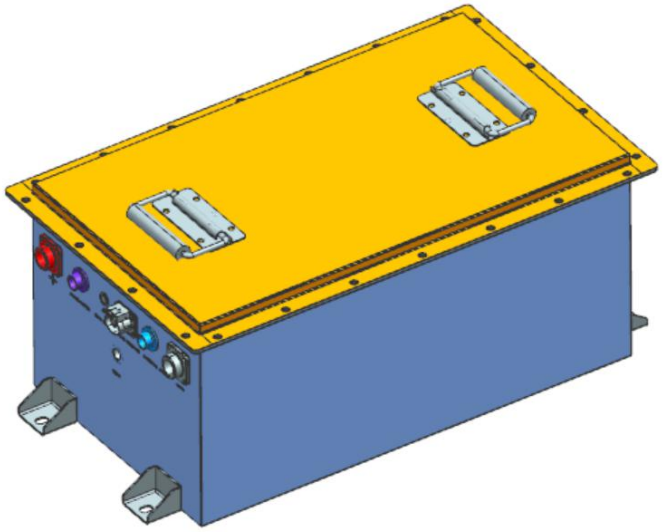
105Ah 16S1P System

Technical Customer Information



文件 编号 File NO.：RD-S51105P-S-01
版　　本 Version：B
日　　期 Date:　2020.6.6

产品名称 Part Name	Battery System
产品型号 Part Number	S51105P
产品规格 Specification	105Ah 16S1P
拟　制 Prepared by	JJ.Zhang
审　核 Check	YL.Li/JZ.Deng
批　准 Approve	CS.Li

电话 TEL：0752-5709886
Add:广东省惠州市仲恺高新区惠风六路 27 号乐亿通工业园
RoyPow Industrial Park, #27 Huifeng 6th Road, Zhongkai High-Tech District, Huizhou, Guangdong, China

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

Change history 修订记录

Version 版本	Date 日期	Reason for change 修订原因	Author 修订人	Release 发布
A	2020.5.21	Initial version 初期版本	JJ.Zhang	
B	2020.6.6	修改部分英文描述及接口标注	JJ.Zhang	

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

Table of contents

1. PRODUCT OVERVIEW....4

1.1. Product Information....4

1.2. Product function Cell voltage measurement....4

1.3. Product Specification....5

2. SYSTEM ARCHITECTURE....7

2.1 Battery System Overview....7

2.1 Battery System principle diagram....8

3. ASSEMBLY....9

3.1. Mechanical architecture....9

3.2 MechanicalInterface....10

3.3 . Battery System Power Interface....11

3.4 . Battery System LV Interface....11

3.5 . Battery System identification Information....12

4. EOL TEST....13

4.1 Production line layout & EOL equipment....13

4.2 EOL test sequence & specification....14

5.PACKING REQUIREMENTS....14

5.1 Refer to company module packaging design specification....14

5.2 Product packing list....14

6. OPERATION LIMIT....15

7. HANDLING PRECAUTION AND PROHIBITIONS OF LITHIUM- ION BATTERY MODULE....16

8. TECHNICAL TERMINOLOGY....18

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

1. Product Overview

This document describes the battery system specifications, including battery cells and battery module controllers, that will provide low-voltage system power output to electric vehicles.

本文件描述了电池系统的规格，包括电池电池和电池模块控制器，将给电力车辆提供低压系统动力输出。

1.1.Product Information

System		Version	Remark
Assembly		A	S51105P
	Cell	F	EVE LF105
	BMS	V0.6	XBA48V300AS

1.2.Product function Cell voltage measurement

- The battery system provides power output 电池系统能提供动力输出
- The battery system has a single voltage detection function 电池系统具备单体电压检测功能
- The battery system has the function of total voltage detection 电池系统具备总电压检测功能
- The battery system has a temperature detection function 电池系统具备温度检测功能
- The battery system has current detection function 电池系统具备电流检测功能
- The battery system has charging overcurrent protection function 电池系统具备充电过流保护功能
- The battery system has overvoltage protection for charging 电池系统具备充电过压保护功能
- The battery system has the protection function of charging over temperature 电池系统具备充电过温保护功能
- The battery system has discharging overcurrent protection function 电池系统具备放电过流保护功能
- The battery system has overvoltage protection for discharging 电池系统具备放电过压保护功能
- The battery system has the protection function of over - temperature discharge 电池系统具备放电过温保护功能

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

1.3.Product Specification

1) Dimension(L x W x H) :585 (L) x 330 (W) x 254(H) (see Chapter2 for module mechanical spec.)
2) Weight : Module under 46 kg
3) Battery module Specification in series

Item		Unit	Module Specification	Remark
Nominal Capacity 额定容量		Ah	105Ah	@ 0.5C，25℃
Actual Capacity 实际容量		Ah	≥105Ah	@ 0.5C，25℃
Configuration 配置		-	16S1P	
Operating Temp. 操作温度	充电工作温度 Charging operating temperature	℃	0~55	
	放电工作温度 Discharge operating temperature	℃	-20~55	
Storage Temp. 存储温度	短期（1 个月内） Short term (within 1 month)	℃	-20~45	
	长期（一年内） Long term (within one year)	℃	0~35	
Nominal Voltage 额定电压		V	51.2	Cell 3.2V
Max. Voltage 最大电压		V	58.4	Cell 3.65V
Min. Voltage 最小电压		V	40	Cell 2.5V
Nominal Energy Content 常规容量		kWh	≥5.376	@ 0.5C，25℃
Weight 重量		Kg	46±1.5	
Discharge Operation max current 放电最大电流 (@30s, 25℃, SOC50%, BOL)		A	250	
Charge Operation max current 充电最大电流 (@2s, 25℃, SOC 50% BOL)		A	50	
Continuous Discharge Operation current 连续放电电流 (@25℃, SOC50%, BOL)		A	105	
Continuous Charge Operation current 连续充电电流 (@25℃, SOC 50% BOL)		A	30	
Standard Charge (@ 25℃) 标准充电			Constant Current: ≤0.5C Constant Voltage:3.65V End Condition(Cut off): ≥0.02C	
The state of charge(SOC) of the module before shipping		-	SOC 30%±3%	
Self Discharge Rate 自放电率 (@SOC 100%, 25℃ , Loss/Month， @BOL)		%	Max 3	
Safety and Reliability 安全可靠性		-	GBT Certificate	cell
Insulation 绝缘		MΩ	Min 20MΩ/1000VDC,	@25℃±5℃, RH50%
Cooling type 冷却方式		-	Natural(Passive) Convection	
SOC Operating Range SOC 工作范围		%	0~ 100%	

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

IP Grade IP 防护等级	-	IP67	
Calendar Life 日历寿命 (@25℃, SOC 100%, EOL 80%)	year	10	
Cycle Life 循环寿命		>3500	@25℃, 0.5C charge, 1C discharge, DOD 100%(SOC0~100%)
Capacity at EOL 寿命终止剩余容量		EOL 70%	According to warranty period, driving pattern, temp. profile, etc

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

2. System architecture

2.1 Battery System Overview

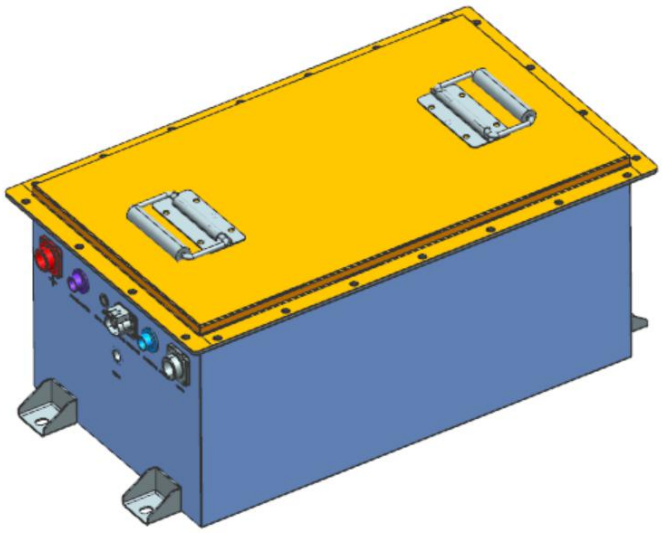


Figure 1. RoyPow 105Ah 16S1P System

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

2.1 Battery System principle diagram

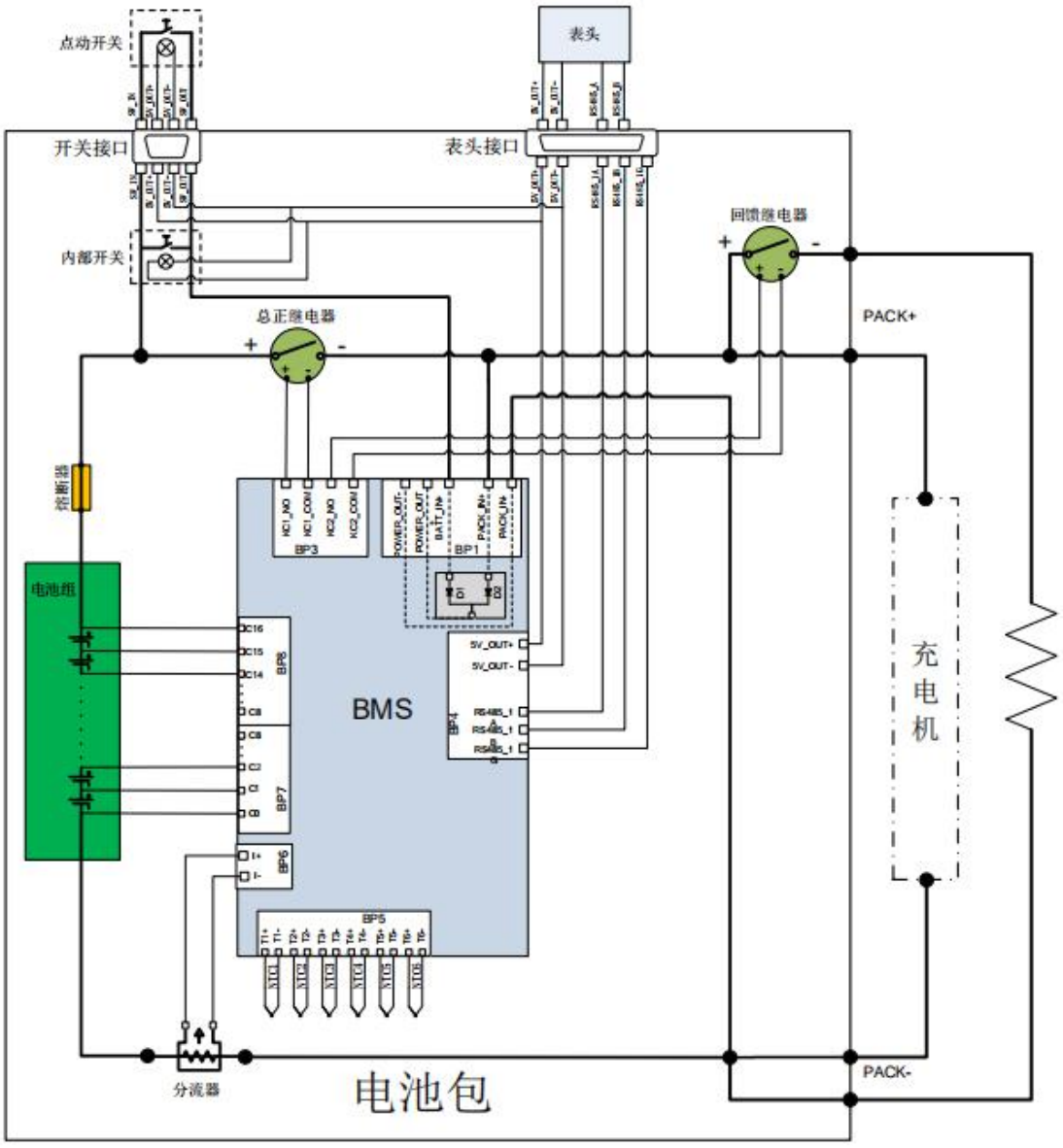


图 4-1 BMS 系统连接示意图

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

3. Assembly

3.1. Mechanical architecture

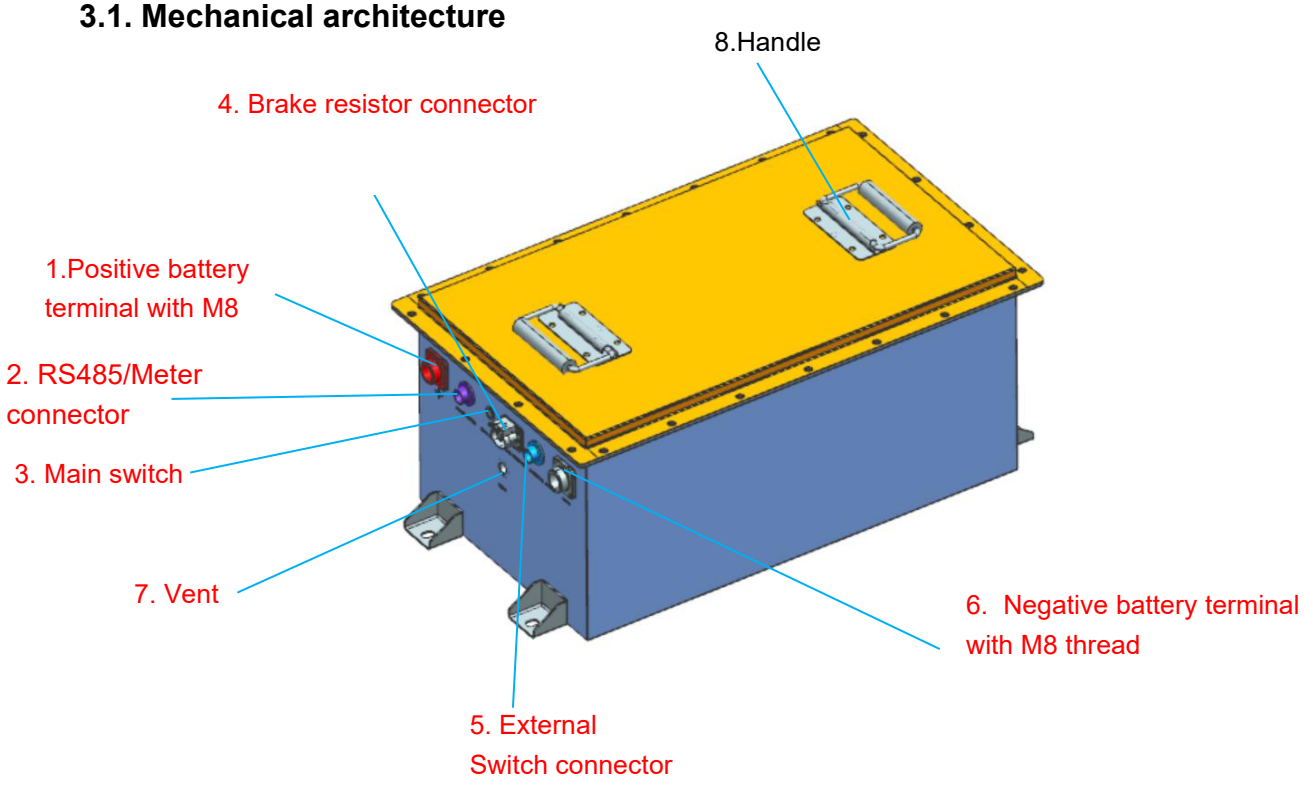


Figure 2. BATTERY SYSTEM ISO View

No.	Part name	Material/Model	Qty
1	Positive battery terminal 正极接口	M8 Thread connector 正极	1
2	RS485/Meter connector RS485/表头接口	GX16-6	1
3	Main switch 电池开关		1
4	Brake Resistor connector 刹车电阻接口	20A 两芯金属插座接口	1
5	External Switch connector 外接开关接口	D16-4P	1
6	Negative battery connector 负极接口	M8 Thread connector 负极	1
7	Vent 泄气阀		1
8	Handle 提手	Galvanized steel 镀锌钢	2

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

3.2 Mechanical Interface

Mounting Hole to pack

- Quantity:4EA
- Recommended Bolt Size： M8
- Size Hole : 10*14
- Recommended Fastening Torque: 12±2N

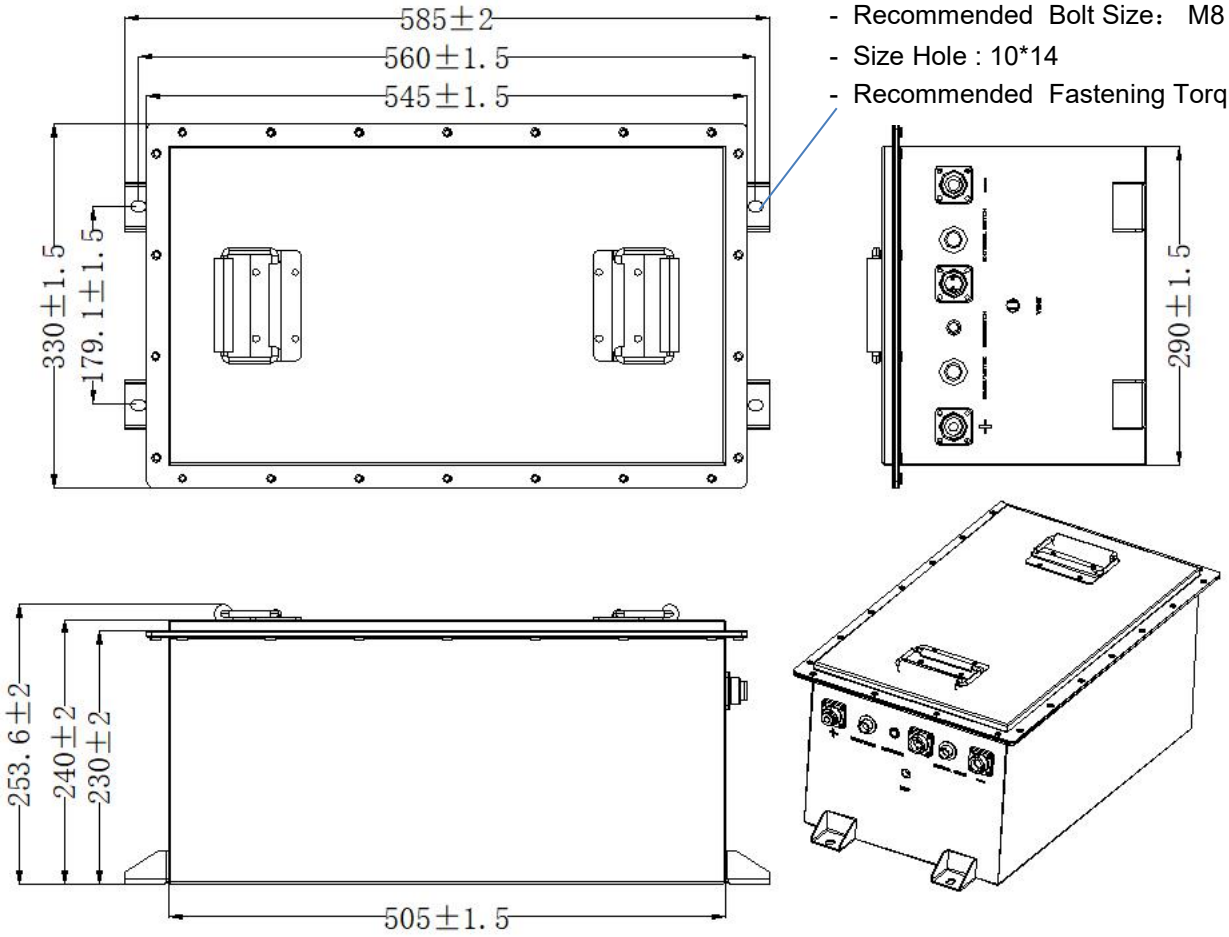


Figure 3. System Tolerance

Fixation method is recommended as below table, 固定方法建议如下表:

NO.	Dimension & Fixation
Dimension 尺寸(mm)	585 (L) x 330 (W) x 253.6(H)
Installation dimension 安装尺寸(mm)	560(L) x 179.1(W)
Fastener 紧固件（ref）	M8, Bolt Height 螺栓高度(M8* 25mm ref)) Fastening Torque (12 ±2Nm)

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

3.3 . Battery System Power Interface

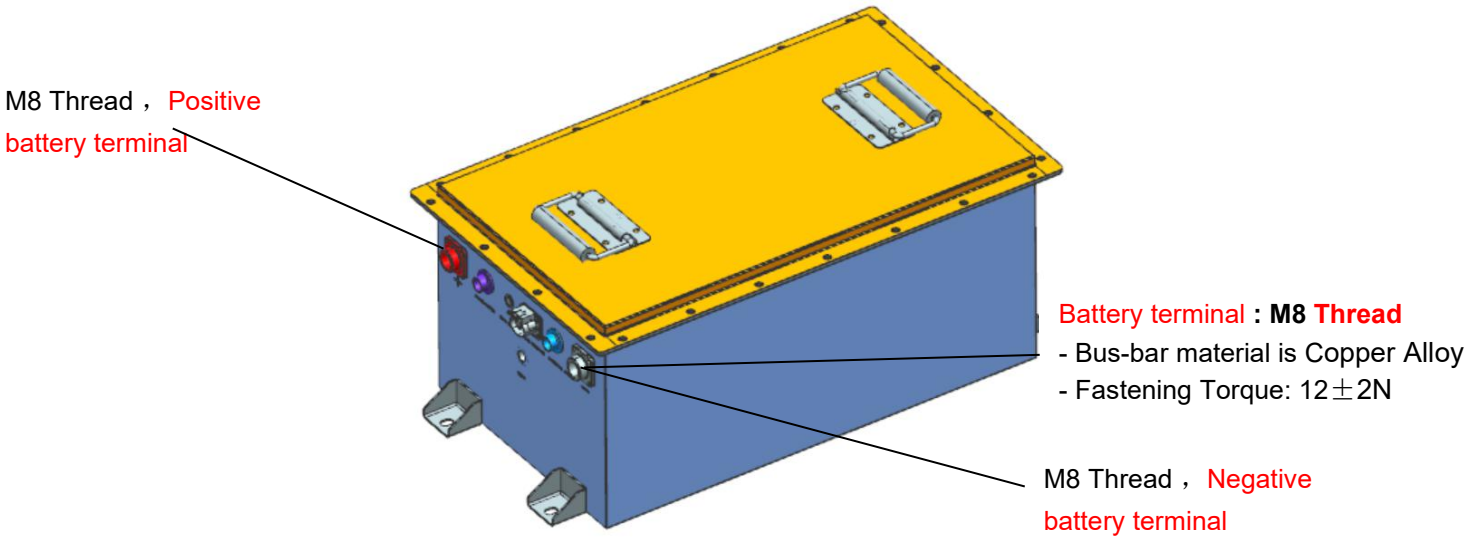


Figure 4. BATTERY SYSTEM ISO View

3.4 . Battery System RS485/Meter connector

1) RS485/Meter connector view 低压连接器视图

PIN Layout of RS485/Meter connector	3D View of RS485/Meter connector
6 Pin Connector	

Figure 5.RS485/Meter connector

2) RS485/Meter connector Pin Assignment **低压连接器引脚分配**

Pin No	Terminal Material	Signal	Signal Description
1	Sn	5V-	黑
2	Sn	485_A	黄
3	Sn	485_B	白
4	Sn	5V+	红
5			
6			

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

3) External Switch connector view 低压通讯连接器视图

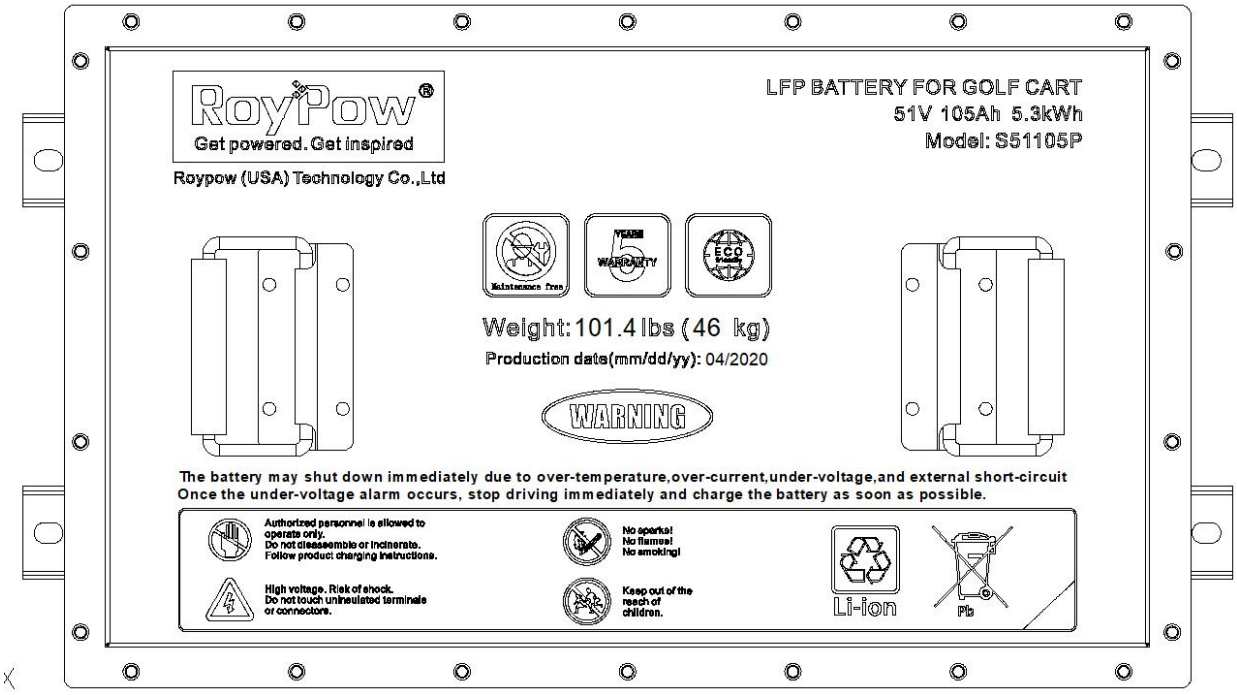
PIN Layout of External Switch connector	3D View of External Switch connector
4 Pin Connector	

Figure 5. External Switch connector

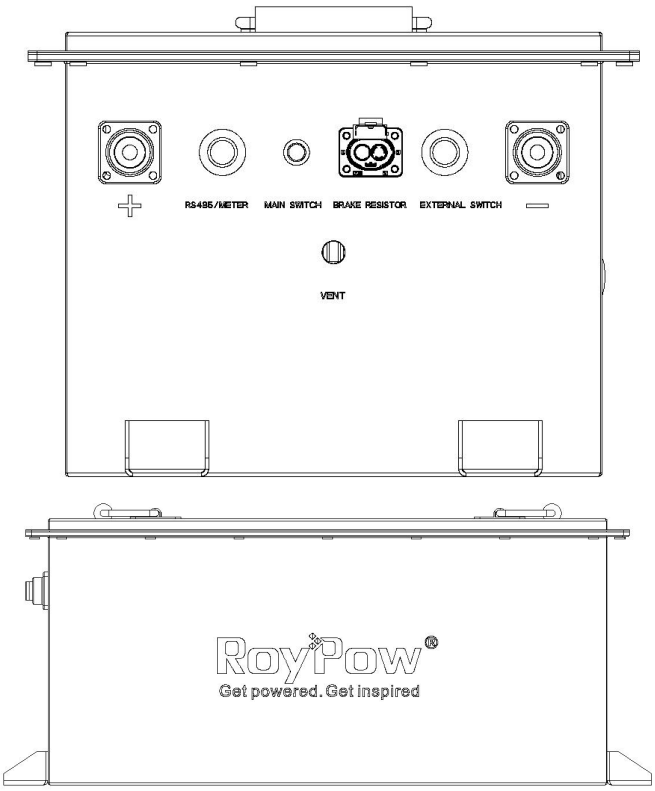
4) External Switch connector Pin Assignment 外接开关通讯连接器引脚分配

Pin No	Terminal Material	Signal	Signal Description
1	Sn	5V-	黑
2	Sn	SW_OUT	黄
3	Sn	SW_IN	白
4	Sn	5V+	红

3.5 . Battery System identification Information

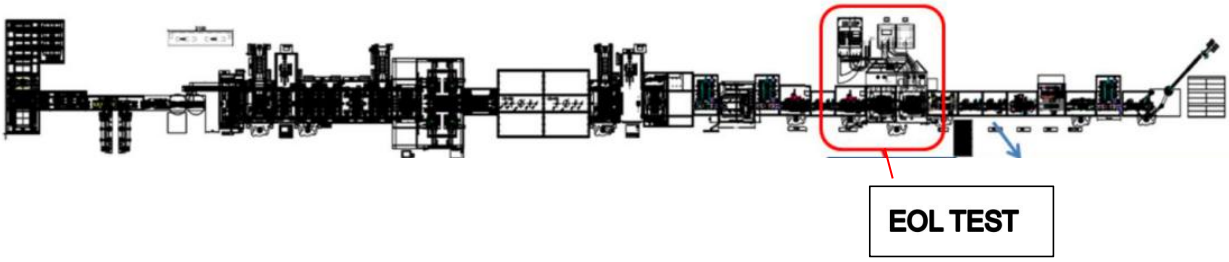


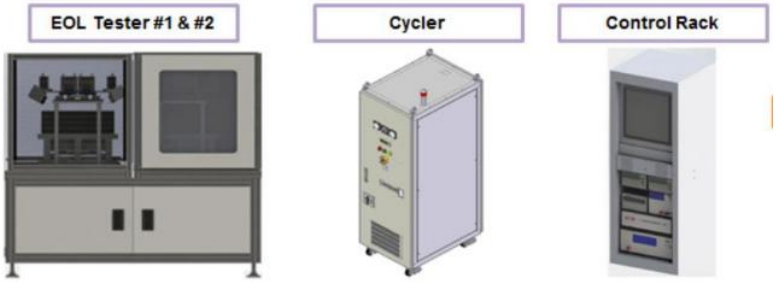
RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

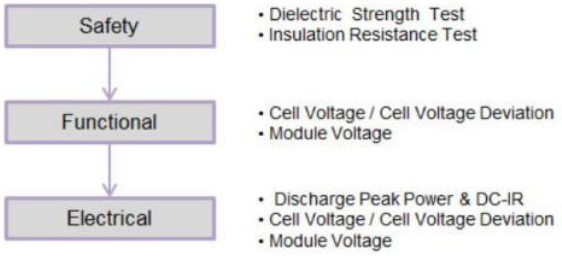


4. EOL TEST

4.1 Production line layout & EOL equipment







RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

4.2 EOL test sequence & specification

Test NO.	Test name	Test condition	Purpose & Description	Specification
1	Insulation Resistance Check 绝缘电阻检查	1000Vdc. 3sec. RT(25±5℃) Soc 30%	To verify insulation resistance for module of between HV terminal and frame 验证高压端子与机架之间模块的绝缘电阻	≥ 20MΩ
2	Module Voltage Check 电池电压检测	RT(25±5℃), Soc 30%	To confirm the Module voltage range 确认模组电压范围	
3	Cell Voltage Deviation Check 电池电压偏差校验	RT(25±5℃), Soc 30%	To confirm the cell voltage Deviation in the module 确认模块中电池电压偏差	

5.Packing requirements

5.1 Refer to company module packaging design specification

5.2 Product packing list

NO.	产品名称 Part Name	产品编码 Part Number	产品规格 Product Specification	包装数量 Package Quantity
1	Battery System	S51105P	105Ah 16S1P	1pcs
2	显示屏线束	S4855SM005	Molex，4 芯线束，线长 3 米	1pcs
3	高尔夫球车系统通用显示屏	S4855S	项目包含单色显示屏保护板、防水壳料及转接线材	1pcs
4	D16-4P 航空插头母座	S12105M005	GX16-4	1pcs

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

6. Operation Limit

● **Temperature limit**

Temperature limit of Operating and Safety 操作温度极限和安全			
Limit	**Item**	**Value**	**Remark**
Safety limit	Max. storage	45°C	This is to be ensured in an ambient temperature range 确保在环境温度范围内
	Min. storage	-20°C	This is to be ensured in an ambient temperature range 确保在环境温度范围内
	Max. operation	55°C	This is to be ensured in a cell core temperature 确保电芯在温度范围内
	Min. operation	-20°C	This is to be ensured in a cell core temperature 确保电芯在温度范围内
Operation limit	Max. operation	55°C	This is to be ensured in a cell core temperature 确保在环境温度范围内
	Min. operation	-20°C	This is to be ensured in a cell core temperature 确保在环境温度范围内

● **Voltage limit**

Voltage limit of charge and discharge			
Limit	**Item**	**Value**	**Remark**
Safety limit	Charging voltage	3.7 V	If charge voltage violates 3.7 V, RoyPow cannot guarantee safety of cell. Cells which violated safety voltage limit have not to be used electrically and right after violation and must be changed immediately. **如果充电电压违反 3.7 V, RoyPow 不能保证电池的安全。违反安全电压限制的电池不得在违反安全电压限制后立即使用，必须立即更换。**
	Discharging voltage	1.50 V	If discharge voltage violates 1.5 V, RoyPow cannot guarantee safety of cell. Cells which violated safety voltage limit have to be changed right after violation. **如果放电电压超过 1.5 V, RoyPow 不能保证电池的安全。违反安全电压限制的电池必须立即更换。**
Operation limit	Charging voltage	3.65V	represents the error limit for voltage limit violations 表示违反电压极限的错误极限
	Discharging voltage	2.50 V	represents the error limit for voltage limit violations 表示违反电压极限的错误极限

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

7. Handling Precaution and Prohibitions of Lithium- Ion Battery Module

Before using the battery module, be sure to read the battery module handling user manual and precautions.
在使用电池模块之前，请务必阅读电池模块处理用户手册和注意事项。
Improper handling of lithium ion battery may cause leakage, heat, smoke, an explosion, or fire. This could cause deterioration of performance or failure.
Please be sure to follow instructions carefully.
锂离子电池操作不当可能导致泄漏、发热、冒烟、爆炸或火灾。这可能会导致性能恶化或失败。 请务必认真按照说明操作。

7.1. Storage 存储

Store the battery module at room-temperature conditions 在室温条件下储存电池模块

短期（1 个月内）Short term (within 1 month)	-20~45℃
长期（一年内）Long term (within one year)	0~35℃

Customer incoming inspection should be completed within 1 month after arrival date at customer side.
客户需要在到货后 1 个月内完成来料检

7.2. Safety precautions and prohibitions 安全注意事项及禁止事项

To assure product safety, please list the following precautions in the application's instruction manual.
为确保产品安全，请在使用说明书中列出以下注意事项。

7.3. Electrical misusage 电滥用

- Use dedicated charger 使用专用充电器
- Use or charge the battery only in the dedicated applications
  电池只能在专用场合使用或充电
- Reverse charging is prohibited 禁止反向充电
- Charge current must be controlled by the specified value in the battery specification充电电流必须控制在电池规格中规定的值
- Cut-off voltage for charging must be 58.4V (3.65V x 16)
  充电截止电压为**58.4V (3.65V x 16)**
- Charger must stop charging battery by detecting cut-off current specified in the battery specifications
  充电器必须通过检测指定的截止电流来停止充电电池规格
- Discharge current must be controlled by the specified value in the product Specifications 放电电流必须控制在产品规定的规格值内
- Cut-off voltage of discharging must be over 40V (2.5V x 16)
  放电截止电压必须超过 **40V (2.5V x 16)**

7.4. Environmental misusage 环境滥用

- Don't leave the battery near a fire or heat sources不要把电池放在火源或热源附近
- Don't throw the battery into a fire 不要把电池扔进火里
- Don't immerse, throw, and wet the battery in water / seawater
  不要将电池浸泡在水中或海水中

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

7. 5. Others

- Don’t store metallic objects such as keys or screwdriver near the cell
  不要将钥匙或螺丝刀等金属物品存放在电池附近
- Don't short circuit (+) and (-) terminals with metallic object intentionally
  不要故意用金属物品短路**(+)**和**(-)**端子
- Don't pierce the battery with a sharp object such as a needle or screwdrivers
  不要用尖锐的东西如针或螺丝刀刺穿电池
- Don't heat a part of the battery with heating objects such as a soldering iron
  不要用电烙铁等加热物体加热电池的一部分
- Don't hit the battery with heavy objects such as a hammer or heavy weights
  不要用重物如锤子或重物撞击电池
- Don't step on the battery and throw or drop the battery on the hard floor
  请勿踩到电池上，将电池摔落在坚硬的地面上
- Don't disassemble the battery or modify the battery design including electric Circuit 不要拆卸电池或修改电池的设计，包括电路
- Don't solder anything on the battery directly 不要直接焊接电池上的任何东西
- Don't use seriously scar or deform the battery 不要使用严重疤痕或变形电池
- Don't put the battery into a microwave oven, dryer, or a high-pressure container
  不要将电池放入微波炉、烘干机或高压容器中
- Don’t disassemble the battery by customer. 请勿自行拆卸电池。
- Don’t put into the water. 不要放入水中。
- Don’t expose the water splashing condition. 不要暴露在溅水的环境中。
- Don’t expose the heavy humidity condition. 不要暴露在潮湿的环境中。
- Don’t use after drop accident 坠落事故后请勿使用
- Before using charger, be sure to read the charger’s user manual.
  使用充电器前，请务必阅读充电器的使用说明书。
- Before installing and removing the battery from application, be sure to read the application’s user manual
  在从应用程序中安装和移除电池之前，请务必阅读应用程序的用户手册
- If the cell or module needs to be stored for a long period, the cell or module should be removed from the application and stored in a proper place under room temperature conditions. 如果电池或模块需要长时间存储，则应将电池或模块从应用程序中移除，并在室温条件下存储在适当的位置。
- While the battery is charged, used and stored, keep it away from object materials with static charge 电池充电、使用、储存时，应远离带静电的物体材料

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.

7.6. Warning 警告

- Stop charging the battery if charging isn't completed within the specified time.
  如未在规定时间内完成充电，请停止充电。
- Stop using the module if the battery becomes abnormally hot, develops an odor, becomes discolored, becomes deformed, or develops any other abnormal conditions during use, charge, discharge, or storage.如果电池在使用、充电、放电或储存过程中出现异常发热、异味、变色、变形或其他异常情况，请停止使用模块。
- Keep away from fire or hot heat sources immediately when a leakage or foul odors are detected. If liquid leaks onto your skin or cloths, wash it out with plenty of fresh water immediately.当发现有泄漏或异味时，应立即远离火源或热源。如果液体泄漏到皮肤或衣服上，立即用大量的清水冲洗干净。
- If liquid leaks from the battery and gets into your eyes, don't rub your eyes.
- Wash your eyes out with plenty of clean water and seek medical attention Immediately. 如果液体从电池漏出进入眼睛，不要揉眼睛。
  用立即大量的清水清洗眼睛，并寻求医疗救助。
- If the terminals of the battery become dirty, wipe them with a dry cloth before using the battery module .如果电池的端子脏了，在使用电池模块之前用干布擦干净。
- The battery can be used within the following temperature ranges. Don't exceed these ranges: -20 ~ 55℃ at temp sensor. Cover terminals with proper insulating tape before disposal.
  电池可在以下温度范围内使用，不要超过温度范围:**-20 ~ 55**℃。
  在处置端子之前，用适当的绝缘胶带覆盖端子。

8. Technical terminology

BOL	Beginning of life	寿命开始
EOL	End of life	寿命终止
SOC	State of capacity	荷电状态
DOD	Depth of discharge	放电深度
RH	Relative Humidity	相对湿度
RT	Room temperature	室温

RoyPow confidential / All rights reserved: no part of these pages may be used for any purpose other than for the purpose expressly permitted by RoyPow. Reproduction, modification, storage in a retrieval system or retransmission, in any form or by any means, electronic, mechanical or otherwise is strictly prohibited.