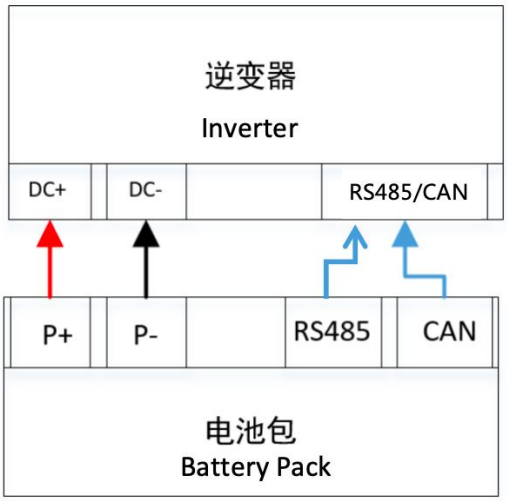


图 7：电池单机接线图

Figure 7: Battery Unit Wiring Diagram

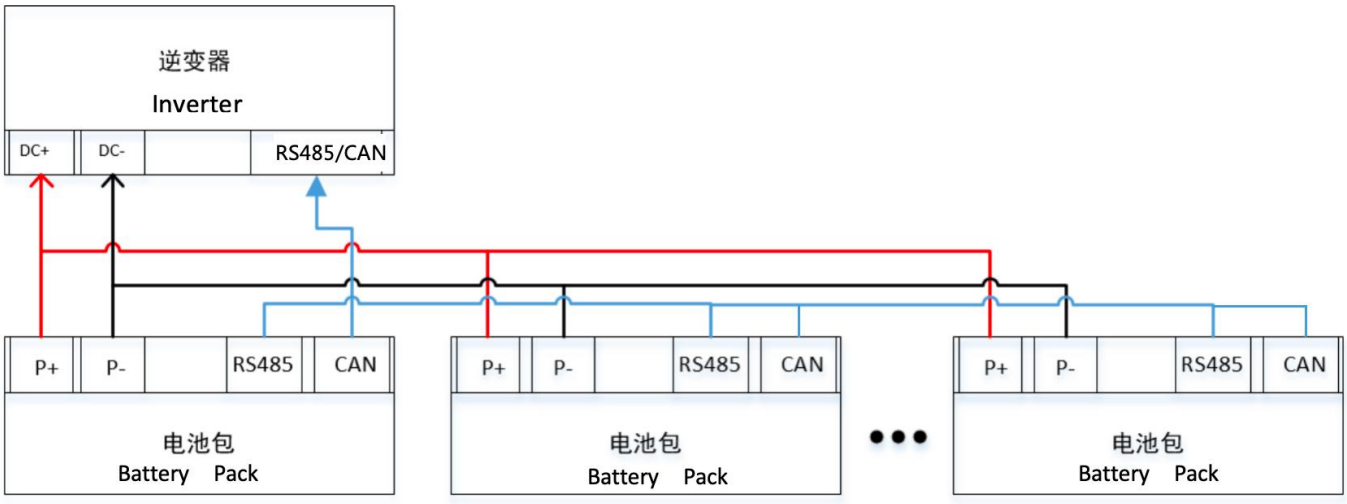


图 8：电池并机接线图

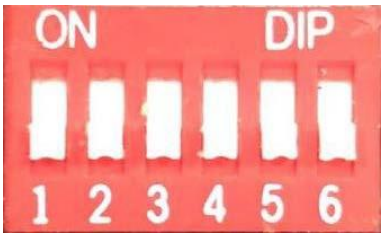
Figure 8: Battery Parallel Connection Diagram

连接步骤：电池休眠状态（出厂默认休眠状态）下使用正负极线束与逆变器或另一组电池进行连接，接着连接通讯线。连接完成后启动逆变器使用。

Connection steps: Use the positive and negative wiring harnesses to connect with the inverter or another set of batteries in the battery sleep state (factory default sleep state), and then connect the communication cable. After the connection is completed, start the inverter for use.

注：拨码开关第 6 位是匹配电阻，当逆变器与电池包之间通讯信号差时需拨到“ON”,一般一个电池包开启就行。

Note: The 6th bit of the dip switch is the matching resistor. When there is a signal difference in communication between the inverter and the battery pack, switch it to "ON". Usually, only one battery pack needs to be turned on.



（五）故障排除 Troubleshooting

如果电池不能正常工作，请使用下表解决问题。

If the battery is not functioning properly, please refer to the table below for troubleshooting.

故障 **Fault**	**可能的原因** **Possible Causes**	**解决** **Solution**
前面板无指示和报警 No indication and alarm on the front panel	休眠状态 Sleep mode	按重置为呼醒模式 Press reset to wake up
前面板没有指示和警报，甚至复位仍然没有反应 No indication and alarm on the front panel, even after reset	电池电压过低 Low battery voltage	立即给电池充电 Charge the battery immediately
待机时红色 LED 闪烁 Red LED blinking during standby	电池低电压 Low battery voltage	立即给电池充电 Charge the battery immediately
充电时红色 LED 闪烁 Red LED blinking during charging	充电时报警保护 Charging alarm protection	获取警报释放条件 Identify and release alarm

		conditions
放电时红色 LED 闪烁 Red LED blinking during discharge	电压太低，将关闭 Voltage too low, will shut down	立即给电池充电 Charge the battery immediately
红色 LED 连续照明 Continuous illumination of red LED	电池损坏 Battery damaged	需要维修 Requires repair

四、 系统原理图 System schematic diagram

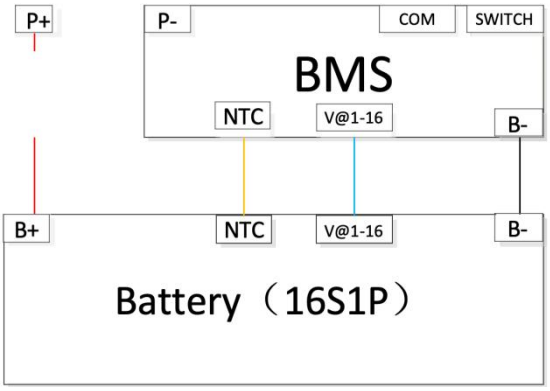


图 9：系统原理图
Figure 9: System schematic diagram

整机系统工作原理 Operating principle of the whole machine system：

按下电源键后，电源灯亮起，系统上电正常运行，BMS 自检工作，无异常进入工作状态，将外部设备端子连接到充放电端口，连接好通讯端口，信号连接握手成功后，开始并机启动充放电。

Press the switch to start up. After the system is powered on, it runs normally. BMS self-check works and enters the working state without any abnormality.

五、逻辑和策略 Logic and strategy

（一）休眠 Sleep Mode

当满足以下任意一条件时，系统将进入低功耗模式（即休眠）：
1）单体或总体过放保护后 60 秒内仍未解除。
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、无充电器、无电流）。
3）静置超过 24 小时（同时满足无通信、无充电器、无电流）。
4）通过上位机软件强制休眠。
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。
The system will enter a low-power mode (i.e. sleep) when any of the following conditions are met:
1) The over-discharge protection for a single cell or the entire battery pack is not released within 60 seconds.
2) The lowest single cell voltage is below the sleep voltage and has been maintained for the sleep delay time, while meeting the conditions of no communication, no charger, and no current flow.

3) The system has been idle for more than 24 hours, while meeting the conditions of no communication, no charger, and no current flow.
4) Forced sleep is initiated through the PC software.
Before entering sleep mode, it is necessary to ensure that no external voltage is applied to the input terminal, otherwise low-power mode cannot be entered.

（二） 唤醒 Wake-up

当系统处于低功耗模式（休眠），满足以下任意一条件时，系统将退出低功耗模式（休眠）， 进入正常运行模式：
1）接入充电器，充电器的输出电压需大于 48V。
2）通讯激活唤醒。
3）按键激活
When the system is in low-power mode (sleep), it will exit low-power mode (sleep) and enter normal operating mode when any of the following conditions are met:
1) The charger is connected and the output voltage of the charger is greater than 48V.
2) Communication activates wake-up.
3) Key activation

（三） 上下电逻辑 Power On/Off Logic

上电逻辑：
1) 1 号地址电池包向逆变器发送允许的充电电流为 0，放电电流为 0；
2) 从 CAN 获取其它电池包的数据。
3) 压差在 1.5V 以内的电池包，并入系统。
4) 开启 MOS；
5) 根据各个电池包的信息，向逆变器发送允许的最大充电电流与放电电流。
下电逻辑：
1) 1 号地址电池包向逆变器发送允许的充电电流为 0，放电电流为 0；
2) 各个电池包检测无充电电流和无放电电流后,关闭 MOS,关闭相应的供电电源。
Power On/Off Logic:
Power On Logic:
1) Battery pack with address 1 sends a permission signal to the inverter for charging current and discharging current set to 0.
2) Obtain data from other battery packs via CAN.
3) Include battery packs with a voltage difference of less than 1.5V in the system.
Turn on the MOS.
4) Based on the information from each battery pack, send the maximum allowed charging current and discharging current to the inverter.
Power Off Logic:
1) Battery pack with address 1 sends a permission signal to the inverter for charging current and discharging current set to 0.
2) After detecting no charging current or discharging current from each battery pack, turn off the MOS and the corresponding power supply.

（四） SOC 策略 SOC Strategy

1 号地址电池包通过 CAN 总线获取各个电池包的信息，并统计出总的 SOC,充电状态下，当总 SOC 为

100%时，向逆变器请求的充电电流设置为 0。放电状态下，当总 SOC 为 0%时，向逆变器请求的放电电流设置为 0。

Battery pack with address 1 obtains information from each battery pack through the CAN bus and calculates the total SOC. When charging, if the total SOC reaches 100%, the requested charging current to the inverter will be set to 0. Similarly, when discharging, if the total SOC reaches 0%, the requested discharging current to the inverter will be set to 0.

（五） 功率请求策略 Power request strategy

1 号地址电池包通过 CAN 总线获取各个电池包的信息，并对各电池包的数据进行统计分析处理，计算出电池组最大的允许的充电电流与放电电流，再通过 CAN 总线将电流数据发送到逆变器。

The No.1 address battery pack obtains information from each individual battery pack through the CAN bus, and conducts statistical analysis and processing on the data of each battery pack. It calculates the maximum allowable charging and discharging current for the battery pack, and then sends the current data to the inverter through the CAN bus.

（六） 均衡策略 Balancing strategy

在电池包充电末端，如果电芯的最高电压超过均衡设定的开启电压，并且电芯的最高与最低的压差超过设定的开启值，则最高电压的电芯开启均衡，通过内部电路，进行小电流放电。如果最高电压的电芯与最低电压的电芯的差值小于均衡开启差值，或最高电压的电芯小于均衡开启电压，或退出充电状态，则退出均衡状态。

At the end of battery pack charging, if the highest voltage of a cell exceeds the opening voltage set for balancing and the voltage difference between the highest and lowest cell exceeds the opening value set, the cell with the highest voltage will be balanced by opening it, and will be discharged with a small current through internal circuitry. If the voltage difference between the cell with the highest voltage and the cell with the lowest voltage is less than the balancing opening difference, or the cell with the highest voltage is lower than the balancing opening voltage, or it exits the charging state, the balancing state will be exited.

（七） 并机策略 Parallel connection steps

并机步骤：

1) 断开电池包动力线上的空开使电池包与动力总线脱离，连接所有的电池包的 CAN 总线.

2) 通过 CAN 总线发送休眠指令：标准帧,波特率 500K,ID:<201> 内容 <FF F3 AA 55 00 00 00 F1>使所有的电池包进入休眠，并检查是否已进入休眠,指示灯关闭。

3) 在确保电池包进入休眠后，合上电池包动力线上的空开，接入动力总线。

4) 通过 CAN 发送任一数据，激活所有的电池包，电池包在激活后会进行并机判断，（以最低的电池包的总电压为基准）电池包总压压差低于 1.5V 的电池包的会打开 MOS 投入总线，压差超过 1.5V 的电池包则不会打开 MOS。当接入充电器后，将电池的总电压充到压差 0.5V 以内后，自动并入。

1) Disconnect the circuit breaker on the power line of the battery pack to disconnect the battery pack from the power bus, and connect the CAN bus of all battery packs.

2) Send a sleep command through the CAN bus: Standard frame, baud rate 500K, ID: <201>, content <FF F3 AA 55 00 00 00 F1> to make all battery packs enter sleep mode, and check if they have entered sleep mode by checking if the indicator light is off.

3) After ensuring that the battery packs are in sleep mode, close the circuit breaker on the power line of the battery pack and connect to the power bus.

4) Send any data through the CAN bus to activate all battery packs, and the battery packs will perform parallel connection judgment after activation (based on the total voltage of the lowest battery pack). The battery packs whose total voltage is lower than 1.5V will turn on the MOS to enter the bus, while the battery packs whose voltage difference exceeds 1.5V will not turn on the MOS. When connected to the charger, the total voltage of the battery is charged to within 0.5V of the

pressure difference, and it is automatically incorporated.

六、产品贮存及运输 Storage and Shipment Of the Product

（一） 产品贮存 Product Storage

产品长期存放不使用时，请放置于干燥通风处，避开易燃易爆物品；每三个月定期对电池包进行充点电维护确保电池处于最佳性能状态。

Put the product in a dry, ventilated place for long-term storage; charge the battery pack regularly every three months to ensure the battery is in optimum performance.

（二） 产品运输 Product Shipment

电池包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。

The battery pack can only be shipped with external packaging and violent shaking, striking and squeezing should be avoided in the shipment. Don’t expose the battery pack to the sun and rain.

七、使用说明及安全规程 Operating Instruction and Safety Regulations

（一） 使用说明 Operating Instruction

- 使用电池前，请仔细阅读规格书。

  Before using the batteries, carefully read the service manual and the specification of the batteries.

- 请在正常的环境中使用电池，充电温度 0℃~50℃，放电温度-20℃~55℃,相对湿度：60±25%。

  Please use the batteries in a normal environment, charge temperature is 0℃~50℃, discharge temperature -20℃~55℃and the relative humidity is 60%±25%.

- 在使用过程中，电池应远离热源、高压，避免儿童玩弄电池，切勿摔打电池。

  During their use, the batteries should be kept away from heat sources and high voltages, children should not be allowed to play with them, and they should not be knocked violently.

- 切勿将电池正负极短路，切勿自己拆装电池，也勿让电池放在受潮处，以免发生危险。

  In no circumstance should the positive and negative poles of the battery be short circuited. Do not disassemble or assemble the batteries yourself and do not place the batteries in a damp place in order to avoid danger.

- 长期不用时，请将电池储存完好，让电池处于半荷电状态。请用不导电材料包裹电池，以避免金属直接接触电池，造成电池损坏，将电池保存阴凉干燥处。

  When the batteries are not to be used for a long time, please store them safely so that they will stay in a half-charged state. Please wrap the batteries with non-conductive materials in order that metallic materials will not contact the batteries directly, which may result in damage to the batteries. Keep the batteries in a cool and dry place.

- 废弃电池请安全妥当处理，不要投入火中或水中。

  Please dispose of the used batteries properly. Do not throw them in fire or water.

- 如果将电池用于其他设备，请与供应商咨询，不得擅自将本电池包用于其他系统。

  If the battery is to be used in other devices, please consult with the supplier about the degree of perfection of its protective function, Do not make arbitrary decisions to use battery in other devices.

（三） 注意事项 Cautions

- 充电温度范围 Temperature range during charging

  推荐的充电温度范围是 0-45℃。在超出此范围的环境中充电会造成电池性能下降、减少寿命。

  The recommended temperature range for battery charging is between 0℃ and 45℃. Charging of the batteries out of that temperature range will cause the performance of the batteries to decrease and their life to shorten.

- 咨询 Consultation

  购买电池时，请注意销售商联络方法，以便需要时及进与销售商取得联系，得到咨询。

  When purchasing the batteries, be careful to remember the way to stay in contact with the seller so that you can contact the seller and have consultation with it when needed.

- 保用期 Warranty period

  属于使用不当而非质量问题，即使在保用期内，生产厂家也不会无偿更换新电池。

  The manufacturer will not replace the battery free of charge even in the warranty period if the problem with the battery results from misuse rather than bad quality.

- 安全使用保障 Safety use guaranteed

  如果将电池用于其他设备，请与供应商讨保护功能的完善性。至少应该咨询电池的大电流、快速充电、特殊应用的问题。

  If the battery is to be used in other devices, please consult with the supplier about the degree of perfection of its protective function. You should at least have a clear knowledge of such issues as the heavy current, fast charging and special application of the battery.

（四） 危险警告 Warning Against Risk

- 禁止拆装电池 Do not disassemble the batteries

  电池内部具有保护机构和保护电路可以避免发生危险。不合适的拆装会损坏保护功能，将会造成让电池发热、冒烟、变形或燃烧。

There are a protective mechanism and a protective circuit inside the battery, which helps prevent danger. Improper disassembly of the battery can damage the protective function of the battery and therefore causes the battery to heat, smoke, deform or even burn.

- 禁止让电池短路 Short circuit of the battery is prohibited

  不要将电池的正负极用金属连接，也不要将电池组与金属片放在一起存储和移动。如果电池被短路，将会有超大电流流过，将会损坏保险丝。

  Do not short circuit the positive and negative poles of the battery with metal and do not store or move the batteries together with metal sheets either. If the battery is short circuited, a heavy current will run through the battery, which will damage it and cause it to heat, smoke, deform and even burn.

- 严禁加热和焚烧电池 Heating and burning of the battery is prohibited

  加热和焚烧电池将会造成电池隔离物的溶化、安全功能丧失或电解质燃烧，过热就会使电池发热、冒烟、变形或燃烧。

  Heating and burning of the battery causes its separator to melt, its safety function to lose or its electrolyte to burn. Overheating of the battery will cause it to heat, smoke, deform and burn.

- 避免在热源附近使用电池 Avoidance of use of the batteries near a heat source

  不要在火源、烤炉附近或超过 60℃的环境中使用电池，过热将会导致电池内部短路，使电池发热、冒烟、变形或燃烧。

  Do not use the batteries near a fire source, a furnace or in an environment of which the ambient temperature exceeds 60℃. Excessively high temperature will cause a short circuit to occur within the battery, which will cause the battery to heat, smoke, deform or burn.

- 禁止弄湿电池 Damping of the battery is prohibited

  不要弄湿电池，更不能将电池投入水中，否则会造成电池内部保护电路和功能丧失及发生不正常的化学反应，电池有可能发热、冒烟、变形或燃烧。

  Do not moisten the battery and throwing of the battery into water is even more prohibited. Otherwise the inner protective circuit within and the protective function of the battery may be lost and abnormal chemical reactions may occur, and as a consequence the battery may heat, smoke, deform or burn.

- 避免在火源附近或阳光直射下充电 Avoidance of charging of the battery near a fire source or in direct sunlight

  否则会造成电池内部保护电路和功能丧失和发生不正常的化学反应，电池有可能发热、冒烟、变形或燃

  If the principle is violated, the inner protective circuit within and the protective function of the battery may be lost and abnormal chemical reactions may occur, and as a consequence the battery may heat, smoke, deform or burn.

- 禁止破坏电池 Damage of the battery is prohibited

  禁止用金属凿入电池、锤打或摔打电池或其他方法破坏电池，否则会造成电池发热、冒烟、变形或燃烧，甚至会发生危险。

  The battery should not be damaged by means of methods like knocking metallic things into the battery, hammering the battery, knocking it violent or etc. Otherwise the battery may heat, smoke, deform or burn and even dangers may happen sometimes.

- 禁止在电池主体上直接焊接 Welding is not allowed to be conducted on the battery

  过热将会造成电池隔离物的溶化、安全保护功能丧失，使电池发热、冒烟、变形或燃烧。

  Overheating causes the separator of the battery to melt and the safety protection function to be lost, which will lead to the heating, smoking, deforming or burning of the battery.

- 不可将电池用于其他设备 The battery cannot be used in other devices

  不恰当使用会损坏电池的性能、降低寿命，甚至会使电池发热、冒烟、变形或燃烧。

  Improper use may affect the performance of the battery or shorten its life, and sometimes it may even cause the battery to heat, smoke, deform or burn.

- 不要直接触及漏液电池 Direct contact with the leaking battery is prohibited

  渗漏的电解液会造成皮肤不适，万一电解液进入眼睛，尽快用清水冲洗，并迅速送医院处理。

  The electrolyte that has leaked out may injure the skin. Flush the eye with clear water immediately in case the electrolyte goes into it accidentally. Do not knead the eye and go to hospital for further medical treatment immediately.

（五） 危险类型 Dangerous Mode

客户知悉在电池使用和操作过程中存在以下潜在的危险：

Client acknowledges there are in the process of operation and use battery potential dangers：

1、操作者在操作时可能会受到化学品、电击或电弧的伤害。尽管人体对遭受直流电与交流电的反应不同，但是高于 50 伏的直流电压对人体的伤害是同样严重的，因此客户必须在操作中采取保守的姿势以避免电流的伤害。

The operator during operation may be limited by chemical damage, electric shock or electric arc. Higher than 50V/DC voltage is damage serious, the harm of human body so the customer must to be conservative in the operation to avoid the current damage.

2、存在来自电池中的电解液的化学风险。

Chemical risks from the electrolyte in the battery.

3、在操作电池和选择个人防护装备时，客户必须考虑到以上潜在的风险,防止发生意外短路，造成电弧、爆炸或热

失控。

When handling batteries and selecting personal protective equipment, customers must take into consideration the potential risks mentioned above to prevent accidental short circuits, which could lead to electrical arcs, explosions, or thermal runaway.