

Universal RPC BMS Operation Instruction

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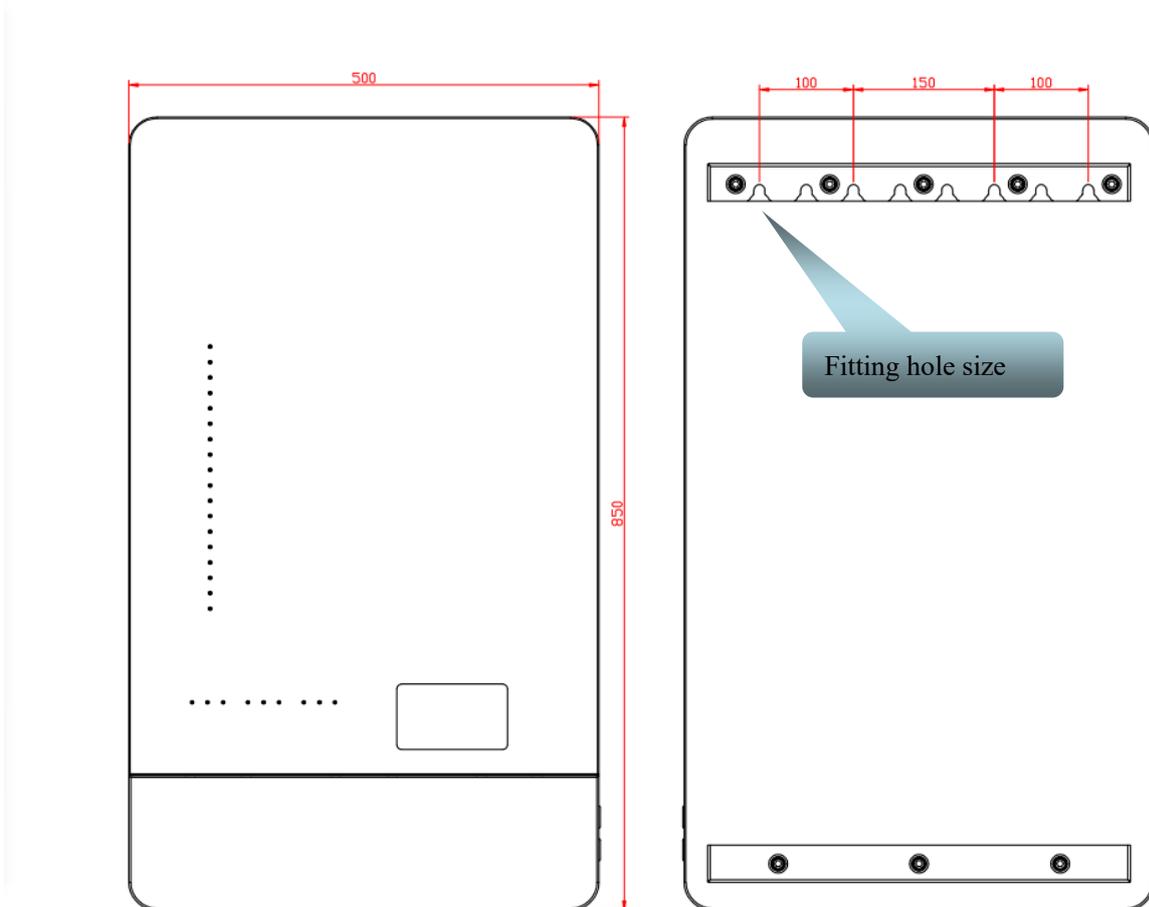
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1. General

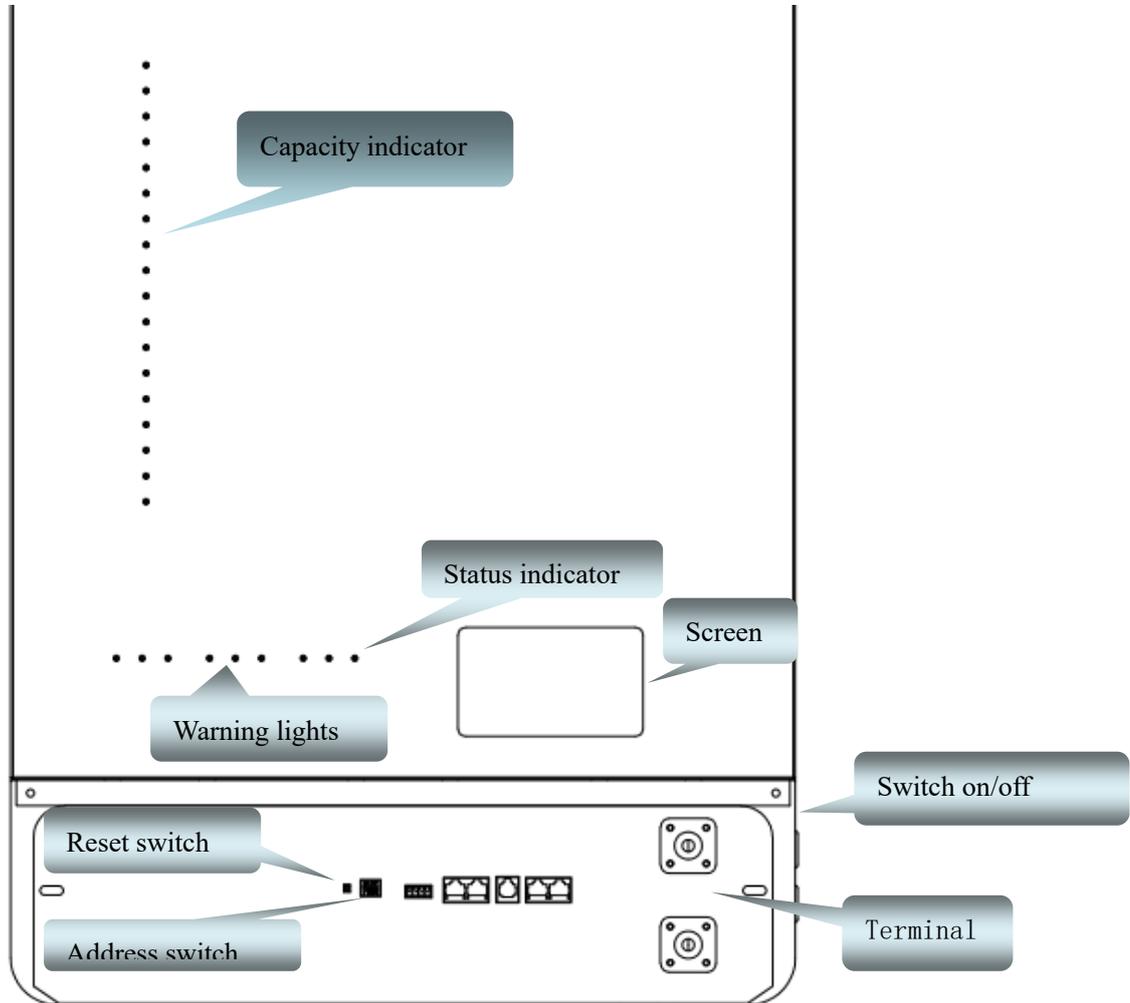
1.1 Application

The specification is applicable to NPP Rack power performance, technical requirement, testing method, warning and caution of the LiFePO4 Li- ion rechargeable battery. System can monitor the voltage, current and temperature of the cells and protect cells from over voltage, over current, under voltage, high temperature, low temperature and short circuit. High precision calculate for SOC and SOH. Balance voltage when charging. From PC software, the voltage, current, temperature and warning information can be set. Real time status and history status can be recorded and saved in PC. Kinds type of dormant and wake up applied. RS485/RS232/CAN communicate make it remote controllable.

1.2. Related product picture



1.3. Instructions of Front Control Panel



NO	Item	Function specifications	Note
1	Terminal	Positive port: input/output for positive	
2	Terminal	Negative port: input/output for negative	
3	Screen	Show the status and information of the battery	Show the battery information
4	Address switch	Set the battery address \pm	
5	RJ45 and RJ11 port	Communicate port RS485,CAN, RS232	
6	External sub switch	Signal output	Dry contact
7	Reset switch	Power on/off the BMS	
8	Status indicator	(1) Power on/off (2, 3) Run Alarm	
9	Capacity indicator	Battery capacity estimation (4,5,6,7,8,9)	5pcs green lights represent four steps Period of electricity

1.4. Computer Software

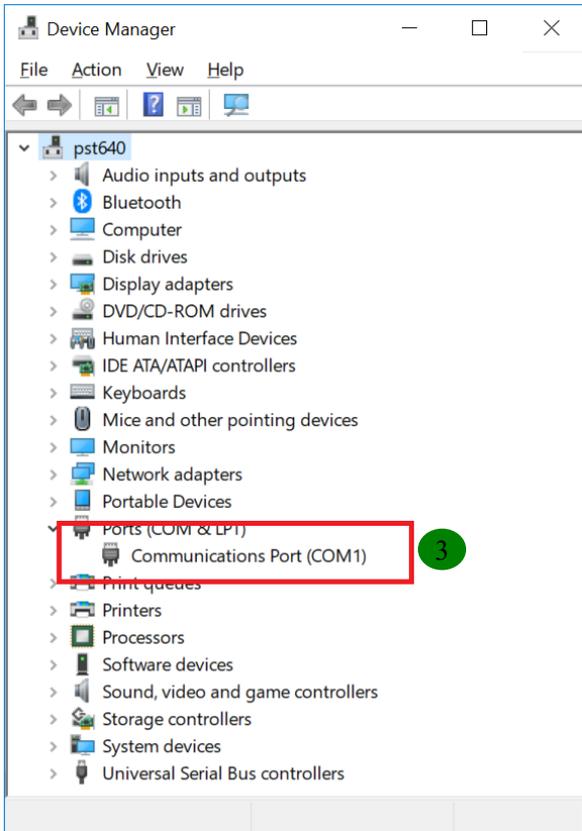


data	2022-06-13 10:47	文件夹	
Language	2022-06-13 10:47	文件夹	
Log	2022-06-13 10:47	文件夹	
XML	2022-06-13 10:47	文件夹	
BmsTools	2022-06-13 10:47	应用程序	535 KB
BmsTools.exe	2022-11-05 20:33	XML Configurati...	1 KB
DevComponents.DotNetBar2.dll	2013-05-23 11:02	应用程序扩展	2,640 KB
NPOI.dll	2015-10-27 9:48	应用程序扩展	1,586 KB

Receive and save the .rar file, then extract the file to the path where wanted.

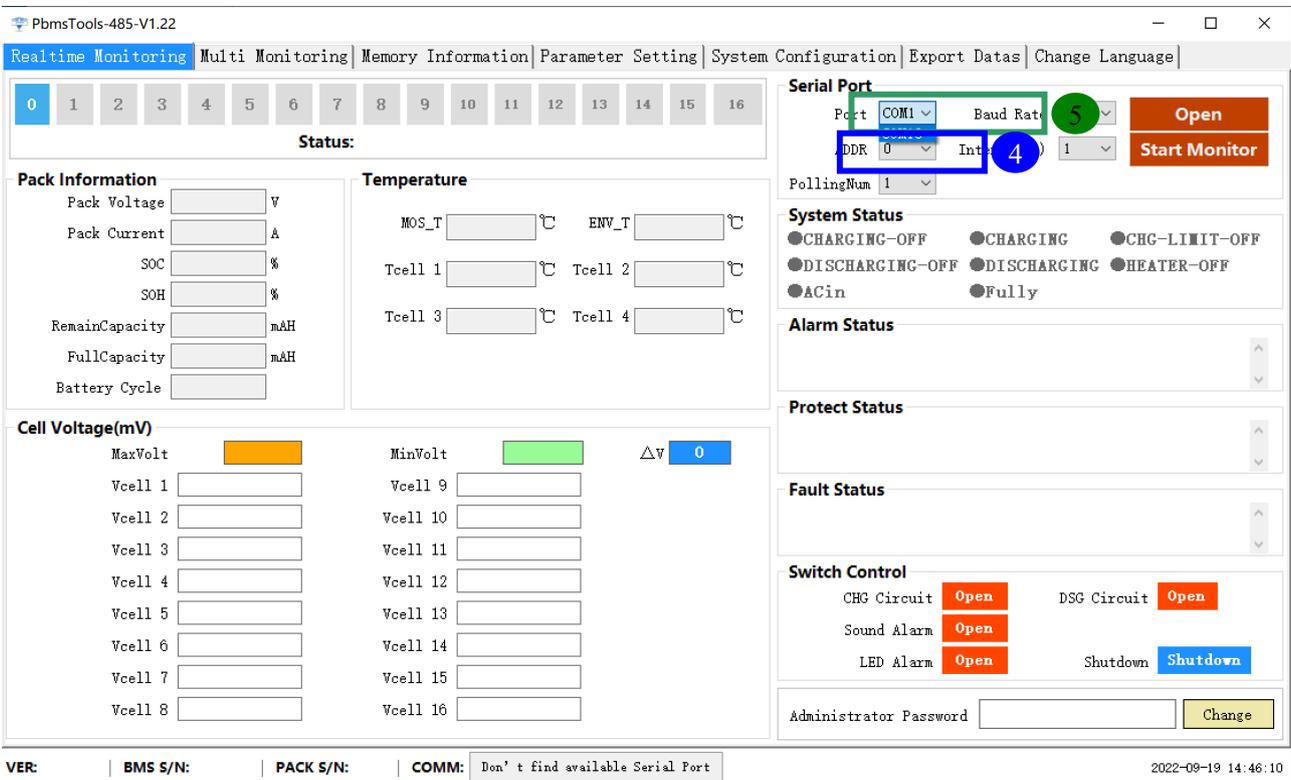
Open the folder and double click the exe file to run the software.

After started the software, the default language is Chinese, please just click the message confirm button (2). Then click the top-right button to set the language (1).



Ports checking:

As left picture shows, Open the Device Manager to check the correct Com port number (3). The com number should be checked when operating the software.



After clicked the language setting button, click the Serial port setting menu at (5); choose the correct COM number as (3) checked and check(4), if the battery address is correct as set in page 11,(sector 5.3).

2. Function Characteristics

2.1 Voltage Measurement of Cells and Battery

For the over-voltage, under-voltage, high voltage, low voltage testing of cells and the battery, the precision is <math><20\text{mV}</math> at

2.2 Current Measurement of Battery

Warning and protection for charge/discharge over-current, and short circuit. Max Continuous charge current and discharge current is 120A, the temperature rise is less than

2.3 Temperature Measurement of Cells and Ambient

Warning and protection for the high temperature and low temperature is carried out from cell temperature sensors and ambient temperature sensor, the precision is $\pm 3^{\circ}\text{C}</math>.$

2.4 Battery Capacity and Cycles

Real-time SOC, automatically get capacity from one cycle of charge and discharge, precision of capacity calculation is less than 5%. Automatically record the cycle times. The optimal cyclic capacity is 90%.

2.5 Switch On/Off the MOSFET

Low internal resistance, large current, for high power capacity load application, specially designed for the power on and short time changing-over.

2.6 Smart Balance the Voltage of Each Cell

Smart balance strategy can be revised when charging, High effectively improve the battery service time and cycle life.

2.7 LED Indicator

9pcs LEDs indicate the battery remaining capacity, working mode and the alarm, protection status.

From left to right:

1 Power on /off status

2 Working status: Run or not

3 Alarms

4, 5, 6, 7, 8, 9 capacity

2.8 Switch Setting/Function Enable/Unable

One button power on/off, system can be powered on by hand when it's off status, and power off when it's in Non- Standby State by hand, the BMS can be reset by long press the button and clean kinds of abnormal status.

Also from the pc, multi-functions can be operated, such as switch on/off the charge MOS, discharge MOS, force sleep, and current-limiting enable/disable.

2.9 RJ45 and RJ11 Communicate Port

PC or other smart device can control or monitor the system remotely from the RS45 communicate port, and cascade manager or monitor multi-batteries.

From left to right:

1. Individual RS485 communication.
2. CAN communication.
3. RS232 communication.
- 4 and 5. RS485 are for parallel protocol.

Cells or Battery over-voltage, under-voltage, over-current when charging/discharging, high temperature/low temperature, balance strategy, cells series connecting qty, battery capacity and so on can be set by PC.

2.10 Data Storage

Data record function enable for saving work status, running data, the recorders can be used for analysis, monitor and maintenance of the system.

2.11 Short Circuit Protection

The system is with function for pre-charge, when load is connected, the system will charge the capacity of the load automatically, and will try the short circuit protection for 5 times, and each time the pre-charge function will start before release short circuit protection.

Pre-charge function can match maximum 30000uF capacitive loading.

3. Electrical Characteristics

3.1 Electrical Attributes

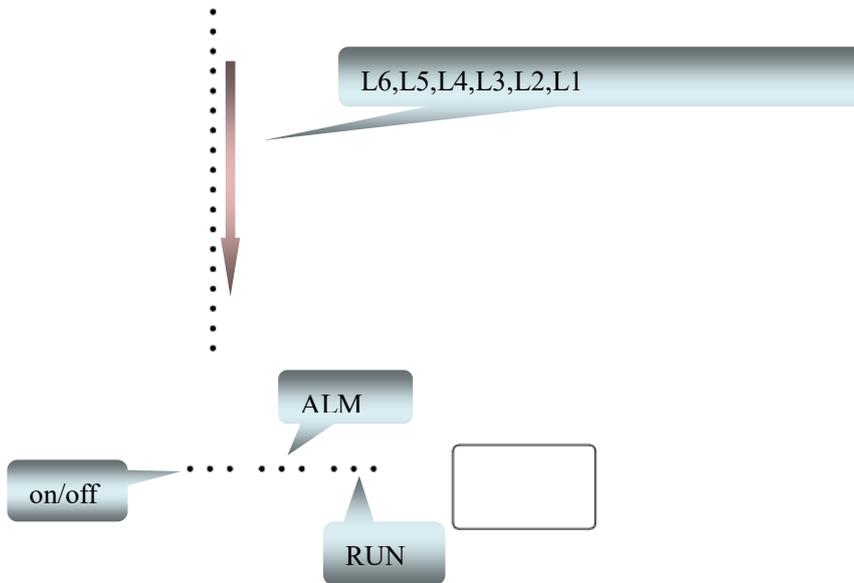
Item	Min	Max	Type	Unit
Nominal work voltage	2.80V/cell	3.65V/cell	3.20V/cell	V
Nominal charge voltage	3.50V/cell	3.65V/cell	3.60V/cell	V
Work temperature range	-20	70	25	°C
Work humidity range	10	85	/	%
Continuous charge current	1	100	20	A
Continuous discharge current	1	100	50	A
Discharge output impedance	<20			mΩ
BMS normal work power consumption	<30			mA
BMS static power consumption		250	200	uA

3.2 Basic Parameter Settings

Items	Status	Instructions	Default	Setting	Note
Cell voltage alarm	Enable	Over voltage alarm	3650mV	Can be set	
	Enable	Under voltage alarm	2900mV	Can be set	
Cell over voltage protection	Enable	Over voltage protection	3750mV	Can be set	
	Enable	Over voltage protection delay	1S	Can be set	
	Enable	Over voltage protection release	3340mV	Can be set	
Cell under voltage protection	Enable	Under voltage protection	2700mV	Can be set	
	Enable	Under voltage protection delay	1S	Can be set	
	Enable	Under voltage protection release	3000mV	Can be set	
Battery voltage alarm	Enable	Over voltage alarm	3.65V/cell	Can be set	
	Enable	Under voltage alarm	2.8V/cell	Can be set	
Battery over voltage protection	Enable	Over voltage protection	3.7V/cell	Can be set	
	Enable	Over voltage protection delay	1S	Can be set	
	Enable	Over voltage protection release	3.6V/cell	Can be set	
Battery under voltage protection	Enable	Under voltage protection	2.7V/cell	Can be set	
	Enable	Under voltage protection delay	1S	Can be set	
	Enable	Under voltage protection release	2.85V/cell	Can be set	
Cell temperature alarm	Enable	Charge high temperature alarm	60°C	Can be set	
	Enable	Charge low temperature alarm	5°C	Can be set	
	Enable	discharge high temperature alarm	60°C	Can be set	
	Enable	discharge low temperature alarm	5°C	Can be set	
Cell temperature charge protection	Enable	High temperature protection	65°C	Can be set	
	Enable	High temperature protection release	55°C	Can be set	
	Enable	Low temperature protection	0°C	Can be set	
	Enable	Low temperature protection release	3°C	Can be set	
Cell temperature discharge protection	Enable	High temperature protection	75°C	Can be set	
	Enable	High temperature protection release	65°C	Can be set	
	Enable	Low temperature protection	-20°C	Can be set	
	Enable	Low temperature protection release	-15°C	Can be set	
Ambient temperature alarm	Enable	High temperature	65°C	Can be set	
	Enable	Low temperature	-20°C	Can be set	
MOS temperature	Enable	High temperature alarm	90°C	Can be set	
Charge current	Enable	Over charge current alarm	55A	Can be set	
Charge current protection	Enable	Charge current protection	120A	Can be set	
	Enable	Charge current protection delay	4S	Can be set	
Discharge current	Enable	Over discharge current alarm	105A	Can be set	
Discharge current protection	Enable	discharge current protection	110A	Can be set	
	Enable	discharge current protection delay	5S	Can be set	
Secondary discharge current protection	Enable	discharge current protection	150A	Can be set	
	Enable	discharge current protection delay	500mS	Can be set	
Output short circuit protection	Enable	Short circuit protection	330A		
	Enable	Short circuit protection delay	500uS		
	Enable	Short circuit protection release	Charging release, current≥2a		
Over discharge current protection release		Auto delay release	15 minutes	Auto release 15 min later	
Cell voltage balance	Enable	Charge voltage balance	Enable when charging		
	Enable	Balance enable voltage	3450mV	Can be set	
	Enable	Balance enable voltage difference	20mV	Can be set	
Battery capacity	Battery nominal capacity		100Ah	Can be set	
	Enable	Low capacity alarm	1, 15% can be set;2, 10% can not be set		

Power on/off switch setting	Power on: press 1S power on when BMS is not in sleeping status		
	Power off: press 3S power off when BMS is not in charging status		
BMS setting	Sleep time: 1440 minutes, no discharge and communicate	Can be set	

3.3 Indicator Definition (If available)



3.3.1 Flash Definition

Flash mode	● lit on time	○ lit off time
F1	0.25S	3.75S
F2	0.5S	0.5S
F3	0.5S	1.5S

3.3.2 Capacity Indicator

Status	Charging						Discharging					
	L6	L5	L4	L3	L2	L1	L6	L5	L4	L3	L2	L1
capacity	0~16.6%	○	○	○	○	F2	○	○	○	○	○	●
	16.6~33.2%	○	○	○	○	F2	●	○	○	○	○	●
	33.2~49.8%	○	○	○	F2	●	●	○	○	○	●	●
	49.8~66.4%	○	○	F2	●	●	●	○	○	●	●	●
	66.4~83.0%	○	F2	●	●	●	●	○	●	●	●	●
83.0~100%	F2	●	●	●	●	●	●	●	●	●	●	●
Run LED	●						F3					

3.3.3 Status Indicator

Status	Mode	On/Off	RUN	ALM	Capacity LED						Note	
Power off	Sleep	○	○	○	○	○	○	○	○	○	○	All ○
Standby	Normal	●	F1	○	See capacity indicator 3.3.2						Standby status	
	Alarm	●	F1	F3	See capacity indicator 3.3.2						Low voltage	
Charge	Normal	●	●	○	See capacity indicator 3.3.2						Flash F2 when full,	
	Alarm	●	●	F3	Flash F2 if full charged							
	Overcharge	●	●	○	●	●	●	●	●	●	●	If no input power, turn to standby status
	Protection	●	○	●	○	○	○	○	○	○	○	Stop charging
Discharge	Normal	●	F3	○	See capacity indicator 3.3.2							
	Alarm	●	F3	F3	See capacity indicator 3.3.2							
	Under voltage	●	○	○	○	○	○	○	○	○	○	Stop discharging
	Protection	●	○	●	○	○	○	○	○	○	○	
Failed		○	○	●	○	○	○	○	○	○	○	Stop charge/discharge

4. Work Mode

4.1 Charge/Discharge Mode

When BMS detected external power connected, the voltage $\geq 48V$ and the cell voltage, temperature in rechargeable range, the charge MOSFET will be switched on and system turn into charge mode when charge current is valid, in this mode, the charge MOSFET and discharge MOSFET both are switched on.

When BMS detected load connected and cell voltage, temperature is in the dischargeable range, and the discharge current is valid, the system will turn into discharge mode.

4.2 Standby Mode

When it's not charge mode or discharge mode, the system will turn into standby mode.

After the system reached the standby time, and battery under voltage protection, power on/off key pressed, or power on command sent from PC, the BMS will turn into sleep mode.

Wakeup condition:

1. charge the battery;
2. press the power on/off button.

4.3 Reset Key Instruction

When BMS is in sleeping mode, press the key for 3-5 seconds, then release, the system will be activated; LED indicator will be lit up from RUN to right, each 0.5 second.

When BMS is in work mode, press the key for 3-5 seconds, then release, the system will turn into sleep mode; capacity indicator will be lit up from right to left, each 0.5 second.

When BMS is in work mode, press the key for 6-10 seconds, the BMS will be reset, all LED will lit up 1.5 seconds at the same time. After resetting, the function and parameter setting will be kept. If initial resetting needed,

please connect battery to computer and reset from computer software, but the working record will be kept (the capacity, cycle numbers, and protection records).

4.4 Sleep and wakeup Mode

When below condition is met, the system will turn into low power consumption-sleep mode.

- 1). Cell or battery over discharge protection is activated and not released for 30 minutes.
- 2). Key is pressed for 3-5 seconds, and then released.
- 3). Minimum cell voltage is lower than setting voltage (default 3300mV), and continuous time meet sleep delay time (default 1440 minutes) (at the same time, no communicate, no charge/discharge current).
- 4). Force powered off from PC, and before turn into sleep mode, no charger connected.
- 5). Standby mode last more than 24 hours (no communications, no charger connected, no discharging, no charging).

When system is in low power consumption mode, on of below condition is reached, the system will exit sleep mode and turn into normal work mode.

- 1). Charger is connected and voltage $\geq 3.2V/cell$.
- 2). Key is pressed for 3-5 seconds, and then released.
- 3). RS232 communication activated.

4.5 Alarm

Failure: Beep 0.25S per second.

Protection: Beep 0.25S per 2seconds.

Alarm: Beep 0.25S per 3seconds.

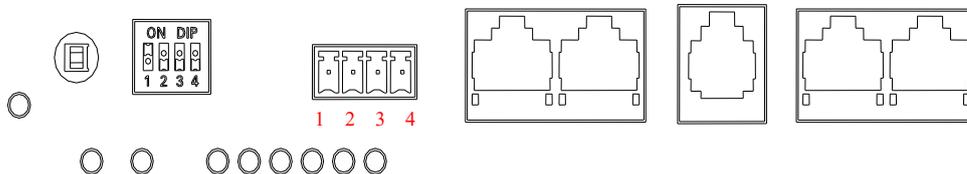
The beeper function can be unable or enable. Default is unable.

5. Communicate

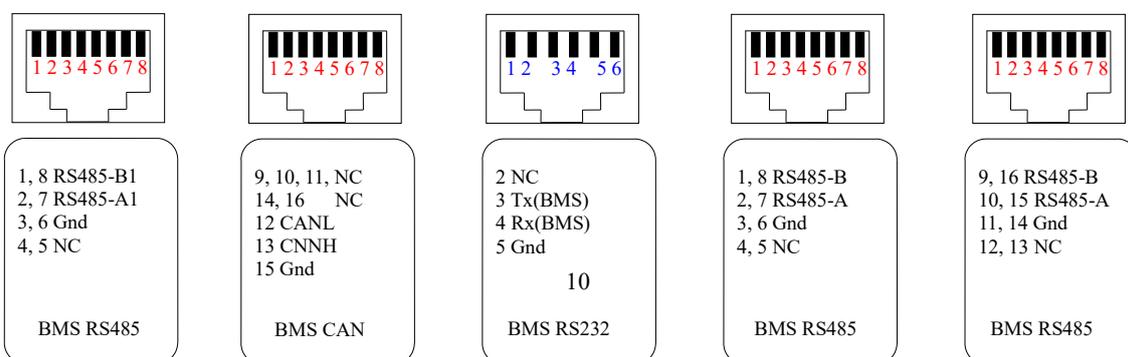
The system can communicate with computer from RS485 ports, one battery and multi-batteries communicate at the same time.

The communication specifications need to refer to the communication protocol specification.

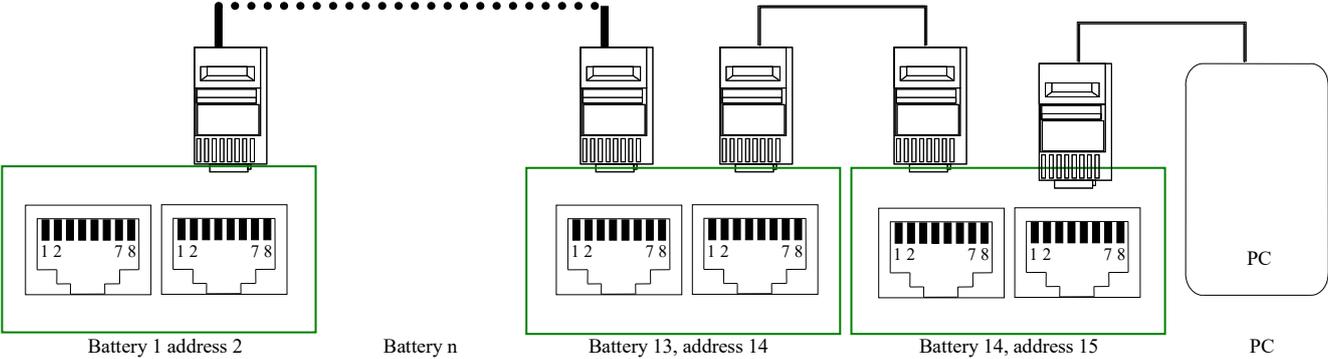
5.1 Communicate port and External sub switch/Dry contact



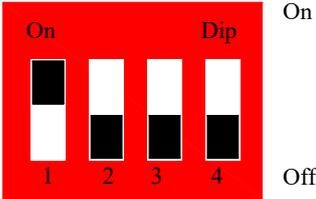
External sub switch: 1 and 2 keeps switching off and turn to switch on when low capacity
3 and 4 keeps switching off and turn to switch on when system failed.



5.2 RS485 parallel ports, Multi-Batteries parallel connection

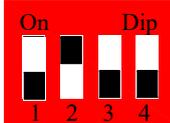
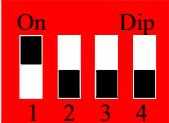


5.3 Address Switch



5.3.1 Switch Definition

When multi-batteries connected, each switch of the batteries should be set first. BCD format is used, address 1 is like below (black is off, white is on, below is the same), address 2 is like below .



address	Switch setting			
	#1	#2	#3	#4
0	Off	Off	Off	Off
1	On	Off	Off	Off
2	Off	On	Off	Off
3	On	On	Off	Off
4	Off	Off	On	Off
5	On	Off	On	Off
6	Off	On	On	Off
7	On	On	On	Off
8	Off	Off	Off	On
9	On	Off	Off	On
10	Off	On	Off	On
11	On	On	Off	On

12	Off	Off	On	On
13	On	Off	On	On
14	Off	On	On	On
15	On	On	On	On

5.3.2 PC Communicate Address Setting

When batteries connected to PC, the current battery address should be input into software, and then communication can be check and start to communicate.

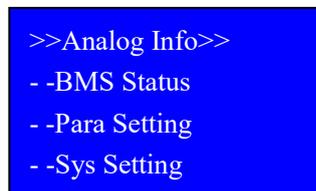
When BMS is working in single battery mode, the address can be any value (the PC or FSU address should match); when BMS is working in multi-batteries mode, the address should be different from 2 to 15 (the PC or FSU address should match).

6. Screen (If available)

When power on, the screen will show the default page as below: (General screen)



Then Press Menu key to enter the main page like below:



Each line start with ">>" or "- -", when it starts with ">>", press down, it will move down, press enter key to enter sub menu.

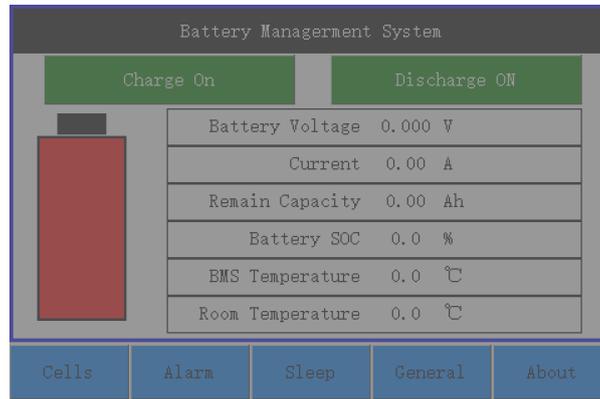
Press ESC key to return to parent Menu.

The screen can be activated by press any key when it's in sleeping mode.

When battery is in working mode, the screen will go into sleep/power off mode if no any operation for more than 60 seconds, and screen can be activated by press any key.

NOTE: the screen is only for showing the battery status information. Don't support parameters set.

6.2 Full color touch LCD screen (If available)



Touch the bottom menu key to check the work status and parameters:

Cells: show all cells voltage;

Alarm: if there is any alarm occur, the button will be red, it will show the warning, or protection information, like over voltage, over load, over current, low voltage, high temperature and so on..

Sleep: screen turn into sleep mode, lit off.

General: adjust the brightness of the screen, autosleep time.

About: show the battery information.

NOTE: the screen is only for showing battery information and working status information.

7. Heat Battery Strategy (If available)

When heating component is available, the component will work as below.

1. when heating is off status, any 2 or more than 3 temperature sensor (4 sensors totally) detect low temperature (lower than 0°C and continuous low temperature more than 30 seconds, and any one of below conditions is met, the battery will start the heating function:

A. Battery is in charging mode;

B. Average cell voltage larger than 3.35V;

C. Battery is in low temperature charging protection mode.

2. When heating function is working mode, any 2 temperature sensors detect temperature larger than 20°C, or one of the two reaches 25°C, the function will be closed 30 seconds later.

3. The heat function can be force powered on/off from RS485 by PC.

8. PC System

The computer software is free. Monitor platform or computer can communicate with the batteries directly from RS485/RS232 communicate port, real-time battery voltage, current, temperature, status, SOC and history data, single battery or multi-batteries can be connected and monitored at the same time, also, from the RS485 port, the setting information can be imported, exported, the system also can be updated from the RS485/RS232 port.

9. FAQ

1. Why computer can not communicate with the battery?

Please check the software version, make sure correct version is used, different version is for different port.

Please check the communicate port on the battery; RS232 and RS485 are for different ports.

Please check the communicate wire, different brand wires, the function and pins are different.

Please check the correct com NO. is selected, different computer will have several different com NO.

2. Why the battery is cut off when discharge, and can not be charged?

The lithium battery will be activated when there is real charging current, but some devices will detect the battery voltage first, if no voltage, it will not charge the battery, even give alert that no battery is connected, please retry is later till the battery released from over-discharge protection mode.

Change the battery settings, set the over-discharge protection release voltage lower to let the battery recover the voltage earlier.

Change the cut off voltage higher on the device.

3. Why the SOC is not correct?

The SOC is calculated by discharge time and discharge current, but the current detection precision is 0.2%, after long time using, the SOC difference will be larger little by little. If this occurs, please do one 100% cycle, e.g. 100% discharge, then 100% recharge, the BMS will adjust the SOC information automatically.

10. Recommendation

1. Always consult a qualified, licensed electrician prior to the installation of the product.

2. Always pre-test the power assembly and ensure all components are joined properly before they are installed.

3. It is recommended that adequate airflow in the application, improper thermal management may lead to premature failure, even fire.

4. Exceeding the operating temperature values may lead abnormal working.

5. Avoid voltage drops and large heat on the wires by using a dedicated line for each maximum power consumption line.

6. If no consult qualified electrician prior, please don't open the battery box.

7. If no consult qualified technical prior, please don't modify the internal connection and reassemble the BMS control board.

8. Please notice that no water goes inside of the power box, and the environment humidity can not be too high (maximum 85%).

9. If the power box should be open for maintenance, please contact with manufacturer to get enough guide first.

10. Optimal carrying capacity for storage is 50%~70%, please don't storage the lithium battery with 100% capacity or 0% capacity.

11. Optimal cyclic DOD is from 10% to 90%.