Specification confirmation

Product name	**Rack Mounted LiFePO4 Battery pack**
Product model	**FP51150LFP-RM**
Customer code	
Document number	
Version number	A/0
Issu date	2022-11-20

Approved by	**Reviewed by**	**Prepared by**
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Directory

1. Scope

This specification is only applicable to FP51150LFP-RM 7680Wh rack type battery. This product is composed of 3.2V 150AH new lithium iron phosphate battery, which adopts 16S 1P mode. The battery pack adopts scientific internal structure design, advanced BMS system, industry-leading production technology, high specific energy, long life, safety and reliability. It has the characteristics of wide temperature range and is an ideal green energy storage power product.

2. Product Pict

Item		Parameter	Unit
Product Size	Length	4483 (including lug 500)	mm
	Width	440	mm
	Height	190	mm

3. Product specifications and parameters

Battery Model	FP51150LFP-RM
Battery Type	LiFePO4
Battery Rated Voltage (V)	51.2V
Battery Rated Capacity (0.2C)	150Ah
Energy (Wh)	7680
Size (L*W*H)mm	483 (including lug 500) * 440 * 190
Weight (kg)	≤64
Operating Voltage Range (V)	40-58.4V
Recommended charging current (A)	30A
Maximum Continuous Charging Current (A)	100A
Maximum Continuous Discharge Current (A)	100A
Peak Discharge Current (A)	320A(3S)
Internal Resistance (mΩ)	40 mΩ
Storage Temperature	10℃~35℃
Storage Humidity	10%~90% RH
Shipping Voltage	51V ~ 52V
Charging Temperature	0~55℃
Discharge Temperature	-20~55℃
Cooling Mode	natural cooling
Waterproof Level	IP54
Battery Cycle Life	6000 times ≥80% (standard charge and discharge)
Standard Environmental condition	Temperature : 23±5℃
	Humidity : 45-75%RH
	Atmospheric Pressure : 86-106 KPA

4. BMS Functional configuration

Function	Configuration	Function	Configuration
Cell voltage	3.2V	485Communication ports	2 independent 3 RJ45 ports
Number of battery strings	16S	CAN communication interface	Yes
Nominal capacity	150Ah	Dial the code address	The default number for 6 digits is 111111
Current limiting function	10A Traffic limiting, disabled by default	LED light	Six parallell
Storage capabilities	≤10000 article	Display screen interface	Yes
Precharge Function	Support	Heated film interface	Yes,≤100W
Reverse connection protection function	Support	External switch interface	Yes
Real Time Clock (RTC)	Support	Activate way	Charge, press button, communication activation
Button battery holder and battery	Support	B + line specifications	350mm red wire OT8 terminal
Buzzer	Yes (off by default)	Sampling and wiring requirements	7676
NTC number	6	Dry contact	2
B-, P- screw specifications	M5	Rated current	Rated 100A charge and discharge

5. BMS Parameter Setting

No.	Indicators project		Specifications	Settable or Not	Remark
1	Cell overcharge protection	Overcharge alarm voltage	3600mV	Settable	
		Overcharge protection voltage	3650mV	Settable	
		Overcharge protection delay	1.0S	Settable	
	Cell overvoltage protection release	Overcharge protection release Voltage	3600mV	Settable	
		Recovery condition	1. When the lowest voltage is lower than the recovery point and the highest voltage < 3.6V, it will recover after a delay of 24H; 2. The effective discharge current of the battery is detected.		
2	Cell over-discharge protection	Over-discharge alarm voltage	2700mV	Settable	
		Over-discharge protection voltage	2500mV	Settable	

		Over-discharge protection delay	1.0S	Settable	
	Cell over-discharge protection release	Over-discharge protection release voltage	2700mV	Settable	
		Recovery condition	1. When single cell voltage rises to the protection recovery point, it will automatically recover; 2. The effective charging current is detected.		
3	Pack Overcharge Protection	Overcharge Alarm voltage	57.6V	Settable	During charging , overvoltage alarm and protection are stored as “events” or uploaded
		Overcharge protection voltage	58.4V	Settable	
		Overcharge protection delay	1.0S	Settable	
	Pack overvoltage protection release	Overcharge protection release Voltage	57.6V	Settable	
		Recovery condition	1. The Pack voltage drops to the recovery point and recovers after a delay of 0.5H; 2. The effective discharge current of the battery is detected.		
4	Pack over-discharge protection	over-discharge alarm voltage	43.2V	Settable	
		over-discharge protection voltage	40.0V	Settable	
		over-discharge protection delay	1.0S	Settable	
	Pack over-discharge protection release	Over-discharge Protection Release Voltage	43.2V	Settable	
		Released when charging	1. The pack voltage rises to the recovery point and automatically recovers; 2. The effective charging current of the battery is detected.		
5	Charging overcurrent protection Level 1	Charging overcurrent alarm current	105A	Settable	
		Charging overcurrent protection current	110A	Settable	
		Charging overcurrent protection delay	15S	Settable	
	Charge overcurrent protection level 2	Charge overcurrent protection current	120A	Settable	
		Charge overcurrent protection delay	100ms	Settable	
	Charging overcurrent protection release	Recovery condition	1. After charging overcurrent occurs, the system will automatically be recovered at regular intervals (adjustable, default 30min); And locked after		

			10 consecutive attempts (Settable) and no longer recover automatically; 2. Discharge to release the charging overcurrent state.		
6	Discharge overcurrent protection 1	Discharge overcurrent alarm Current	105A	Settable	
		Discharge overcurrent protection Current	110A	Settable	
		Discharge overcurrent protection delay	15S	Settable	
	Discharge overcurrent protection 1 release	Recovery condition	1. Automatic recovery every 3 minutes, when entering discharge overcurrent for the third time, the protection state is locked and no longer automatically recovers 2. Charging recovery		
7	Discharge overcurrent protection 2	Discharge overcurrent protection current	120A	Settable	
		Discharge overcurrent protection delay time	100mS	Settable	
	Discharge over-current protection 2 release	Recovery condition	1. Automatic recovery every 3 minutes, when entering the discharge over-current for the third time, the protection state is locked and no longer automatically recovers 2. Charging recovery		
8	Short-circuit protection	Short-circuit protection function	320A		
		Short-circuit protection delay	300us		
		Short protection release	1. Short-circuit protection detection is 4 times, each detection time is 1 minute, the fourth detection is still short-circuit, it will be locked; 2. Charging resumes; 3. Manual reset.		
9	MOS High Temperature Protection	Over temperature alarm	100℃	Settable	
		Over temperature protection	110℃	Settable	
		Protection release temperature	100℃	Settable	
10	Cell Temperature Protection	Charging low temperature alarm	0℃	Settable	
		Charging low temperature protection	0℃	Settable	
		Charging low temperature protection release	5℃	Settable	

		Charging high temperature alarm	50℃	Settable	
		Charging high temperature protection	55℃	Settable	
		Charge high temperature protection release	45℃	Settable	
		Discharge low temperature alarm	-15℃	Settable	
		Discharge low temperature protection temperature	-20℃	Settable	
		Discharge low temperature protection release	-15℃	Settable	
		Discharge high temperature alarm	55℃	Settable	
		Discharge high temperature protection	60℃	Settable	
		Discharge high temperature protection release	55℃	Settable	
11	Ambient temperature alarm	Ambient low temperature alarm	-15℃	Settable	
		Ambient low temperature protection	-20℃	Settable	
		Ambient low temperature protection release	-10℃	Settable	
		Ambient high temperature alarm	55℃	Settable	
		Ambient high temperature protection	65℃	Settable	
		Ambient high temperature protection release	50℃	Settable	
12	Consumption Current	Self consumption current during operation	≤ 35mA (with display) ≤ 30mA (without display)		
		Low power consumption mode current	250μA		
13	Balanced function	Cell Charge Balancing	Turn on condition: active charge current state		
		Balanced Opening voltage	3450mV	Settable	
		Balanced off voltage	3400mV	Settable	
		Balanced opening voltage difference	20mV	Settable	
		Balanced terminal voltage difference	5mV	Settable	

		Balanced temperature limit	Set the balanced opening temperature range as per the balanced temperature.		
		Balanced high temperature Protection	55℃	Settable	
		Balanced high temperature protection recovery	50℃	Settable	
14	Capacity default setting	Low capacity alarm	SOC<10%	Settable	
		Low capacity alarm recovery	SOC > 25%	Settable	
		Fully Charged Capacity setting	150AH	Settable	
15	Sleep function	Sleep voltage	3300mV	Not Settable	
		Delay time	30min	Not Settable	
16	Charge and Discharge cycles	Calculation method: The cumulative discharge reaches 80% of the nominal value as one cycle			
17	Effective charging current	Charging entry current	500mA	Settable	Stop charging after meeting the requirements at the same time, and update the SOC to 100%
		Charging exit current	300mA	Settable	
	Effective discharge current	Discharge entry current	500mA	Settable	
		Discharge exit current	300mA	Settable	
18	Cell failure	Voltage difference protection	600mV	Not Settable	Not allowed to charge and discharge
		Voltage difference recovery	300mV	Not Settable	
19	Battery capacity setting	Remaining battery capacity	Power on default 65%		
		Remaining capacity alarm	10%	Settable	
		Remaining capacity alarm recovery	25%	Settable	
20	External switch control	Open	Closed: normal operation open: system shutdown		
21	Current limiting function	Active current limiting	The BMS is equipped with a charging current limiting module, which does not require triggering conditions. As long as it is in the charging state, it actively limits the charging current to the set value.		
		Passive current limiting	The BMS is equipped with a charging current limiting module. When the charging current is greater than the protection value of charging overcurrent 1 or 2, the charging overcurrent protection is triggered, the charging MOS is disconnected, and the current limiting charging is		

			entered. The charging current refers to the setting mode.
		Passive current limiting recovery mode	1. Recover once every 38 minutes; 2. Meet any one of the following conditions (full charge, overvoltage protection, discharge, current is 0 for 2.5 minutes), current limit recovery.
22	Manual key setting	Power on/activation	In the sleep state, press the key for about 3s to activate. After the LED indicator lights up in turn, it turns to the normal working state;
		Shutdown/Sleep	In the power on state, press the key for 3 seconds and then release it. The BMS is dormant. After the LED indicator lights up in turn, the BMS goes into the sleep state;
		Reset	In the power on state, the BMS is reset after pressing the key for 6s.
23	Sleep function	BMS sleep	When any of the following conditions are met, the system enters the low power consumption mode: 1. The single or Pack over-discharge protection has not been released within 30 minutes (configurable). 2. Release the button after pressing the button for 3 seconds. 3. The minimum cell voltage is lower than the sleep voltage (configurable), and the duration reaches the sleep delay time (default 30min, while satisfying no communication and no current). 4. The standby time is more than 1 hour (0.5 to 2 hours can be configured) (no communication, no charge and discharge, no charger access). 5. Forced shutdown through the host computer software. Before entering the sleep mode, make sure that the input terminal is not connected to external voltage, no external communication, and the button is not pressed, otherwise it will not be able to enter the low power consumption mode.
24	Activate function	BMS activation	When the system is in low power consumption mode and meets any of the following conditions, the system will exit the low power consumption mode and enter the normal operation mode: 1. Connect the charger, the output voltage of the charger must be greater than 48V. 2. Press the button for 3S and release the button. 3. Connect the communication line and start the software of the upper computer (it enters the sleep state due to over-discharge protection, this method cannot wake up the protection board).

6. SOC capacity indication

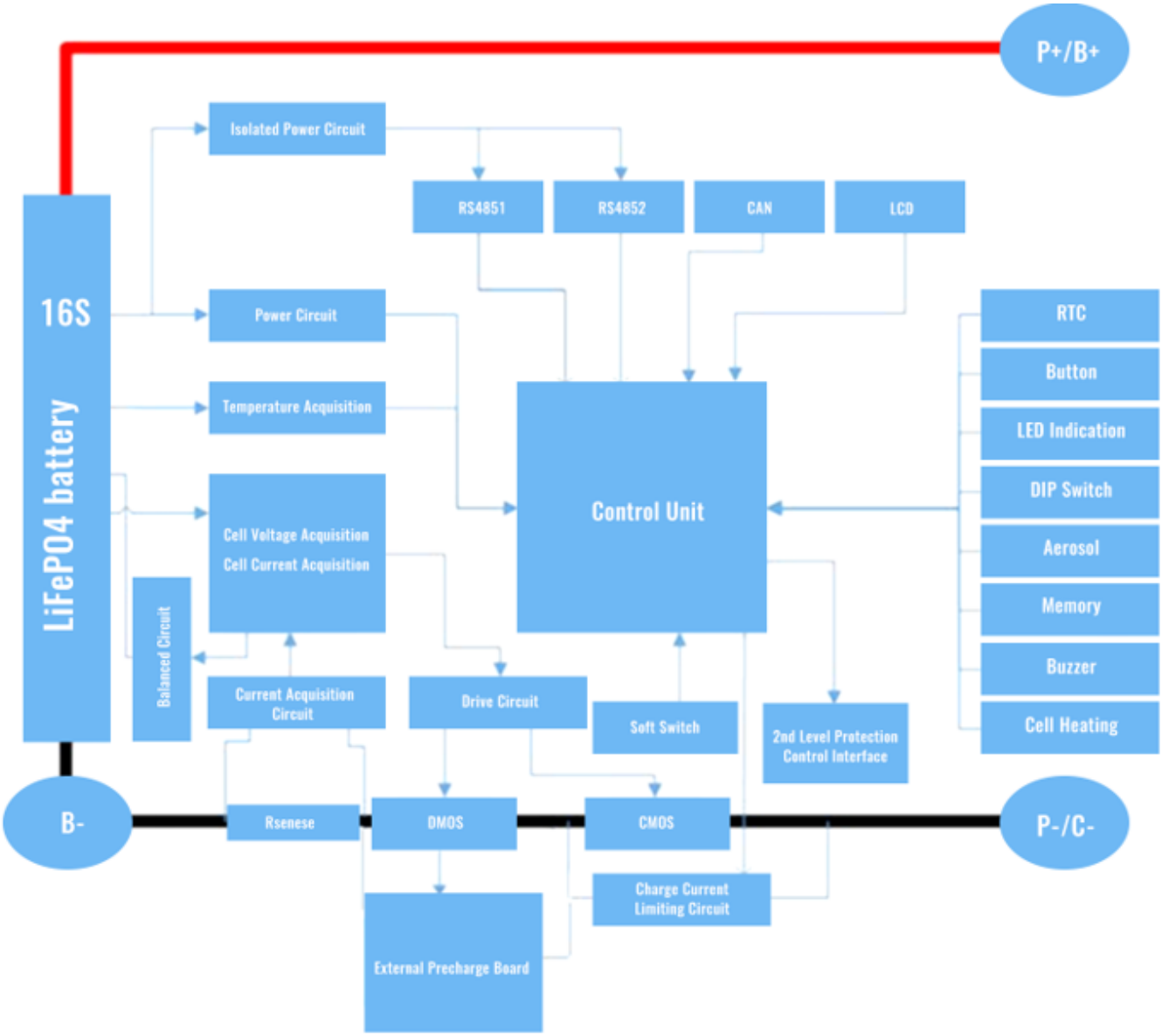
State	Charge				Discharge			
Capacity indicator	L1	L2	L3	L4	L1	L2	L3	L4
0 ~ 25%	OFF	OFF	OFF	Flash 2	OFF	OFF	OFF	ON
25 ~ 50%	OFF	OFF	Flash 2	ON	OFF	OFF	ON	ON
50 ~ 75%	OFF	Flash 2	ON	ON	OFF	ON	ON	ON
75 ~ 100%	Flash 2	ON	ON	ON	ON	ON	ON	ON
Running indicator	ON				Flash 3			

7. LED instructions

Status	**Normal / alarm / protection**	**RUN**	**ALM**	**Power quantity indicates the LED**				**Explain**
		●	●	●	●	●	●	
Shut down	Sleep	OFF	OFF	OFF	OFF	OFF	OFF	All day long
Standby	Normal	Flash 1	OFF	According to the power display				Stand by
	Alarm	Flash 1	Flash 3					Module low voltage
Charge	Normal	ON	OFF	According to power indication (maximum LED flash 2)				The highest power LED flashes (flashing 2), the overcharge alarm ALM does not flash
	Alarm	ON	Flash 3					
	Overcharge protection	ON	OFF	ON	ON	ON	ON	If there is no utility power, the indicator light is on hold state
	Temperature, Overcharge, Short-circuit, Reverse connection, Failure protection	OFF	ON	OFF	OFF	OFF	OFF	Stop charging
Discharge	Normal	Flash 3	OFF	According to the power display				
	Alarm	Flash 3	Flash 3					
	Undervoltage protection	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharge

	Temperature, Overcurrent, Short circuit, Reverse connection. Failure protection	OFF	ON	OFF	OFF	OFF	OFF	Stop discharge
Failure		OFF	ON	OFF	OFF	OFF	OFF	Stop charging and discharging

8. Block Diagram



9. Communication description

1) RS485 communication

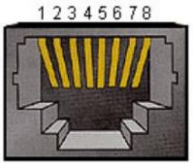
The BMS should have the RS485 host computer communication and cascading communication functions of the battery pack, and the default baud rate is 9600bps.

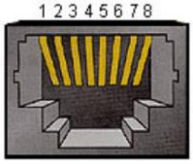
Data is transmitted between the BMS battery pack and the host computer. Its communication protocol refers to "YD/T 1363.3 Communication Bureau (Station) Power Supply, Air Conditioning and Environmental Centralized Monitoring and Management System Part 3: Front-end Intelligent Device Protocol" and "BMS Modus Protocol". When the charging and discharging current is not 0, BMS does not allow firmware upgrades.

BMS485 cascading communication interface adopts 8P8C straight PCB welding telephone socket (round pin),. The BMS is configured with an RS485 interface. when cascading battery packs, the upper computer is the master, and all battery packs are slaves. The upper computer polls the data of each battery pack in the cascade system and uploads it. RS485 communication interface is defined in the following table.

RS485 interface definition - 8P8C vertical RJ45 socket

Pin	Definition description	Port Description	Top view
1、8	RS485 B1	Independent RS485 interface 1	
2、7	RS485 A1		
3、6	Land		
4、5	NC(Overhang)		

Pin	Definition description	Port Description	Top view
1、8	RS485 B2	Independent RS485 interface 2A	
2、7	RS485 A2		
3、6	Land		
4、5	NC(Overhang)		

Pin	Definition description	Port Description	Top view
1、8	RS485 B2	Independent RS485 interface 2B	
2、7	RS485 A2		
3、6	Land		
4、5	NC(Overhang)		

2) Four remote functions

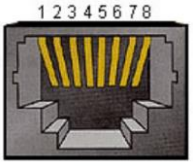
Telemetry: battery pack total voltage, battery pack capacity (SOC), battery pack state of health (SOH), single cell voltage, battery pack charging/discharging current, number of cycles (discharging more than 80% of the nominal capacity is 1 cycle), Cumulative discharge capacity, maximum and minimum cell voltage, ambient temperature / battery pack temperature (4 temperature for battery, 1 for ambient, and 1 for MOSFET), historical data, alarm and protection records, etc.

Remote signaling: protection function status, battery pack charging/discharging status, battery pack total voltage high alarm, battery pack total voltage low alarm, cell charge overvoltage alarm, cell discharge undervoltage alarm, battery pack short circuit, battery pack Charging overvoltage/overcurrent alarm, battery pack discharge undervoltage/overcurrent alarm, battery pack capacity low alarm, battery pack reverse polarity alarm, cell high/low temperature alarm, ambient high temperature/low temperature alarm, MOSFET temperature alarm, Low battery capacity alarm, cell failure alarm (optional), fire equipment startup alarm, etc.

Remote control: protection function status, alarm sound on/off, intelligent intermittent charging mode, current limiting charging mode, charging on/off, discharge start/stop, etc.

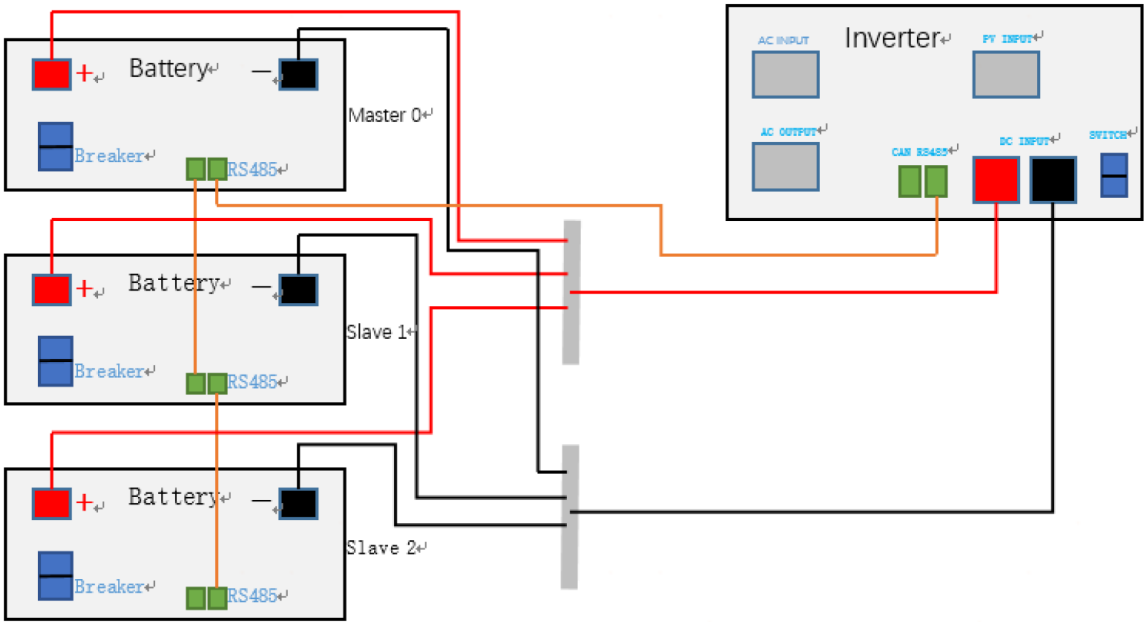
Remote adjustment: various functional states and parameter setting range, matching parameters between BMS and switching power supply system output performance.

3) CAN communication (with CAN communication interface, user can choose)

Pin	Definition description	Port Description	Top view
4	CANH	CAN communication interface	
5	CANL		
7	GND		
1、2、3、6、8	NC		

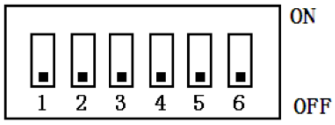
4) Parallel communication

When multiple machines are connected in parallel, the inverter is connected to one of the RJ45 ports of the battery master through a standard network cable, the master is connected to the slave through the other RJ45 port, and the communication lines of the other slaves are connected sequentially. The connection diagram is as follows:
The master requests the battery information of all slaves and summarizes them for the inverter to query all battery information, and the BMS slaves do not communicate with each other.



5) Dip switch address

When battery packs are used in parallel, different PACKs can be distinguished by the hardware address, each PACK address is unique. And the hardware address can be set sequentially through the dial switch on the board. For the definition of the switches, see the following table.



Note If the six-bit DIP switch is used, you need to specify in advance. By default, the five-bit dip switch is invalid. Only the four-bit DIP switch is enabled. Corresponding to the red font in the following table.

The Master is at address 0, and the slave starts at address 1:

Address	Dial-code switch position						Explain
	#1	#2	#3	#4	#5	#6	
0	OFF	OFF	OFF	OFF	OFF	OFF	Set PACK 0
1	ON	OFF	OFF	OFF	OFF	OFF	Set PACK 1
2	OFF	ON	OFF	OFF	OFF	OFF	Set PACK 2
3	ON	ON	OFF	OFF	OFF	OFF	Set PACK 3
4	OFF	OFF	ON	OFF	OFF	OFF	Set PACK 4
5	ON	OFF	ON	OFF	OFF	OFF	Set PACK 5
6	OFF	ON	ON	OFF	OFF	OFF	Set PACK 6

7	ON	ON	ON	OFF	OFF	OFF	Set PACK 7
8	OFF	OFF	OFF	ON	OFF	OFF	Set PACK 8
9	ON	OFF	OFF	ON	OFF	OFF	Set PACK 9
10	OFF	ON	OFF	ON	OFF	OFF	Set PACK 10
11	ON	ON	OFF	ON	OFF	OFF	Set PACK 11
12	OFF	OFF	ON	ON	OFF	OFF	Set PACK 12
13	ON	OFF	ON	ON	OFF	OFF	Set PACK 13
14	OFF	ON	ON	ON	OFF	OFF	Set PACK 14
15	ON	ON	ON	ON	OFF	OFF	Set PACK 15

10. Cell Specification

No.	Items	Specifications		Remark
1	Nominal Capacity	≥150Ah		0.2C Standard discharge
2	Charging and discharging voltage range	2.5~3.65V		T>0℃
		2.0~3.65V		T ≤0℃， Forbid continuous charging
3	Charge Voltage	3.65±0.03V		By standard charge method
4	Standard charging method	23±3℃， 0.2C constant current,3.65V constant voltage charge to 3.65V,continue charging till current decline to ≤0.02C		23±3℃, 0.2C constant current 3.65V constant voltage charge to current ≤0.02C, time of about 7h(for reference)
5	Charge current	0.2C	30A	Standard charge, charge time about 7h(Ref)
		0.5C	75A	Rapid Charge, charge time about: 2h(Ref)
6	Standard discharging method	0.2C constant current discharge to2.0V		0.2C constant discharge to 2.0V
7	Cell Internal Impedance	≤ 0.4mΩ		Internal resistance measured at AC 1KHz after 50% charge
8	Maximum charge current	0.5C	75A	For continuous charging mod

9	Maximum discharge current	1C	150A	For continuous discharging mode
10	Operation Temperature and relative humidity Range	Charge	0.2C(0~10℃) 1C(10~45℃) 60±25%R.H.	Charge at a very low temperature such as below 0℃,will be get a lower capacity and reduce cycle life of the battery
		Discharge	0.5C(-20~10℃) 2C(10-55℃) 60±25%R.H.	
11	Storage temperature for a long time	0~45℃ 60±25%R.H.		Do not storage exceed half year. Must charge once when storage for half year. must charge the battery which with protect circuit when storage for three months.

11. Battery Pack Electrical characteristics

No	Items	Test Method and Condition	Criteria
1	Rated Capacity at 0.2C(Min.)	After standard charge, the capacity shall be measured on 0.2C discharge till the voltage discharge to32.0v,	≥99%
	Rated Capacity at 0.5C(Min.)	After standard charge, the capacity shall be measured on 0.5C discharge till the voltage discharge to 32.0v,	≥98%
	Rated Capacity at 1C(Min.)	After standard charge, the capacity shall be measured on 1C discharge till the voltage discharge to 32.0v,	≥96%
2	Cycle Life	Charging and discharging battery as blew conditions 0.2C standard charge to 58.4V end-off 0.2C standard discharge to 40V cut-off Continuous charge and discharge for 6000 cycles ,the capacity will be measure after the 6000th cycle	≥80% of initial capacity
3	Capacity retention	The battery to be charge in accordance with standard charge condition at 20~2℃,then storage the battery at an ambient temperature 20~25℃ for 28 days. Measure the capacity after 28 days with 0.2C at 20~25℃ as retention capacity	Retention capacity ≥80%

4	Temperature Dependence of discharge capacity	Cells shall be charged per 10 and discharged @0.2 C_5A to 32.0 volts. Except to be discharged at temperatures per Table 11-1. Cells shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 ºC and the percentage shall be calculated.	The discharge capacity of the temperature must be no less than that specified in Table 11-1

Table 11-1

Discharge Temperature	-10℃	-5℃	0℃	23℃	55℃
Discharge Capacity （0.2 C_5A）	＞70%	＞80%	＞85%	＞98%	＞98%

12. Mechanical characteristics

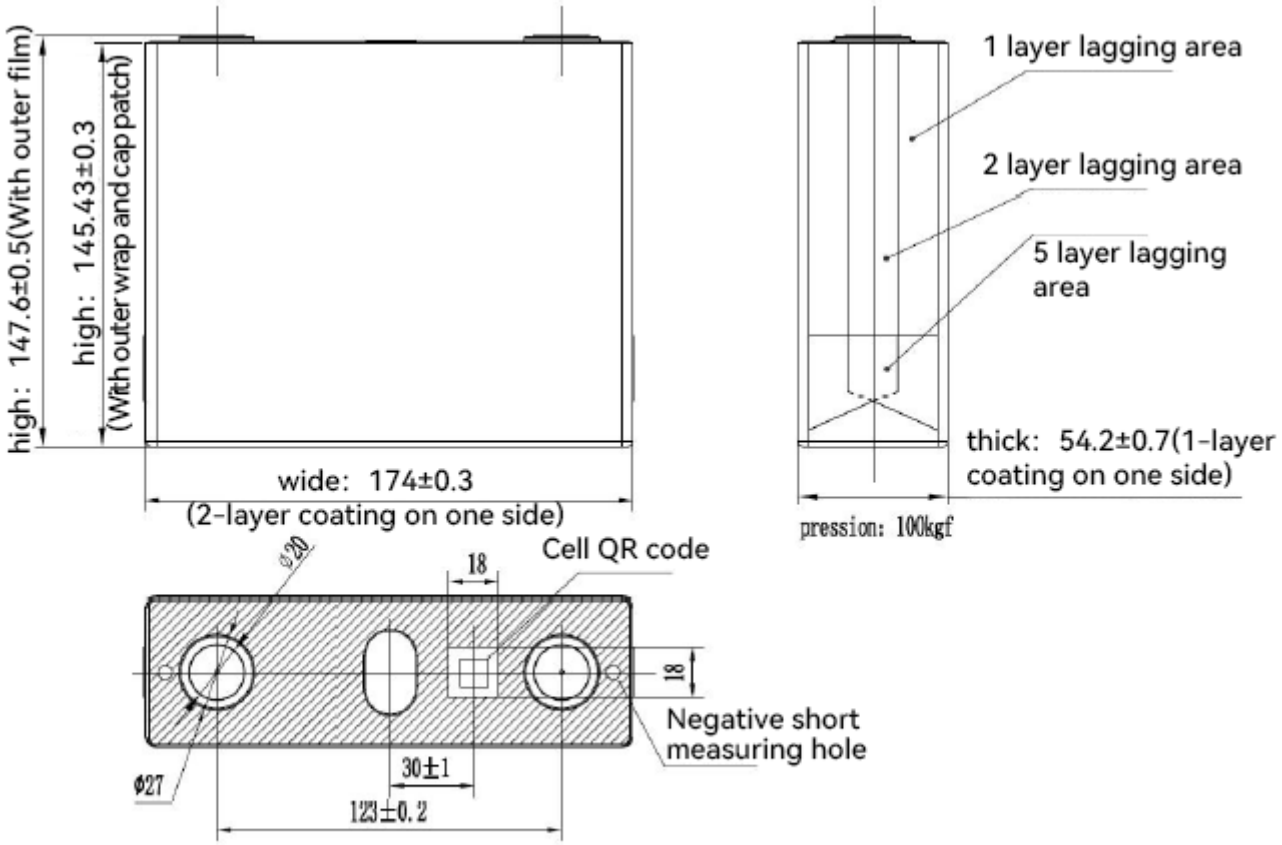
No	Items	Test Method and Condition	Criteria
1	Free fall test	The battery to be fully charged in accordance with standard charge condition, then drop the battery three times from a height of 1,0 m onto a concrete floor. The batteries are dropped so as to obtain impacts in random orientations.	No Fire,
2	Vibration test	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes.	No explosion ,No leakage, No fire

13. Safety performance

No	Items	Test Method and Condition	Criteria
1	Thermal exposure test	Each fully charged cell, stabilized at room temperature, is placed in a circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130 °C ± 2 °C. The cell remains at this temperature for 10 min before the test is discontinued.	No explosion, No fire

2	Shor-Circuit test	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ.Tests are to be conducted at room temperature 20~25°C.	No explosion, No fire The Temperature of the Battery surface not exceeded than 150℃
3	Shor-Circuit test	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ.Tests are to be conducted at room temperature about 60-65°C	No explosion, No fire The Temperature of the Battery surface not exceeded than 150℃
4	Forced discharge test	A discharged cell is subjected to a reverse charge at 1C for 90 min.	No explosion, No fire
5	Over-charge test	After standard charge, continue to charge with a constant voltage 1C/4.2V per a cell, holding 12h.	No explosion, No fire

14. Cell initial Dimensions



Overall cell size

15. Product installation

Pay special attention to:

- Please ensure that the positive and negative pole interfaces of the battery box are under insulation protection!
- Please ensure that the battery box is closed!
- The guide rail or battery rack must be installed in the cabinet, then the battery box must be placed on the guide rail or battery rack, and then the battery box must be fixed on the cabinet column!
- Each battery box must be supported by a separate guide rail and cannot be stacked directly. After installation, at least one floating nut clearance shall be reserved between boxes!
- All battery boxes must be set from top to bottom (1 #, 2 #,..., 14 #, 15 #, if necessary) to set the dial switch ID. The battery box ID in the system cannot be repeated!
- All connections must use appropriate terminals to ensure reliable connection!
- The positive and negative poles shall not be short circuited, and the battery box shall not be connected in series!

Attention of equipment or personnel !

- This equipment is very heavy. Please use a safe and feasible installation method according to the weight of the equipment.
- Be sure to use the recommended number of screws to fix the battery box to the mounting bracket.
- Be sure to use the recommended number of screws and floating nuts to fix the battery box to the cabinet.
- Be sure to install the battery box at or near the bottom of the cabinet.

Rack or cabinet installation

Please install it in an appropriate cabinet or rack according to the size of the product, and lock it on the cabinet with four M5 bolts and left and right lugs;

The panel grounding point shall be grounded with more than 6 square meters of yellow rolled green copper wire, and the grounding shall be good;

Use red and black flexible wires to connect the positive and negative poles of the battery output terminal on the chassis to the positive and negative poles of the switching power supply or the device respectively. Note that the positive and negative poles cannot be reversed; the wire connected to the battery output terminal needs to have an OT terminal at one end., which is locked on the output terminal by the M6 combination screw. 50Ah systems are recommended to 8 AWG wires, 100Ah systems are recommended to 6 AWG wires, and 200Ah systems are recommended to 6 AWG or 4AWG wires;

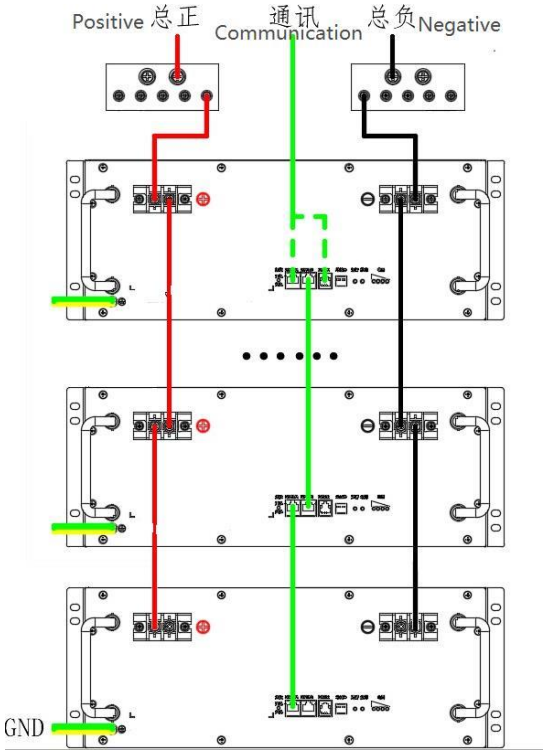


Figure 15-1 Parallel connection diagram of battery box

16. Handling of Cells

16.1. Prohibition short circuit

Never make short circuit battery. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion these are very dangerous.

The LIR tabs may be easily short-circuited by putting them on conductive surface.

Such outer short circuit may lead to heat generation and damage of the cell.

An appropriate circuitry with PCM shall be employed to protect accidental short circuit of the battery pack.

16.2. Mechanical shock

Falling, hitting, bending, etc. may cause degradation of lithium battery characteristics.

17. Notice for Designing Battery Pack

17.1. Pack toughness

Battery pack should have sufficient strength and the lithium battery inside should be protected from mechanical shocks.

17.2. Cell fixing

The lithium battery should be fixed to the battery pack by its large surface area.

No cell movement in the battery pack should be allowed.

17.3. Inside design

No sharp edge components should be insides the pack containing thelithium battery.

17.4. Tab connection

Ultrasonic welding or spot welding is recommended for lithium battery tab connection method.

Battery pack should be designed that shear force are not applied to the lithium battery tabs.

If apply manual solder method to connect tab with PCM, below notice is very important to ensure battery performance:

1) The solder iron should be temperature controlled and ESD safe;

2) Soldering temperature should not exceed 350°C;

3) Soldering time should not be longer than 3s;

4) Soldering times should not exceed 5 times, Keep battery tab cold down before next time soldering;

5) Directly heat cell body is strictly prohibited, Battery may be damaged by heat above approx. 100°C

17.5. For mishaps

Battery pack should be designed not to generate heat even when leakage occurs due to mishaps.

1) Isolate PCM (Protection Circuit Module) from leaked electrolyte as perfectly as possible.

2) Avoid narrow spacing between bare circuit patterns with different voltage.(Including around connector)

lithium battery should not have liquid from electrolyte, but in case If leaked electrolyte touch bare circuit patterns, higher potential terminal material may dissolve and precipitate at the lower potential terminal, and may cause short circuit. The design of the PCM must have this covered.

18. Notice for Assembling Battery Pack

Shocks, high temperature, or contacts of sharp edge components should not be allowed in battery pack assembling process.

19. Others

19.1. Cell connection

1) Direct soldering of wire leads or devices to the cell is strictly prohibited.

2) Lead tabs with pre-soldered wiring shall be spot welded to the cells.

Direct soldering may cause damage of components, such as separator and insulator, by heat generation.

19.2. Prevention of short circuit within a battery pack

Enough insulation layers between wiring and the cells shall be used to maintain extra safety protection. The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

19.3. Prohibition of disassembly

1) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing, explosion, or other problems.

2) Electrolyte is harmful

Lithium battery should not have liquid from electrolyte flowing, but in case the electrolyte come into contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

19.4. Prohibition of dumping of cells into fire

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, which is very dangerous and is prohibited.

19.5. Prohibition of cells immersion into liquid such as water

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others.

19.6. Battery cells replacement

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

19.7. Prohibition of use of damaged cells

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.

20. Period of Warranty

The battery is guaranteed for two years free of charge and then for a paid warranty from the date of shipment. The company is responsible for the return and replacement of batteries if defects develop during the manufacturing process and are not caused by user abuse or incorrect use.

21. Storage of the Batteries

The system shall be stored in a dry warehouse at a temperature of -20~45℃ and a humidity of ≤ 95% without condensation. Keep away from flammable, explosive and corrosive chemicals or heat sources and water sources, and avoid exposure to sunlight, rain and water.
If the battery is expected to be stored for more than 30 days, it is recommended to adjust the SOC to about 50%. The longest charging cycle of the battery at -10~30℃ is every 6 months, the longest charging cycle at 30~45℃ is every 3 months, and the longest charging cycle at 45~65℃ is every 1 month; The above charging cycle is the recommended value, and the actual storage SOC is not less than 8%, which is not affected by BMS or other self consumed power except single battery. We recommend that the battery be charged every six months to prevent excessive discharge.

22. Other The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a

long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

Note:

Any other items which are not covered in this specification shall be agreed by both parties.