

Lithium-ion Battery Pack

Model: U-P48100

User manual

Version: 1.1



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REVISION AND UPDATES

REVISED	DESCRIPTION	Date
1.0 1.1	Add the wiring diagram of the parallel battery pack (Figure 2) on page 18. Change BMS.	2019.11.05 2020.01.03



Please comply with all warnings and operating instructions in this manual strictly. Save this manual properly and read carefully the following instructions before installing the unit. Do not operate this unit before reading through all safety information and operating instructions carefully.

1.Safety Precaution

When Using battery



Danger of High Voltage:

The high voltage power supply offer the equipment power, wet object contact high voltage power supply directly or indirectly , can cause fatal danger.



Using a special tool :

Working in high voltage and ac power, be sure to use a special tool instead of individual tools.



Static - free:

Static electricity would damage veneer on the electrostatic sensitive components, before touching the plug - in, circuit board or chips, be sure to use correct electrostatic prevention measures.



Disconnect the power supply in operation:

When operate the power supply, you must first cut off power supply, power operation is prohibited.



Dc short circuit dangerous:

Power system provides dc regulated power supply. Dc short circuit could cause fatal damage to the equipment.

While Charging



CAUTION:

The temperature range over which the battery can be charged is 0°C to 45°C. Charging the battery at temperatures outside of this range may cause the battery to become hot or to break. Charging the battery outside of this temperature range may also harm the performance of the battery or reduce the battery's life expectancy.

When Discharging the Battery



DANGER:

Do not discharge the battery using any device except for the specified device. When the battery is used in devices aside from the specified device it may damage the performance of the battery or reduce its life expectancy, and if the device causes an abnormal current to flow, it may cause the battery to become hot and cause serious injury.



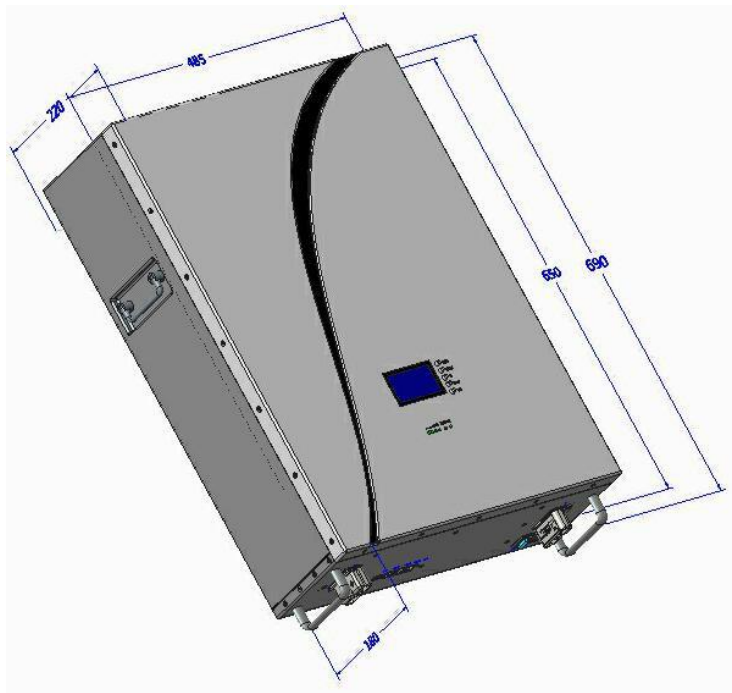
CAUTION:

The temperature range over which the battery can be discharged is -20°C to 60°C. Use of the battery outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.

2 Parameters of Battery

2-1.Parameters of Battery Pack

Model of battery pack	U-P48100
Nominal voltage	LFP battery 48V
Rated capacity	Above 100AH
Rated reserved energy	4800WH
Standard charging current	0.2C
Total charging cut-off voltage	54.75V
Cut-off voltage of charging monomer	3.65V
Standard discharging current	0.2C
Maximum continuous discharging current	100A
Cut-off voltage of discharging monomer	2.5V
Charging temperature range	-5℃~55℃
Discharging temperature range	-20℃~65℃
Dimension (W×D×H)	485*650*180mm (excluding hanger and Anderson connector)
Weight	55kg
Compound mode	15 strings
Storage temperature	0℃~40℃
Differential pressure	Differential pressure at the discharging end (2.5V for monomer) ≤300mV Differential pressure at the charging end (3.65V for monomer) ≤300mV





2-2. Technical Parameters of Battery Management System (BMS)

Function name	Item list	Set value	Setting range
Monomer voltage alarm	Overvoltage alarm voltage	3,600mV	Can be set
	Undervoltage alarm voltage	2,8000mV	Can be set
Monomer overvoltage protection	Overvoltage protection voltage	3,700mV	Can be set
	Overvoltage recovery voltage	3,380mV	Can be set
	Overvoltage recovery conditions	1. When the monomer voltage is lower than the recovery point, automatically recover charging. 2. When the monomer voltage is lower than the protection point and the capacity is $\leq 96\%$ (regularly charging conditions: Charging once per day), recover charging.	
Monomer undervoltage protection	Undervoltage protection voltage	2,500mV	Can be set
	Undervoltage recovery voltage	2,900mV	Can be set
	Undervoltage recovery conditions	The valid charging current is detected and the voltage is higher than the recovery point.	
Alarm of total voltage of battery	Overvoltage alarm voltage	54.0V	Can be set
	Undervoltage alarm voltage	42.0V	Can be set
Battery overvoltage protection	Overvoltage protection voltage	55.5V	Can be set
	Overvoltage recovery voltage	50.2V	Can be set



	Overvoltage recovery conditions	1. When the total voltage is lower than the recovery point, automatically recover charging. 2. When the total voltage is lower than the protection point and the capacity is $\leq 96\%$ (regularly charging conditions: Charging once per day), recover charging.	
Battery undervoltage protection	Undervoltage protection voltage	37.5V	Can be set
	Undervoltage recovery voltage	43.5V	Can be set
	Undervoltage recovery conditions	The valid charging current is detected and the voltage is higher than the recovery point.	
Battery cell temperature alarm	High temperature alarm of battery cell	50°C	Can be set
	Low temperature alarm of battery cell	0°C	Can be set
No charging due to temperature of the battery cell	Charging high temperature protection	55°C	Can be set
	Charging high temperature recovery	50°C	Can be set
	Charging low temperature protection	-5°C	Can be set
	Charging low temperature recovery	0°C	Can be set
No discharging due to temperature of the battery cell	Discharging high temperature protection	60°C	Can be set
	Discharging high temperature recovery	55°C	Can be set



	Discharging low temperature protection	-20℃	Can be set
	Discharging low temperature recovery	-15℃	Can be set
Ambient temperature alarm	High ambient temperature alarm	65℃	Can be set
	Low ambient temperature alarm	-20℃	Can be set
BMS temperature protection	Mos-Over-Temperature Alarm (℃)	90℃	Can be set
	Mos-Over-Temperature Protection (℃)	115℃	Can be set
	Mos-Over-Temperature Protection Release (℃)	85℃	Can be set
Ambient temperature protection	High ambient temperature protection	70℃	Can be set
	High ambient temperature recovery	50℃	Can be set
	Low ambient temperature protection	-20℃	Can be set
	Low ambient temperature recovery	0℃	Can be set
Charging overcurrent alarm	Charging alarm current	105A	Can be set



Charging overcurrent protection	Charging protection current	110A	Can be set
Charging current limiting function	Charging limiting current	20A	
Discharging overcurrent alarm	Discharging alarm current	105A	Can be set
Discharging overcurrent protection	Discharging protection current	110A	Can be set
Output short-circuit protection	Short-circuit protection locking	Continuous output short circuit and exceed the overcurrent locking times	
	Short-circuit unlocking	Continuous charger	
	Reverse polarity protection	Yes	
Automatic recovery of overcurrent	60S	1 S to 60S	
Continuous overcurrent locking	The overcurrent event with the time interval of no more than 5min is called continuous overcurrent.		
	10 times	One to 100 times	
Equilibrium function of battery cell	Charging equilibrium of battery cell	Cut-in conditions: State of valid charging current	
	Equilibrium cut-in voltage	3,450mV	Can be set
	Voltage difference of equilibrium cut-in	30mV	Voltage difference value after equilibrium to 100mV
	Voltage difference after equilibrium	20mV	10mV to Voltage difference value of equilibrium cut-in
	Equilibrium current	80mA	
	Equilibrium high temperature prohibition	50℃	Prohibition value of equilibrium low temperature to 70℃
	Equilibrium low temperature prohibition	0℃	-20℃ to Prohibition value of equilibrium high temperature

	Static equilibrium of battery cell	Cut-in conditions: All non-discharging states	
	Estimate based on the voltage of the battery cell		
	After overvoltage protection, when the rest capacity of the battery is reduced to 95% below or meets the regular charging conditions (charging once per day), recover charging if the voltage is lower than the overvoltage protection setting point.		
Manual key setting	In the shutdown state of BMS, press the key for 1S for startup.		
	In the non-standby state of BMS, press the key for 3S for shutdown.		
	In the non-standby state of BMS, press the key for 10S, until all LEDs lights up for reset.		
BMS power consumption management	Maximum standby time: 4h (The AC does not discharge, without valid discharging current).		
Power consumption of normal running	<30 mA		
Static total power consumption	Max150uA	Type 100uA	
Measure and monitor the State of Charge	≤ 5%		
data record and alarm history	≥ 400 records		
Display of SOC	Yes		
Measure and monitor accuracy	Module level: ≤ 0.5V of accuracy	Cell level: ≤ 0.05V of accuracy	
Measure and monitor the current of battery module	Accuracy: ≤ 5%		
Measure and monitor the temperature of battery	Accuracy: ≤ 3degC		
Static total power consumption	Max150uA	Type 100uA	
Push battery's alarm via dry contact	yes		
Also push alarm even when BMS is dead	yes		

3. Basic Block Diagram

- There are Battery cells and BMS board inside, before connecting the terminal, please read the diagram, and make sure the output is no short or other abnormal connection.

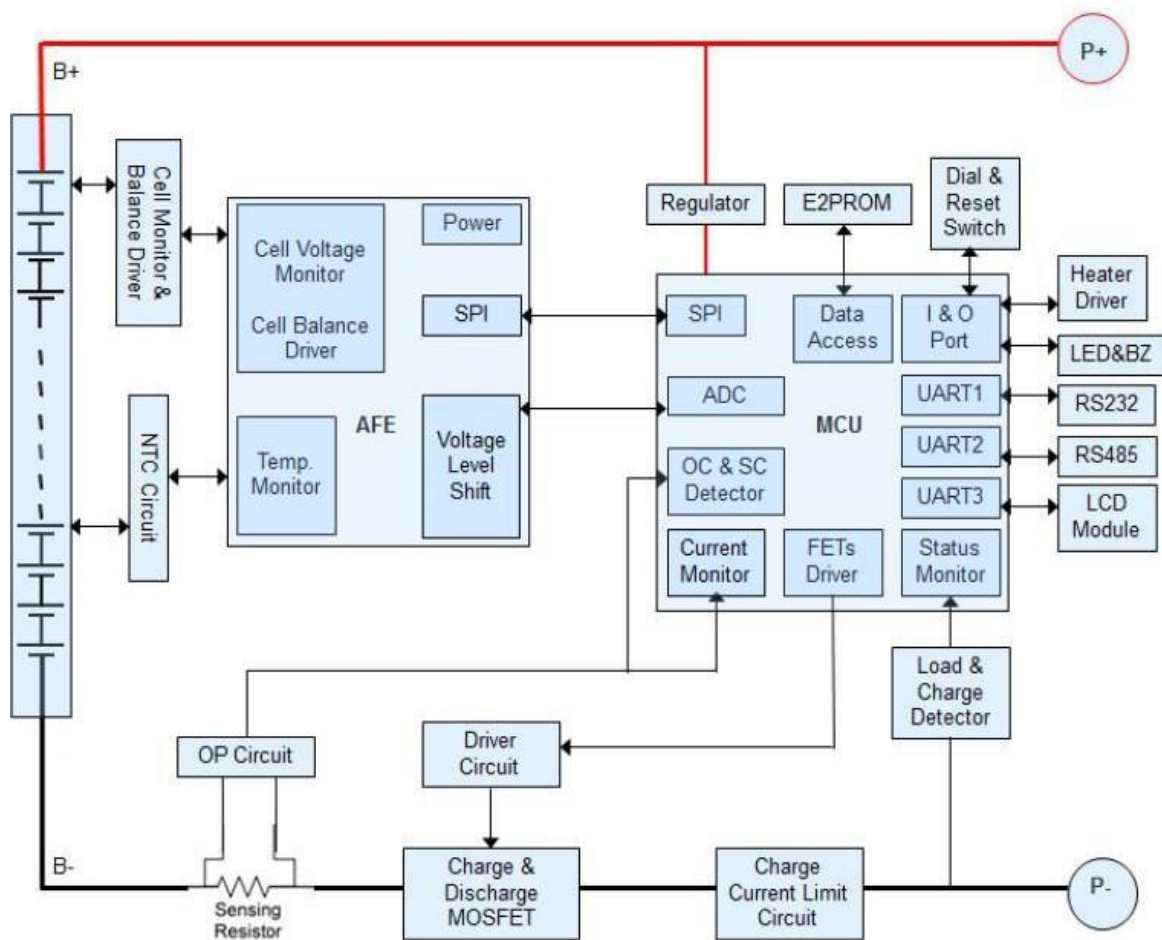


Fig1 Battery Block Diagram

4. Installation and Operation

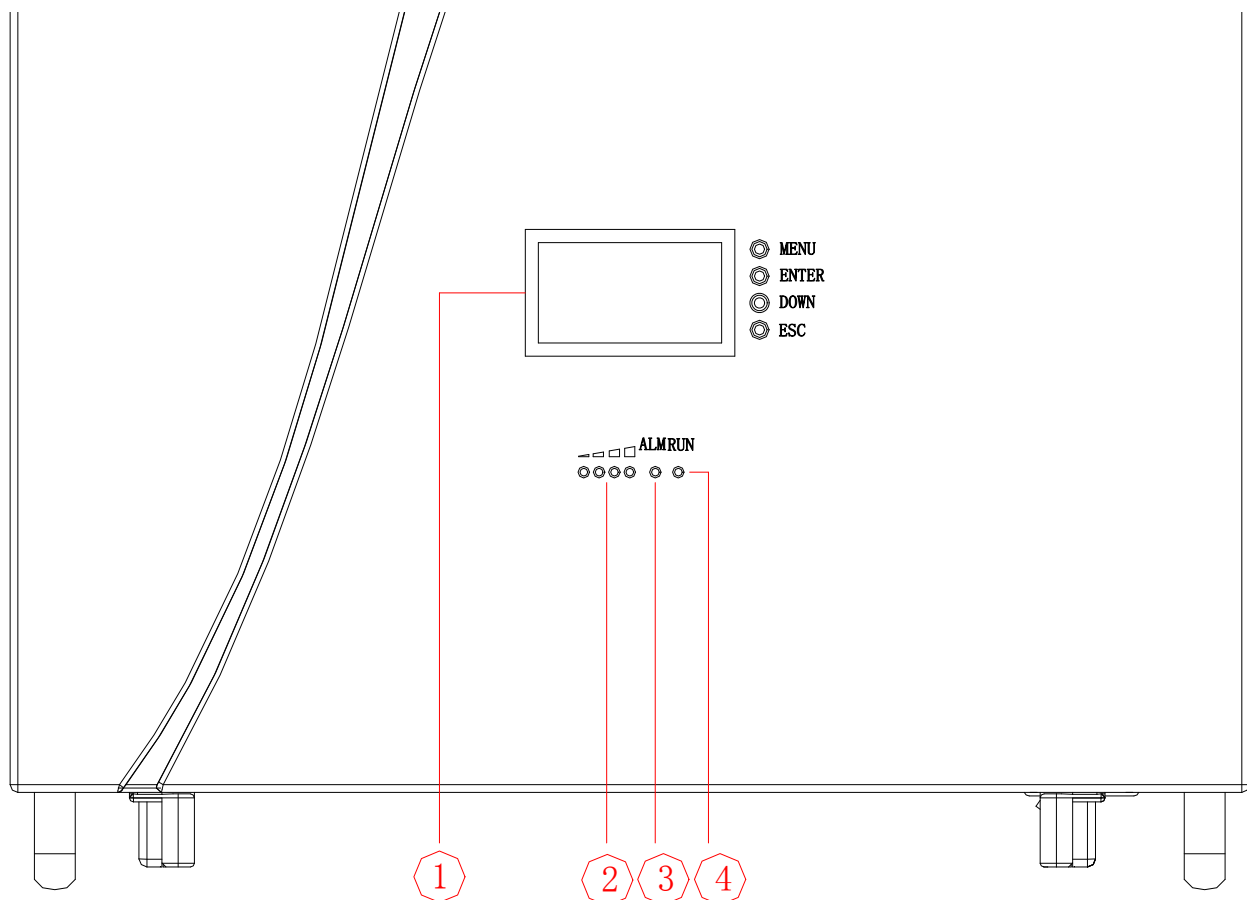
4-1. Unpacking and Inspection

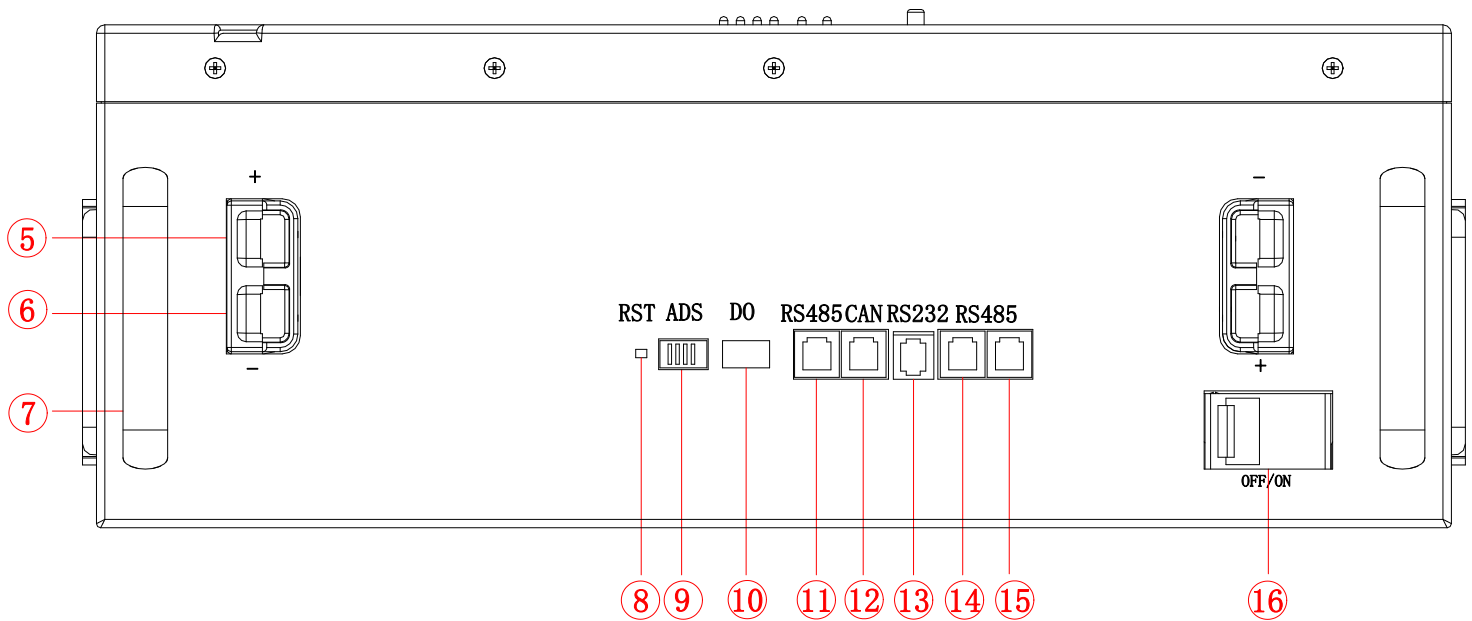
Unpack the package and check the package contents. The shipping package contains:

- One Battery
- Two mounting bracket
- A small bag of screws and nuts

NOTE: Before installation, please inspect the unit. Be sure that nothing inside the package is damaged during transportation. Do not turn on the unit and notify the carrier and dealer immediately if there is any damage or lacking of some parts. Please keep the original package in a safe place for future use.

4-2. Panel View





No.	Description	Functional Description
1	LCD	Display message
2	Display the battery's capacity	Electricity volume indicator
3	Display state information	Run indicator light blinking
4	Red- trouble-light on	ALM alarm indicator light blinking
5	Battery +	Positive terminal
6	Battery -	Negative terminal
7	Handle	Handling
8	Reset key	On/OFF button
9	Display connection address	ADS Dialer
10	Dry contact	1、2 alm 3、4 low power
11	RS-485connection port-B RS485	RS485 communication interface
12	CAN connection port	CAN communication interface
13	RS-232 connection port RS232	RS232 communication interface (Used in View and debug parameter)
14	RS-485connection port-B RS485	RS485 communication interface (Used in parallel)
15	RS-485connection port-B RS485	RS485 communication interface (Used in parallel)
16	MCB	Output ON/OFF

4-3. Single battery Installation

(1) Drill 4-12 holes suitable for M8X60 explosive screws on the mounting wall surface as shown in figure 1 (1), and install the explosive screw.

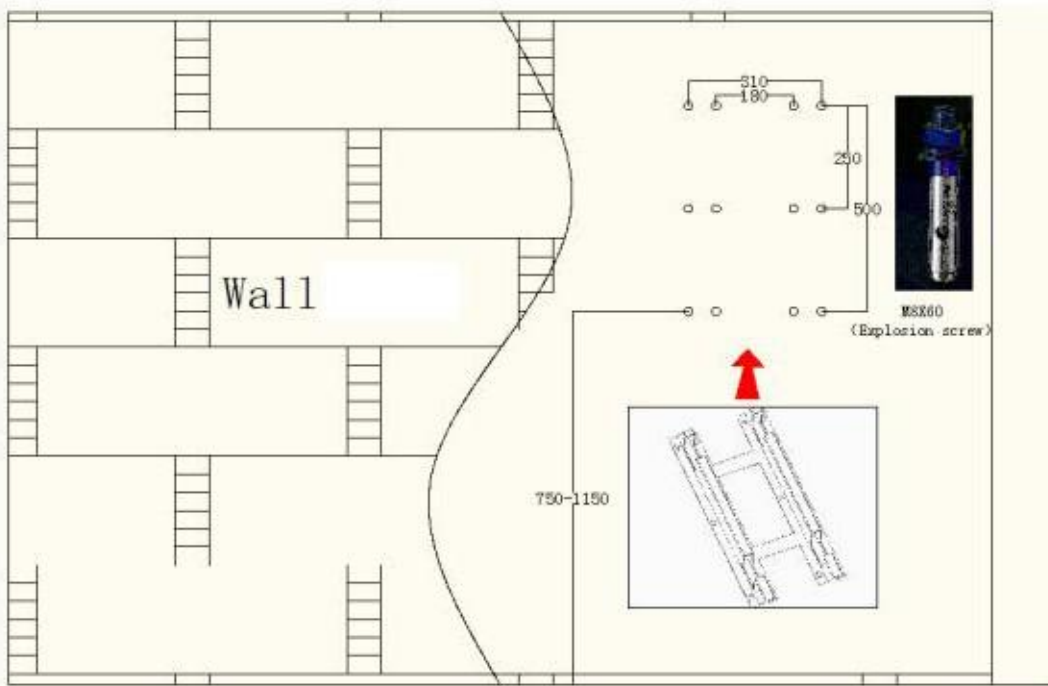


Figure 1(1)

(2) Insert the mounting hole of the bracket into the explosion screw (close to the wall) and lock it with M8 nut.

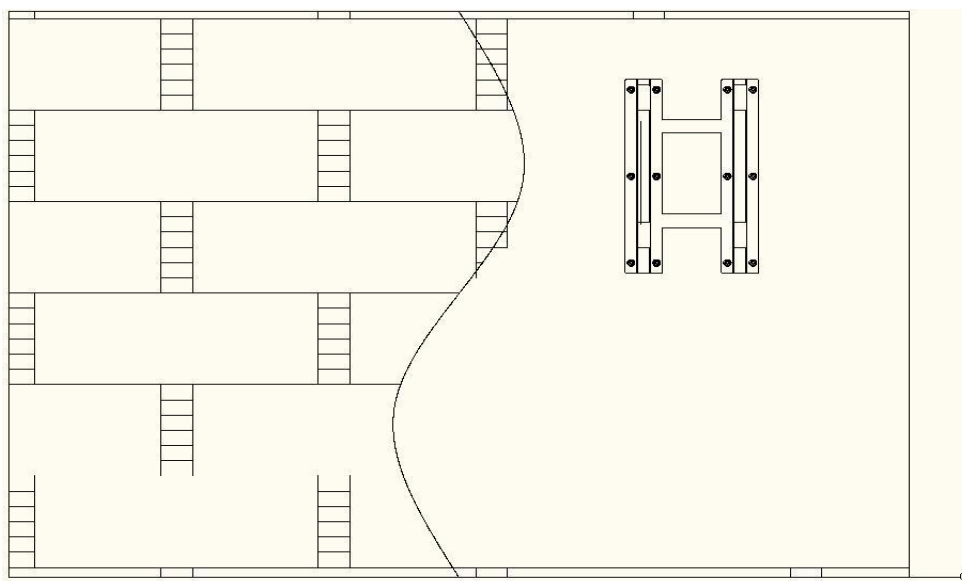


Figure 1(2)

(3) Take the battery and move it in the direction shown in figure 1 (3) below.

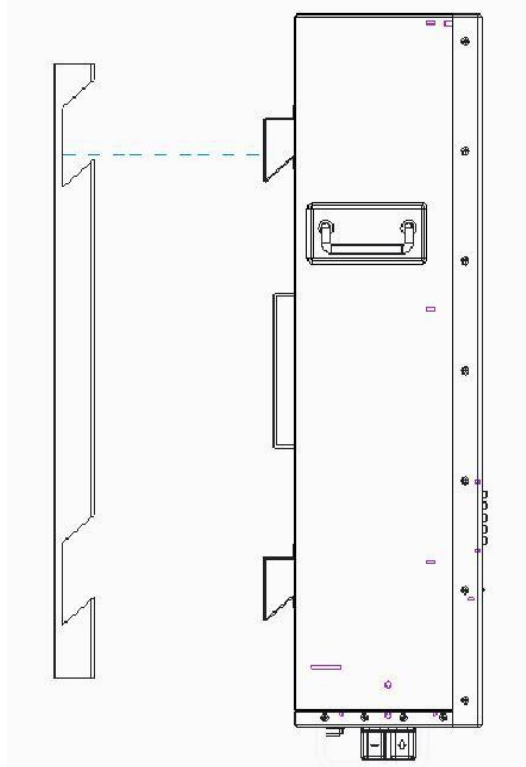


Figure 1 (3)

(4) Move in the direction as shown in figure 1 (4), and fit well, as shown in figure 1 (5).

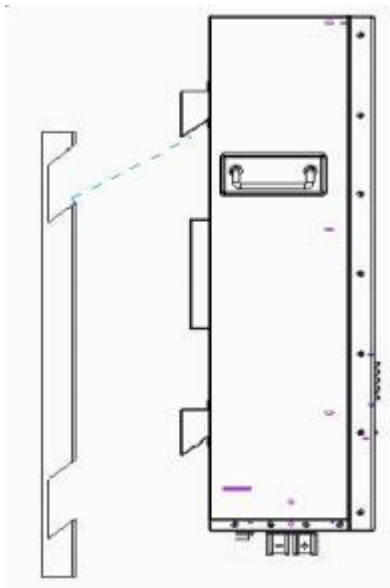


Figure 1 (4)

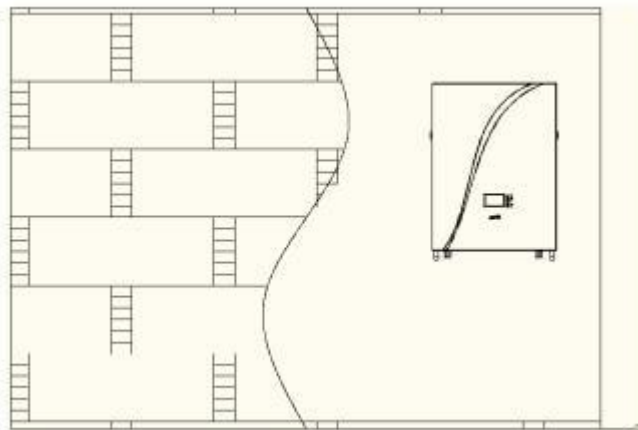
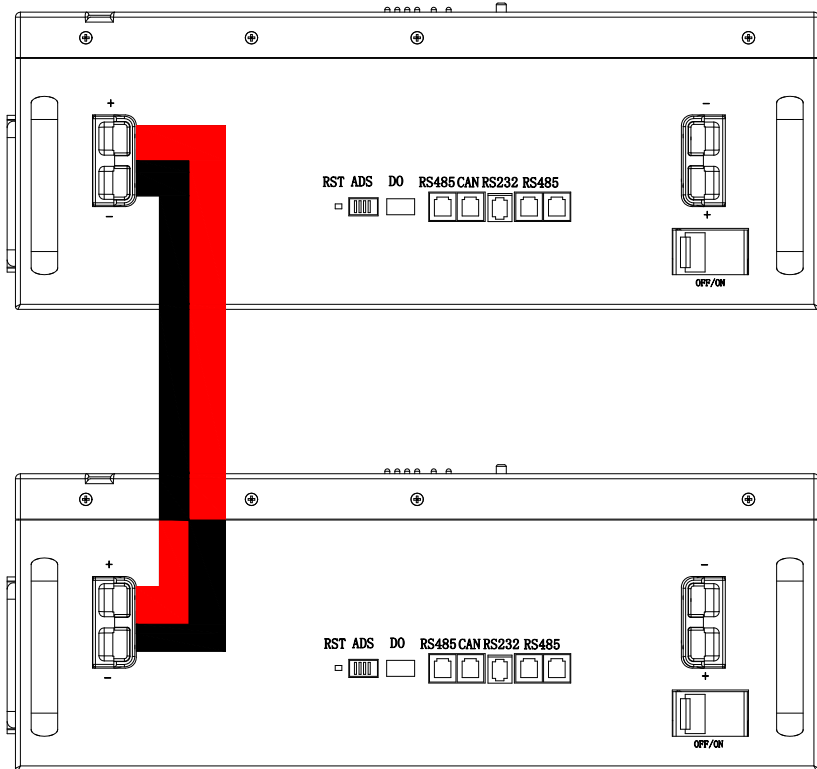


Figure 1 (5)

4-4. Software Installation

For optional computer system protection, install battery monitoring software to fully configure battery shutdown and other setting value.

4-5. Installation of Battery in Parallel



4-6. Installation Precautions

- (1) Prior to installation, unpacking to check the quantity of the parts and battery appearance.
- (2) Different brands of batteries or new and old batteries cannot be used in parallel.
- (3) Static voltage differences $\leq 0.2V$, SOC differences $\leq 5\%$, internal resistance differences $\leq 2m\Omega$ can be used together in parallel.
- (4) Install the hanger and handle and measure the battery voltage with a multimeter. The general factory voltage of the battery is 48V-50.25V.
- (5) Prior to wiring, check the anode and cathode of the battery and the anode and cathode terminals shall not be connected reversely.
- (6) During battery connection, please wear the protective gloves. When using such metal tools as torque wrench, please perform insulating packaging for them and two end of the metal tools such as torque wrench shall not contact the positive and negative terminals of the battery at the same time to avoid battery short-circuit.
- (7) Before the battery is connected with the externally connected equipment, make the equipment in a disconnected state, check whether the connecting polarity of the battery and total voltage are correct, connect the battery anode with the equipment anode and battery cathode with the equipment cathode and fix the connecting line.
- (8) During handling and placement, the battery must be handled gently. No dropping or impacting. The battery shall not be thrown or beaten to avoid damaging the battery or resulting in potential safety hazard.
- (9) Do not touch the surface of the battery box with the sharp part of the tool to scratch or damage the battery box.
- (10) Do not disassemble the battery box without authorization.

(11) Do not put any article made of the metal conductive material together with the battery or assemble it into the battery box.

(12) Install it according to the selected installation mode:

Installation of standard cabinet (rack): Install the matching hanger for the battery pack and fix them in the standard cabinet and the tray protection is added for the battery box.

Installation of wall-mounted box: Prior to installation, please ensure that the wall complies with the wall-mounted requirements; according to the location in the design plan, install the special wall-mounted box of the lithium battery; the battery pack is fixed in the wall-mounted box in a hanger manner.

Installation of integrated indoor and outdoor cabinets (boxes): Install them according to the installation specification for the customized integrated cabinet (box).

4-7. Operation Instruction for Installation

1) Prior to installation, please check whether the battery is normal.

Press the reset key RST on the front panel for 3S for startup. During startup, 4 capacity indicator lights on the front panel, ALM alarm indicator light (red) and RUN running indicator light light up. Check whether all indicator lights light up normally; then the ALM alarm indicator light goes out, the RUN running indicator light lights up and the capacity indicator light lights up according to the capacity.

If the ALM alarm indicator light flashes after startup, it means that the battery has an alarm. The newly installed battery seldom has alarm. The common alarm is the battery undervoltage alarm (which is resulted from non-use of the battery for a long time). Such case may be removed after the battery is charged for 30min; if the alarm may not be removed, please press the reset key RST for 10S, until all LEDs light up for reset, execute the battery reset operation and confirm whether the alarm is removed. If the alarm is removed, the battery may be used normally. Otherwise the battery shall be reworked.

2) For the battery which is normal after detection, please press the reset key RST for 3S to execute the battery ON/OFF operation.

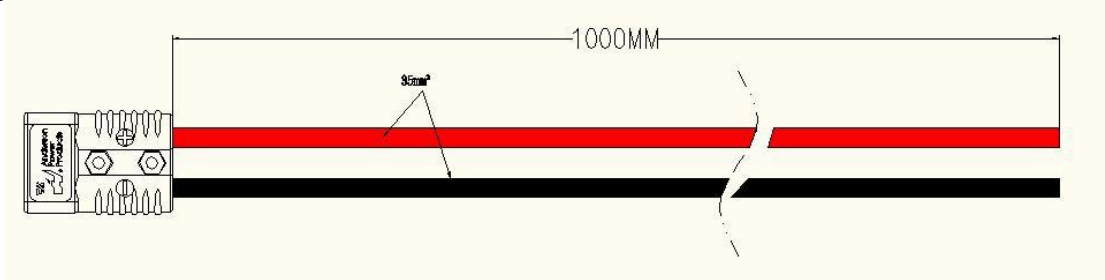
Instructions of manual operation of the reset key RST	Startup	In the OFF state of BMS, press the key for 3S for startup;
	Shutdown	In the non-standby state of BMS, press the key for 3S for shutdown;
	Reset	In the non-standby state of BMS, press the key for 10S, until all LEDs light up for reset.

Instructions: "Shutdown" and "standby" , "startup" and "activation" in Chinese have the same meaning.

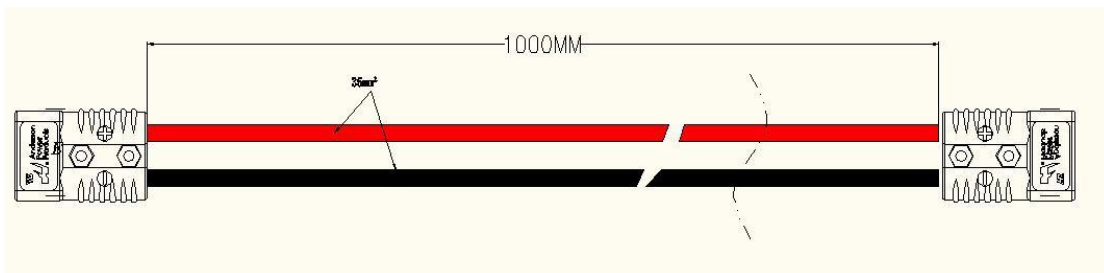
3) Installation of the lithium battery, wiring and startup.

Make the battery pack in a standby state, install it in the battery cabinet one by one, the anode and cathode of the battery pack are connected respectively, which are connected to the switching mode power supply or UPS (Please note that the switching mode power supply and UPS shall be disconnected from the AC). Press the reset key RST of one of battery packs for 3S for startup. Such startup battery may activate other batteries which are connected in parallel (or press the reset key RST of each battery pack for 3S successively) and the whole battery pack with high capacity enters the working state. Later, apply AC to the power supply equipment such as switching mode power supply and UPS to make the whole standby system run.

The specification of the connecting line is selected according to the load current, it is suggested to select 35mm² copper wire. (connection line 1/1pcs) 1000mm.



(connection line 2/1pcs) 1000mm



Introduction to operation steps in detail according to the capacity required:

- **Battery pack in parallel (the wiring diagram is shown in Figure 1 or Figure 2):**

Step 1: Make the battery pack in the standby state and install it in the wall successively.

Step 2: Disassemble the anode insulating cap of the neighboring batteries one by one, connect the anodes of up and own neighboring battery packs with the installation connecting line and screw on the anode insulating cap.

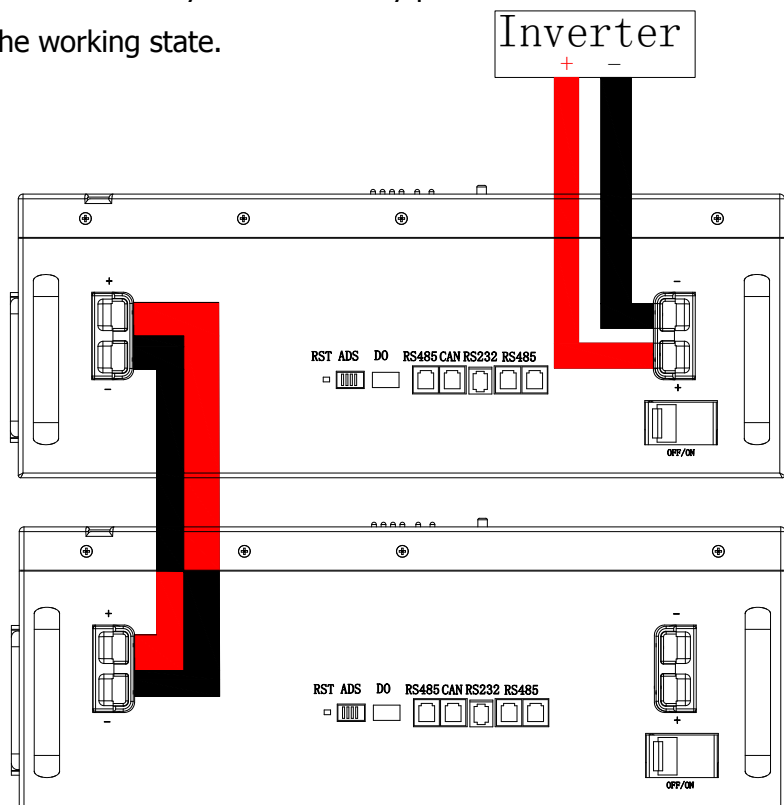
Step 3: According to step 2, connect the cathode of the battery pack.

Step 4: Set the dial-up addresses of all battery modules from top to bottom one by one, which are 1000, 0100, 1100 and 0010 (the dial-up addresses are set according to the number of battery modules actually used) respectively; (this step may be skipped if there is no need to access to the remote monitoring platform).

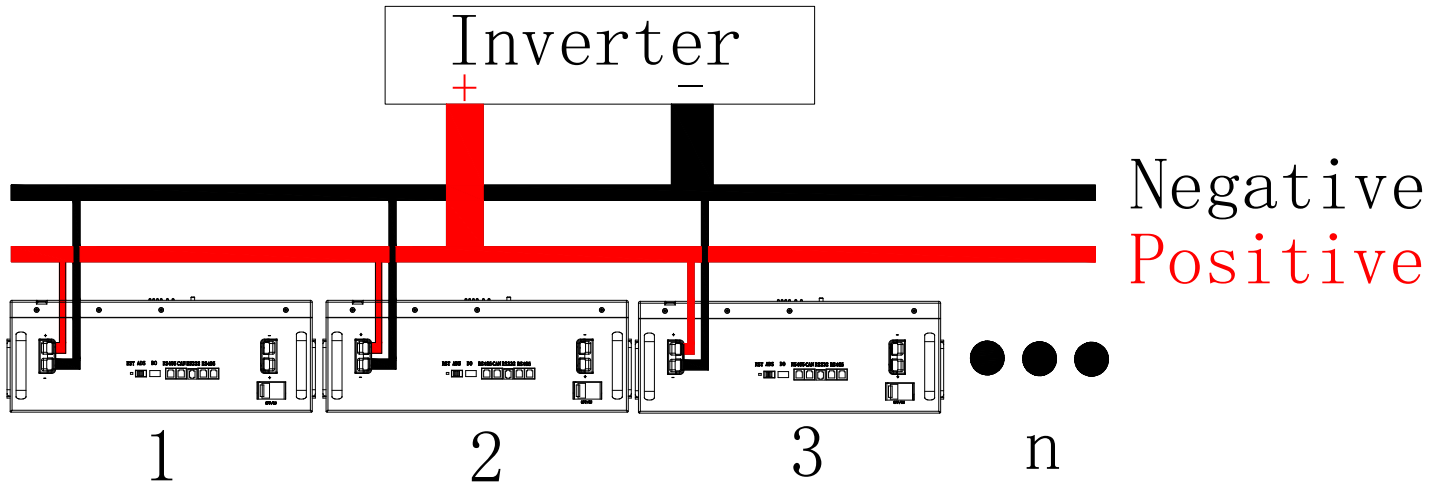
Step 5: Perform the cascade connection to RS485 communication interface of the battery module with the RS485 connecting line; lead to the collector of the monitoring platform from the RS232 interface of the battery module with the address of 1000 with the RS232 connecting line; (this step may be skipped if there is no need to access to the remote monitoring platform).

Step 6: Draw out two wires from the anode and cathode of a battery pack at the top or in the middle respectively as the main connecting line of the battery pack in parallel, which are connected with the switching mode power supply or UPS.

Step 7: Press the RST key of each battery pack for Reset and the whole battery pack with high capacity enters the working state.



Wiring Diagram of Battery Pack in Parallel (Figure 1)

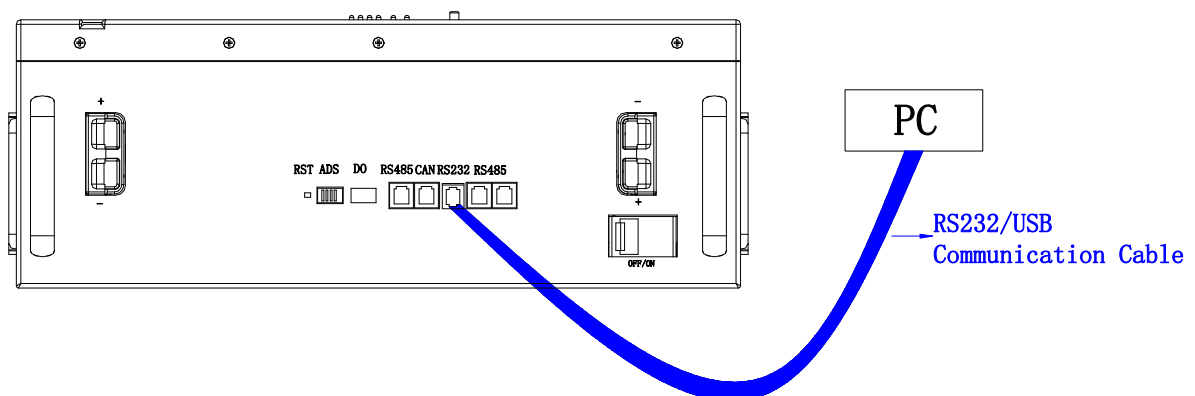


Wiring Diagram of Battery Pack in Parallel (Figure 2)

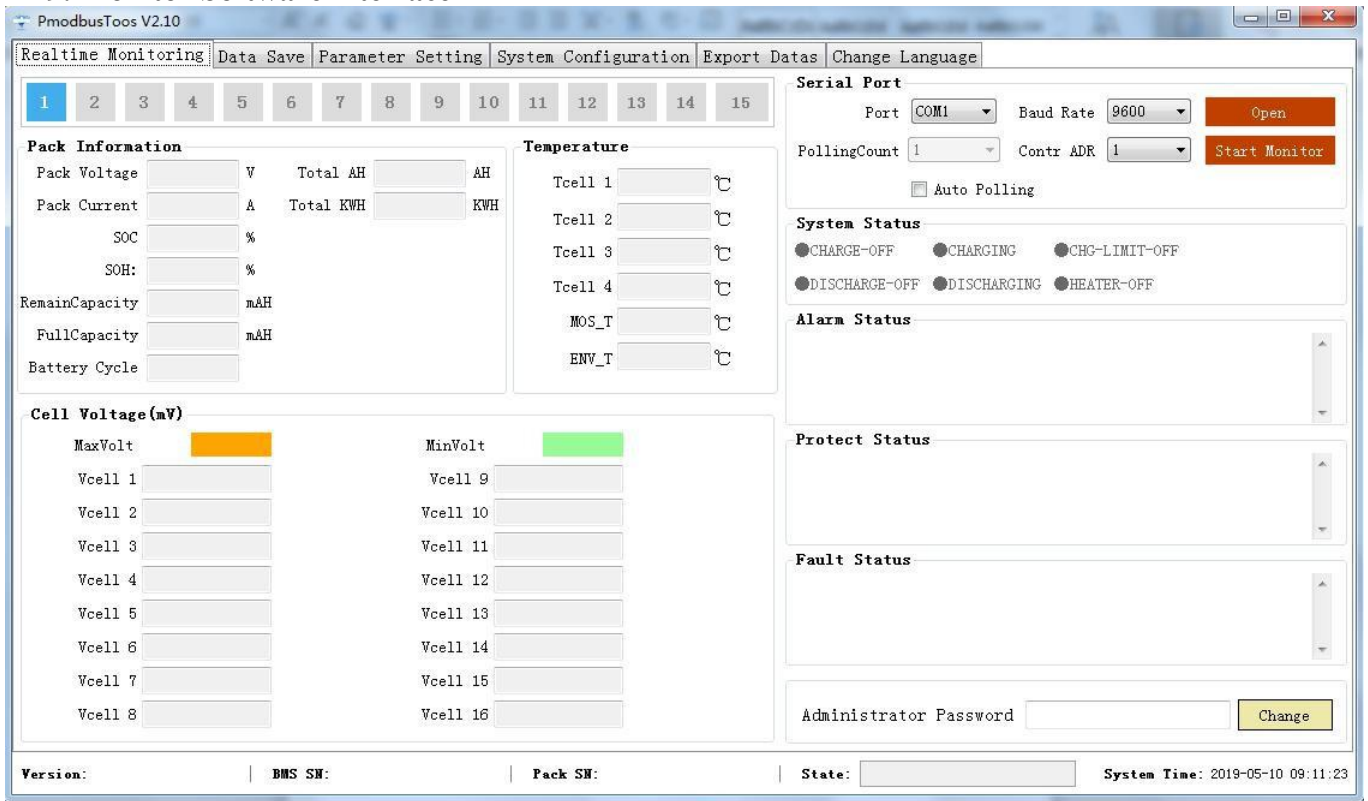
Circuit breaker of battery circuit is set to OFF, connect it to switch power supply, and output voltage of switch power supply is set to 52.5-54V, current set to 0.2C; after all settings done, switch the circuit breaker ON.

4-8. Connection mode for parallel communication

While in parallel communication, dial-up addresses of battery module are 1, 2,3,4.....14,15,of which 1 stands for host computer, to which other batteries' data is uploaded; host computer conducts unified uploading, and host computer with dial-up code of 1 is required to connect with upper computer; FF polling mode used as consulting mode.



4-9. Monitor Software interface



4-10 Upper machine instructions

A、Software source file:

Name of software source file: Unzip the "Pmodbus Toos V2.10.zip" file and get "config"、"Pmodbus Toos V2.10.exe"、"Pmodbus Toos V2.10.exe.config"three documents in total.

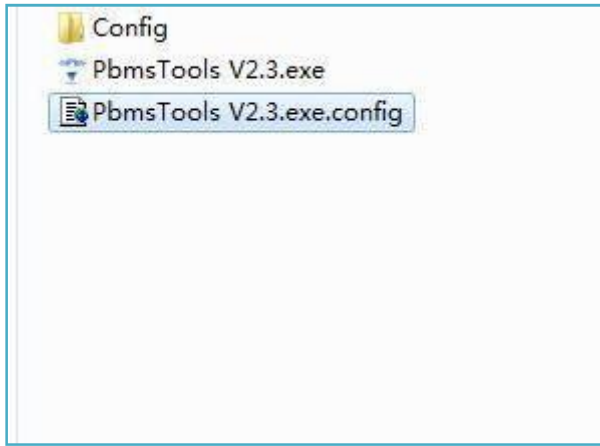
B、Software running envirement:

The software running on the PC and its compatible computer, using WINDOWS operation system.

C、Software using steps:

- (1) Double click PmodbusToos V2.10.exe icon can show the main interface of the software (As shown in figure A) .

RS232 PC software



RS485 Serial port driver and PC software

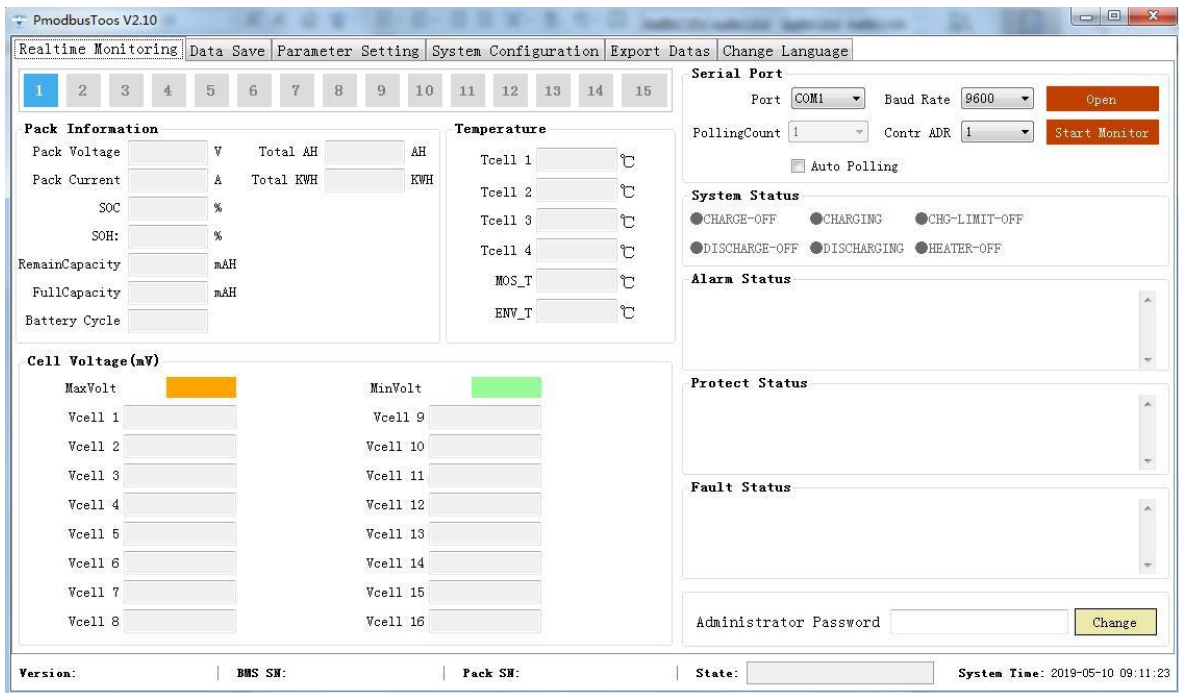
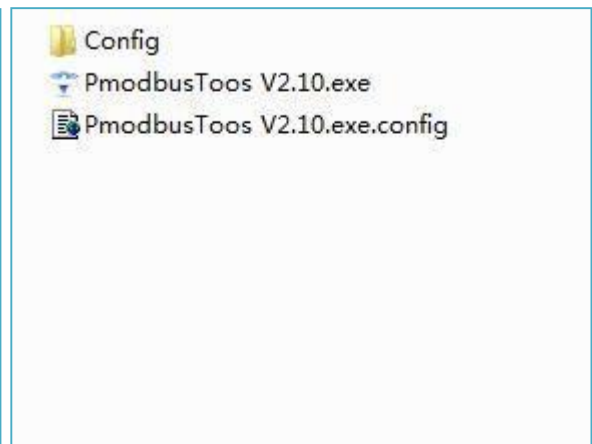
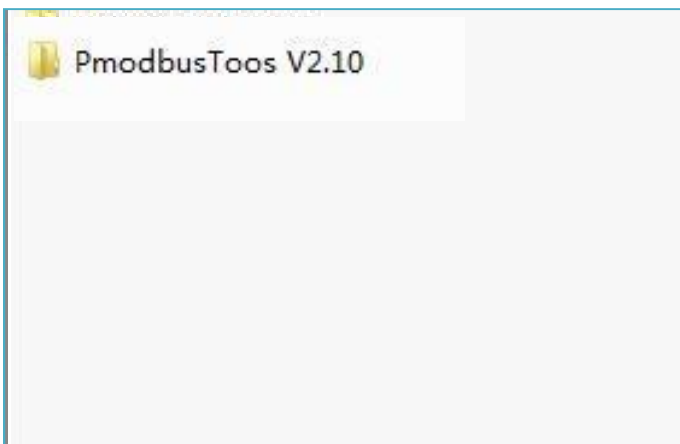


Figure A: Realtime Monitoring

(2) Open the main interface (As shown in figure A) , the software automatically search serial port, and automatically open, real-time read battery voltage, power, temperature, and protection of the state of battery parameters.

Operating authority is divided into general rights and administrator privileges.

(3) In the data save TAB(As shown in figure B),there are two checkboxes, display and automatic storage.

Check the display option, can real-time display the various parameters of the battery.

Check the automatic storage option, can automatically storage the parametersof the battery in the excel table. The file in the software under the current file path of the data folder, storage file name named after pack number and time.For example packNo1_20190510145010.xls.

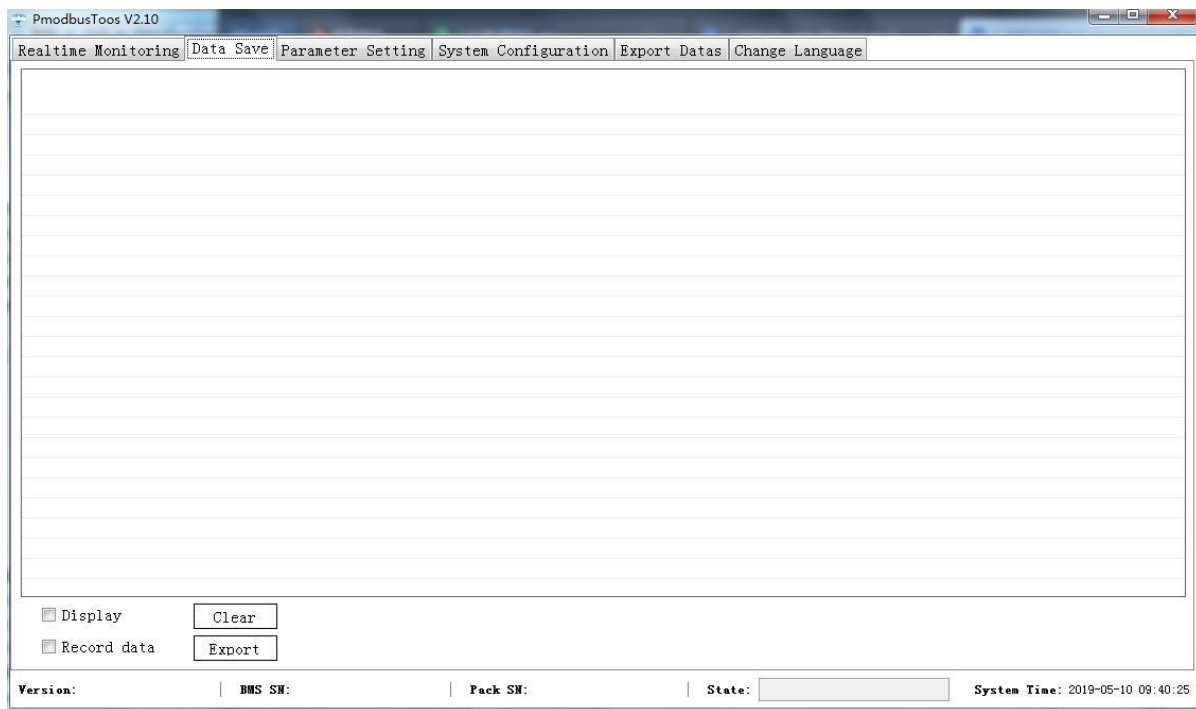


Figure B: Data Save

(4) In the parameter settings TAB(As shown figure C),the TAB for the battery parameters.

Read the parameter I: Read all the parameters of the battery

Write in parameter : Write all the parameters of the battery

Restore default: Restore the default parameters for battery

Import parameters: Export the current battery parameters, for the XML file format.

Expoeer parameters: The parameters of the import file format for the XML to the current TAB

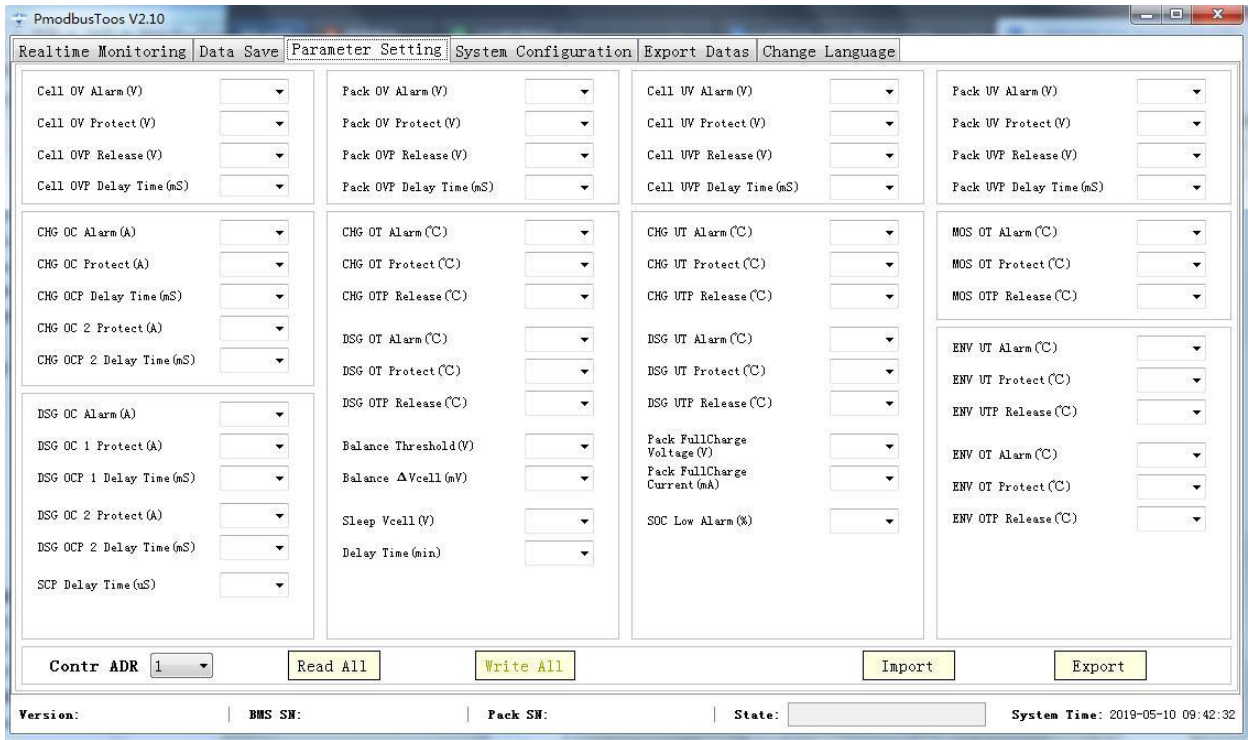


Figure C: Parameter Settings

(5) In the system configuration TAB(As shown in figure D),the TAB for battery calibration, parameters setting, the battery calibration and setting up the battery system parameters need administrator privileges.

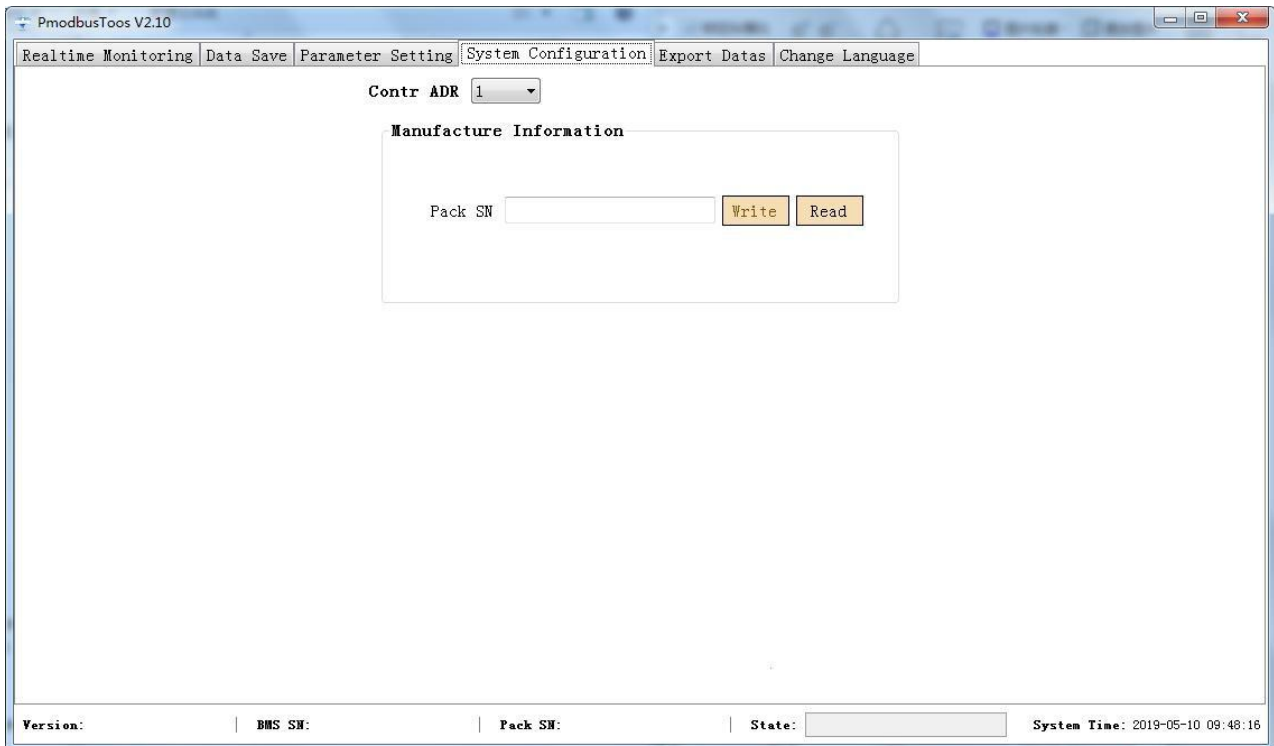


Figure D: System Configuration

(6) In the Export Datas TAB(As shown in figure E), it is used to export test data.

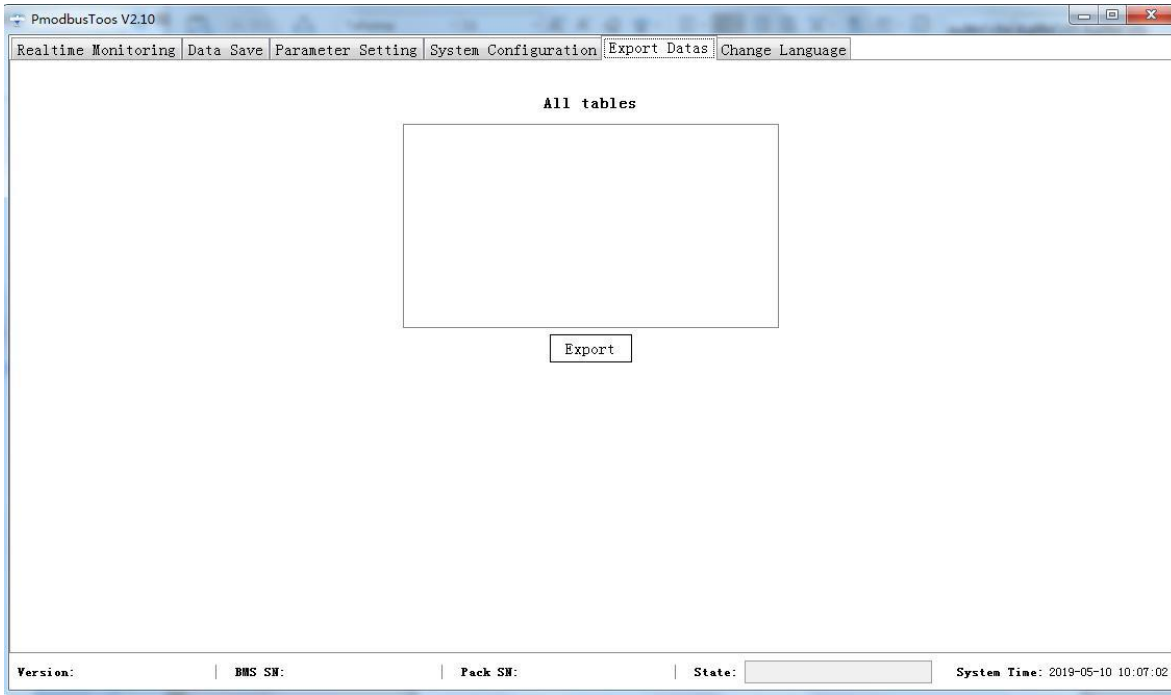
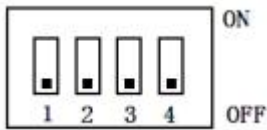


Figure E: Export Datas

4-11 Address Switch function(Only in Parallel)

When battery work in parallel, main pack and slave packs need address as follows:



Address	Dial Switch				Remark
	#1	#2	#3	#4	
0	OFF	OFF	OFF	OFF	
1	ON	OFF	OFF	OFF	Pack1 (Main Pack)
2	OFF	ON	OFF	OFF	Pack2
3	ON	ON	OFF	OFF	Pack3
4	OFF	OFF	ON	OFF	Pack4
5	ON	OFF	ON	OFF	Pack5
6	OFF	ON	ON	OFF	Pack6
7	ON	ON	ON	OFF	Pack7
8	OFF	OFF	OFF	ON	Pack8
9	ON	OFF	OFF	ON	Pack9
10	OFF	ON	OFF	ON	Pack10
11	ON	ON	OFF	ON	Pack11
12	OFF	OFF	ON	ON	Pack12
13	ON	OFF	ON	ON	Pack13
14	OFF	ON	ON	ON	Pack14
15	ON	ON	ON	ON	Pack15

4-12 Communication Function

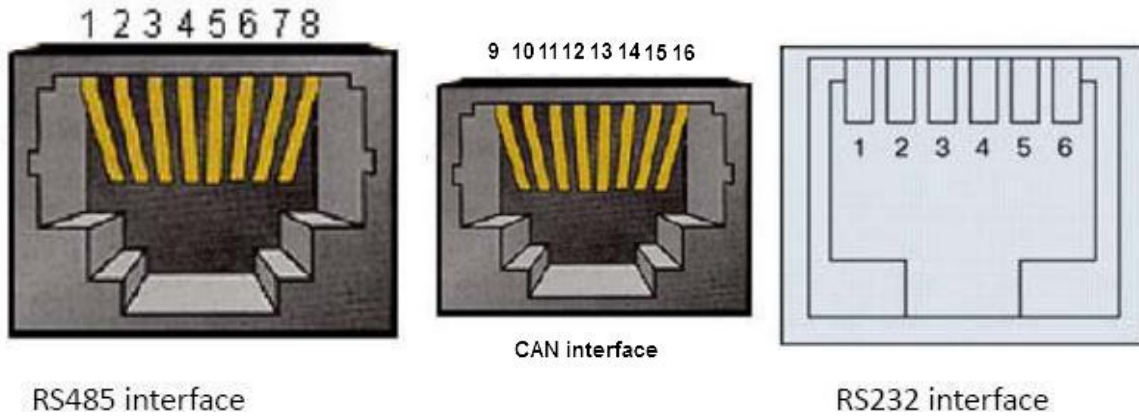


Fig8 Communication Port Interface

RS485 Terminal Port	Definition	CAN Terminal Port	Definition
Pin1,8	RS485_B	Pin9,10,11,14,16	NC
Pin2,7	RS485_A	Pin12	CANL
Pin3,6	GND	Pin13	CANH
Pin4,5	NC	Pin15	GND

RS485&CAN Communication Port Definition

RS232 Terminal Port	Definition
Pin3	BMS Transmit, PC Receive
Pin4	BMS Receive, PC Transmit
Pin5	GND
Pin1,2,6	NC

RS232Communication Port Definition

5. Operations

5-1. LED Indicators

LED Indicators:

There are 6 LEDs on front panel to show the battery working status:







PACK Status	Normal/Alarm/Protection	RUN	ALM	SOC Indication LEDs				Remark
								
Power Off	Sleep	OFF	OFF	OFF	OFF	OFF	OFF	All off
Standby	Normal	Flash 1	OFF	Indication by SOC				Standby state
	Alarm	Flash 1	Flash 3	(The top SOC Led Flash 2)				Cell low voltage
Charge	Normal	ON	OFF	Indication by SOC				ALM Led on when Cell over-charge voltage Alarm
	Alarm	ON	Flash 3	(The top SOC Led Flash 2)				
	Over Charge Protection	ON	OFF	ON	ON	ON	ON	If no mains supply, LED as standby
	Temperature. Over-current Fault Protection	OFF	ON	OFF	OFF	OFF	OFF	Close charge
Discharge	Normal	Flash3	OFF	Indication by SOC				
	Alarm	Flash3	Flash 3					
	Under Discharge Protection	OFF	OFF	OFF	OFF	OFF	OFF	Close discharge
	Temperature. Over-current. Short Circuit Fault Protection	OFF	ON	OFF	OFF	OFF	OFF	Close discharge
Fault		OFF	ON	OFF	OFF	OFF	OFF	Close charge Close discharge

Fig7 LED Operating Status

Flash	ON	OFF
Flash1	0.25Sec	3.75Sec
Flash2	0.5Sec	0.5Sec
Flash3	0.5Sec	1.5Sec

NOTE: LED function can be set by monitor software, the default if on.

5-2. Buzzer Operation(Optional)

Model	Description and Status
Fault	Buzzing 0.25S per 1Sec
Protection	Buzzing 0.25S per 2Sec(expect for over-charge protection)
Alarm	Buzzing 0.25S per 3Sec(expect for over-charge alarm)

NOTE: Buzzer function can be set by monitor software, the default if off.

5-3. Reset key function

Mode	Pressing and Holding time		
	0-3Sec	3-6Sec	>6Sec
Normal	Indication by SOC	Transfer to Sleeping mode	Reset
Sleeping Mode	Wake up from Sleeping mode		

5.3.1 Battery parameters collection page

When the cursor “》” is point to “Battery Parameters Acquisition” , press ENTER key will enter into the page of “Battery Parameters Acquisition” , As shown in the figure below

5.3.2 Key description

- 1) SW1----NEMU, SW2----ENTER, SW3----DOWN, SW4---- ESC.
- 2) Each item is “》” or “--” as a beginning, among them “》” shows the current cursor position, press UP or DOWN key can move the cursor position; with “》” end of the project, the content of the said project has not shown, press ENTER key can enter the corresponding page.
- 3) Press ESC key can be returned at the next higher level directory; In any position, press NEMU key can return to the main menu page.
- 4) In a dormant state, press any key, can activate the screen.

5.3.3 Dormancy/shutdown

Under normal operation condition, with no keystrokes 1 minutes later, system will enter a state of dormancy/shutdown.Shutdown/dormancy state, press any key, screen can be activated.

6. Troubleshooting

If the battery does not operate correctly, please solve the problem by using the table below.

Symptom	Possible cause	Remedy
No indication and alarm in the front display panel	Sleeping mode	Press Reset to normal mode
No indication and alarm in the front display panel even Reset still no	Battery voltage too low	Charge battery immediately
Red LED Flashing when Standby	Battery cell low voltage	Charge battery immediately
Red LED Flashing when charging	Alarm for protection when charging	BMS show alarm, protect and adjustment
Red LED Flashing when Discharging	Battery too low and will shutdown	Charge battery immediately
RED LED Lighting continuous	Battery wrong	Need to repair

7. Storage and Maintenance

7-1. Storage

Before storing, charge the battery at least 7 hours. Store the Battery covered and upright in a cool, dry location. Recommend long-term storage temperature is 15°C -25°C . During storage, recharge the battery in accordance with the following table:

Storage Temperature	Recharge Frequency	Charging Duration
0°C - 40°C	Every 3 months	1-2 hours

7-2. Maintenance



The battery system operates with hazardous voltages. Repairs may be carried out only by qualified maintenance personnel.



Even after the unit is disconnected from the mains, components inside are still connected to the battery cells which are potentially dangerous.



Before carrying out any kind of service and/or maintenance, disconnect the batteries and verify that no current is present and no hazardous voltage exists in the terminals.



Only persons are adequately familiar with batteries and with the required precautionary measures may replace batteries and supervise operations. Unauthorized persons must be kept well away from the batteries.



Verify that no voltage between the battery terminals and the ground is present before

maintenance or repair. In this product, the battery circuit is not isolated from the input voltage. Hazardous voltages may occur between the battery terminals and the ground.



Batteries may cause electric shock and have a high short-circuit current. Please remove all wristwatches, rings and other metal personal objects before maintenance or repair, and only use tools with insulated grips and handles for maintaining or repairing.



When replace the batteries, install the same number and same type of batteries.



When replace the parallel batteries, make sure the new battery is full charged.



Do not open or destroy batteries. Escaping electrolyte can cause injury to the skin and eyes. It may be toxic.



Please replace the fuse only with the same type and amperage in order to avoid fire hazards.



Do not disassemble the battery system.

8. Product Responsibilities and Consulting

- 1) We will not be liable for the accidents resulting from operation breaking this specification and user manual.
- 2) We will not send separate notice, provided that the contents of this specification are changed due to improvement of product quality or technological upgrading; provided that you want to understand the latest information of this product, please contact us.
- 3) We will maintain the product, which is in the warranty period for free of charge, provided that it has any product quality problems within the specified operation range; we may replace the relevant parts, if we fail to maintain it, so as to achieve the purpose of sustainable use without performance reduction; our after-sales service personnel will propose the specific maintenance and troubleshooting methods.

Cautions: Specifications are subject to change without prior notice;

Any technical support, please contact UFO POWER.