# USER MANUAL

# FOR LITHIUM BATTERY

## energy storage system

VERSION 1.0

48V 100Ah/200Ah  51.2V 100Ah/200Ah

Sunpal Power Co.,Ltd.  0086-551-65865992  info@sunpalpower.com  www.sunpalpower.com

# Contents



Note: 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. Introduction

The Energy storage pack is an essential component of the photovoltaic power generation system. It can provide electricity for the connected load, and it can also store photovoltaic solar modules, fuel generators, or wind energy generators by charging the remaining energy in case of emergency. When the sun goes down, energy demand is high, or there is a power outage, you can use the energy stored in the system to meet your energy needs at no additional cost. In addition, the energy storage Pack can help you achieve energy self-consumption and ultimately achieve the goal of energy independence.

According to different power conditions, the energy storage PACK can output power during peak power consumption, and can also store energy during low power consumption. Therefore, when connecting the matching photovoltaic modules or inverter arrays, external equipment is required to match the energy storage the working parameters of the pack to achieve the highest operating efficiency. For a simple diagram of a typical energy storage system.

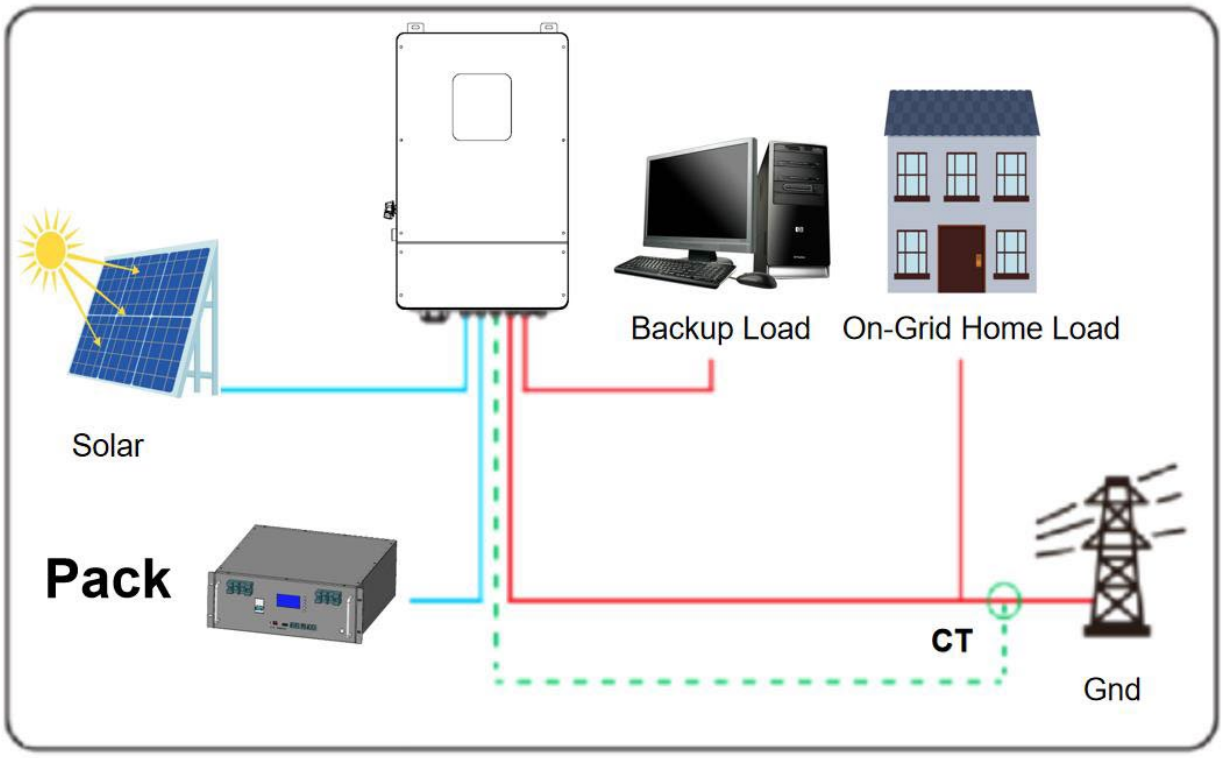



Figure 1 Energy storage System Overview

It is very important and necessary to read the user manual carefully before installing or using the battery. Failure to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, death,
or may damage the battery and the whole system.

- If the battery is stored for a long time, it is requirement that they are charged every three to six months, and the SOC should be no less than 80%, after fully discharging, The battery needs to be recharged within 12 hours.
- Do not expose cable outside; Do not use cleaning solvents to clean the battery.
- All battery terminals must be disconnected before maintenance.

## 2. Important Safety Warning ⚠

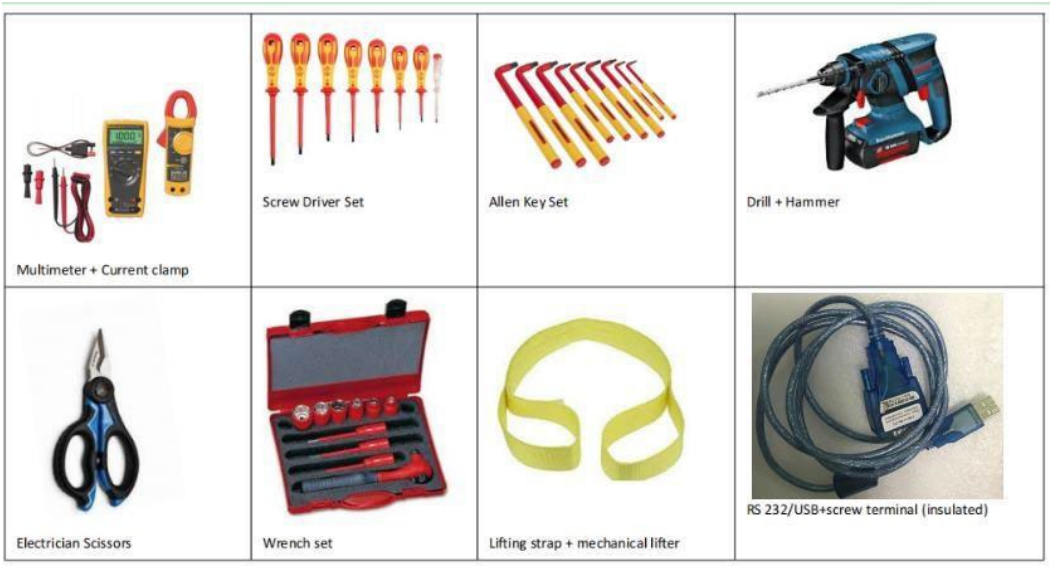
- Do not expose the battery to flammable or harsh chemicals or vapors.
- Do not paint any part of the battery, include any internal or external components.
- Do not connect battery with PV solar wiring directly.
- Any foreign object is prohibited to be inserted into any part of the battery.

- Our company will not bear any warranty claims for direct or indirect damage caused by violation of the above items.

## 2.1 Before Connecting

- After unpacking, please check the battery and pack list first, if the battery is damaged or spare parts are missing, Please contact the dealer.
- Before installation, be sure to cut off the grid power and make sure the battery is in the turned - off mode;
- Wiring must be correct, do not mix-connect the positive and negative cables, and ensure no short circuit with the external device;
- It is prohibited to connect the battery with AC power directly;
- The BMS in the battery is designed for 24VDC/48VDC, DO NOT connect battery in series;
- It is prohibited to connect the battery with different type of battery;
- Please ensure the electrical parameters of battery system are compatible to inverter;
  Keep the battery away from fire or water.

## 2.2 Necessary installation Tools.




## 2.3 Personal protective equipment

## 2.4 During operation

- If the battery system needs to be moved or repaired, the power must be cut off first and the battery is completely shutdown;
- It is prohibited to connect the battery with different type of battery;
- It is prohibited to put the batteries working with faulty or incompatible inverter;
- In case of fire, only dry powder fire extinguisher can be used, liquid fire extinguishers are prohibited;
- Please do not open, repair or disassemble the battery. We do not undertake any consequences or related responsibility due to violation of safety operation or violating of design, production and equipment safety standards.

## 3. Unpacking & Overview

### 3.1 Packing List

You will receive the following parts(Not a full set), sample as follow picture. For customized requirements, please place an order with the manufacturer.

| Battery pack | Inverter common cable(RJ45) | Power out positive cable |
|---|---|---|
|  |  |  |
| **Power out Negative cable** | **Manual *1** | **Parallel common cable(RJ45)** |
|  |   |  |

*NOTE : Types of communication tools need extra order

### 3.2 Product Ove

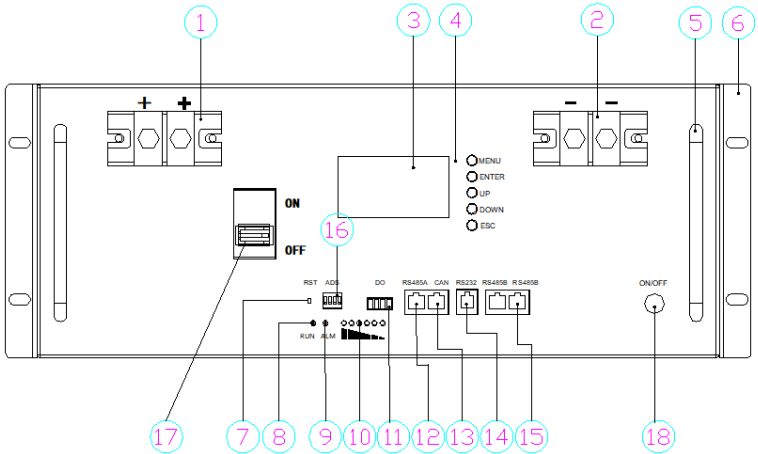



Figure2.

| No. | Description | Silk-screen | Remark |
|---|---|---|---|
| 1 | Pack positive pole | P+ | Output terminal |
| 2 | Pack negative pole | P- | Output terminal |
| 3 | LCD | | |
| 4 | LCD key | | |
| 5 | handle | | |
| 6 | Fixed bracket | | |
| 7 | reset | RST | |
| 8 | Run LED indication | RUN | |
| 9 | ALARM LED indication | ALM | Lift heavy objects |
| 10 | Capacity LED indication | | |
| 11 | DRY connect port | DRY CONTACT | |
| 12 | 485A communication port | RS485A | Connect to inverter |
| 13 | CAN communication port | CAN | Connect to inverter |
| 14 | RS232 communication port | RS232 | Host software |
| 15 | RS485B communication port | RS485B | Parallel use |
| 16 | ADS Coder | ADS | Set Battery address code |
| 17 | Air switch | ON/OFF | |
| 18 | Power switch | ON/OFF | |

# 4. Installation

## 4.1 Selecting Mounting Location

Consider the following points to install the energy storage Pack:

- Do not mount the Pack on flammable construction materials.Mount on a solid surface;
- Install this Pack module at eye level in order to allow the readability of LCD display at all times.
- For proper air circulation to dissipate heat, please leave a gap of about ＞0.3 meter from the ground,30 cm from the side of thedevice.
- The ambient temperature should be between 0°Cand 40°Cand relative humidity should be between 25% and 85% to ensure optimal operation.
- The recommended installation is flat wise adherence.
- Install the batterymodule in a dry, protected area with no excessive dust and sufficient air circulation.Do not operate in locations where the temperature and humidity are outside the specified range.

## 4.2 Mounting The PACK

WARNING!! Remember that this Pack is heavy so please be careful when removing it from the package,or install it .

When installing the Pack bracket, use appropriate screws to fix it. After that, the equipment should be firmly bolted.The pack can be run indoors or o utdoors. However, only professional personnel can enter this area for installation or maintenance.

- Step1:

When receiving the product, first check whether all parts are complete, if not, please report to the Dealer .

- Step2:

Ensure thatthe Packis installedon the Rack.Chooseasuitableinstallationlocationandrequire the battery pack to be placed at a safe.
The first load-bearing plate should be at least 15cm away from the ground. The distance between the load-bearing plates is about 205mm.
We recommend that the installation distance be 205mm.

- Step3:

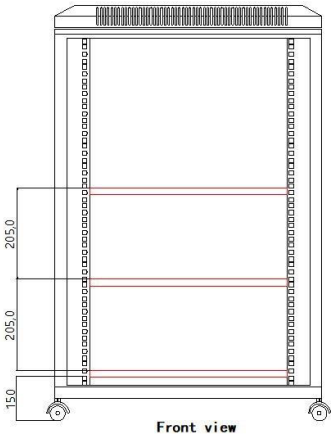



Figure4.

Mark the position of the nut on the cabinet with the mounting bracket, and clamp the nut into the cabinet. See Figure5.

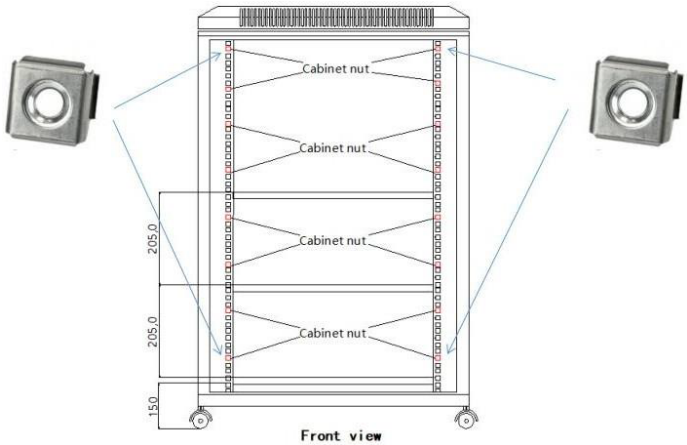
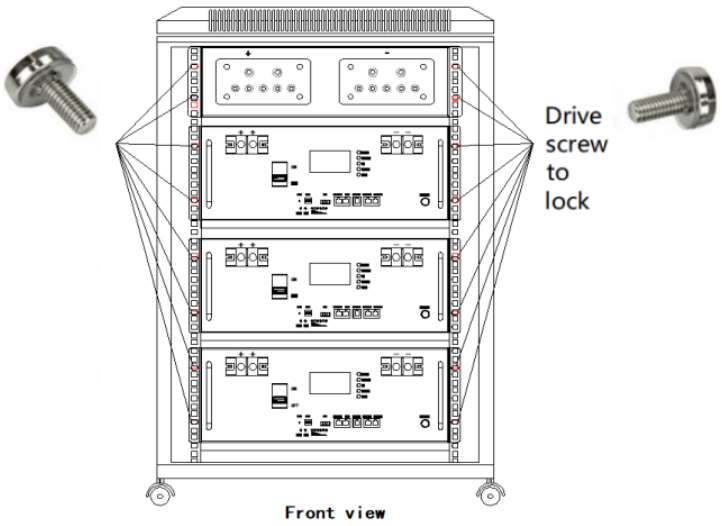



Figure 5

- Step4:

As shown in the below, install the battery pack.The pack is too heavy , Please use a special lifting device to lift the pack for operation and safety protection.Put the battery module into the cabinet and screw it, as shown in Figure 6.




- Step5:

When more than 3 PCS packs are connected in parallel ,then we recommend you install combiner box. 4 locations we recommend you install the combiner box.First select location is Top and Bottom ,see Figure7.

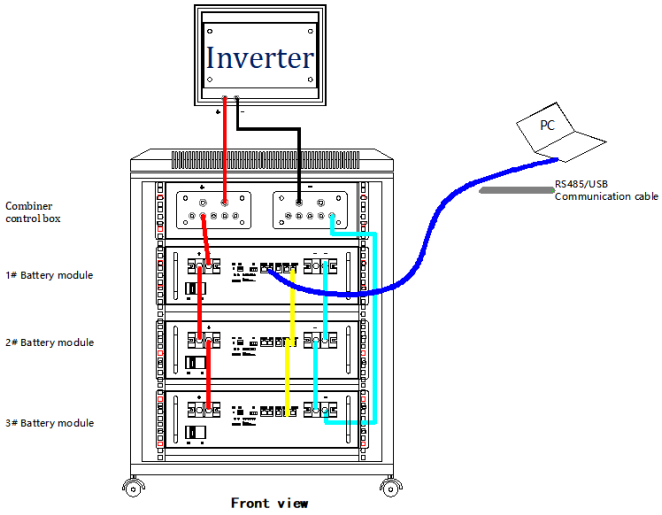
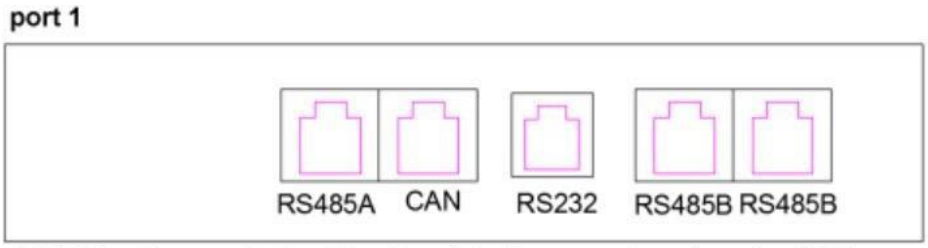



Figure 7

- Step6:

Connect the wiring of the Pack as shown below.see figure 11.If inverter need CAN BUS port /RS485 port.please insert communication cable (RJ45) to CAN port or RS485A,RS485B only be used for battery packs parallel mode.




RS485A---Communicate with external devices,sample as inverter ,EPS
CAN
RS232----Communication with host computer
RS485B---Communication with host computer or parallel communication with battery pack

Figure 8

1 pack---1 Inverter. Single mode .

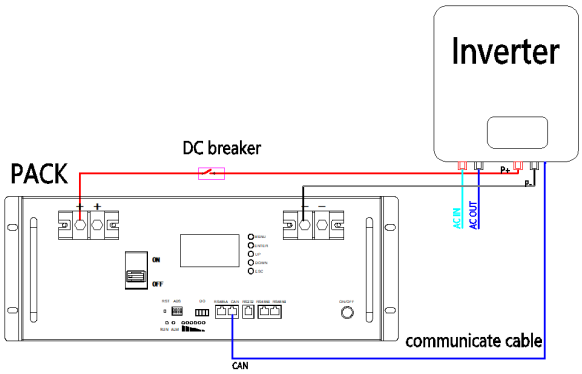



Figure10

2 pack---1Inverter. Pack1 is slave; pack2 is master;Negative and Positive power cable has the same length.Figure11

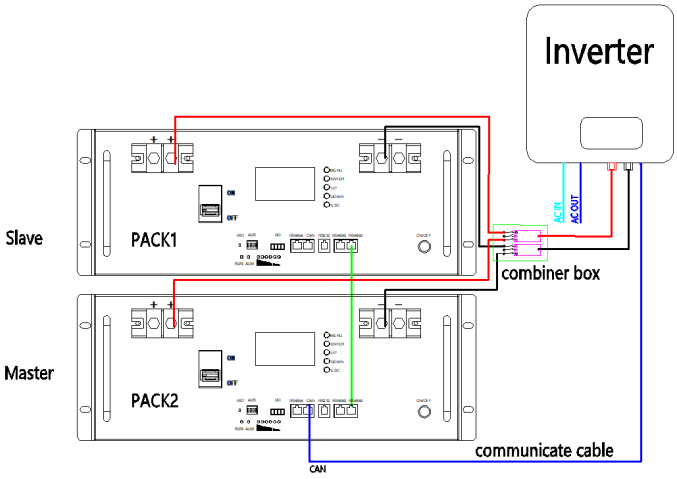



Figure11

3 pack---1Inverter. Pack1 ,2 is slave; pack3 is master.morepackare parallel,one pack is master,other are slave.Negative and Positive power cable has the same. Figure12.

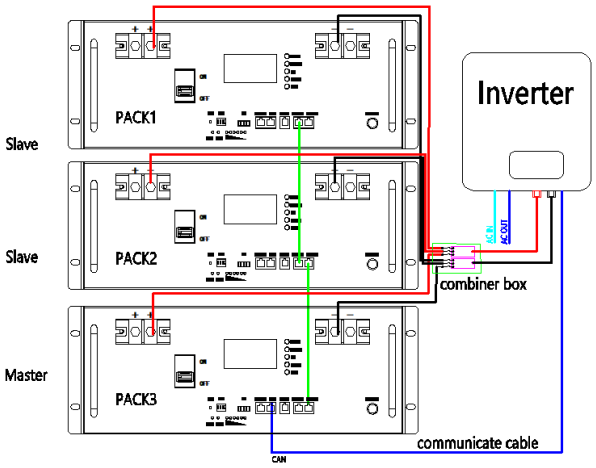
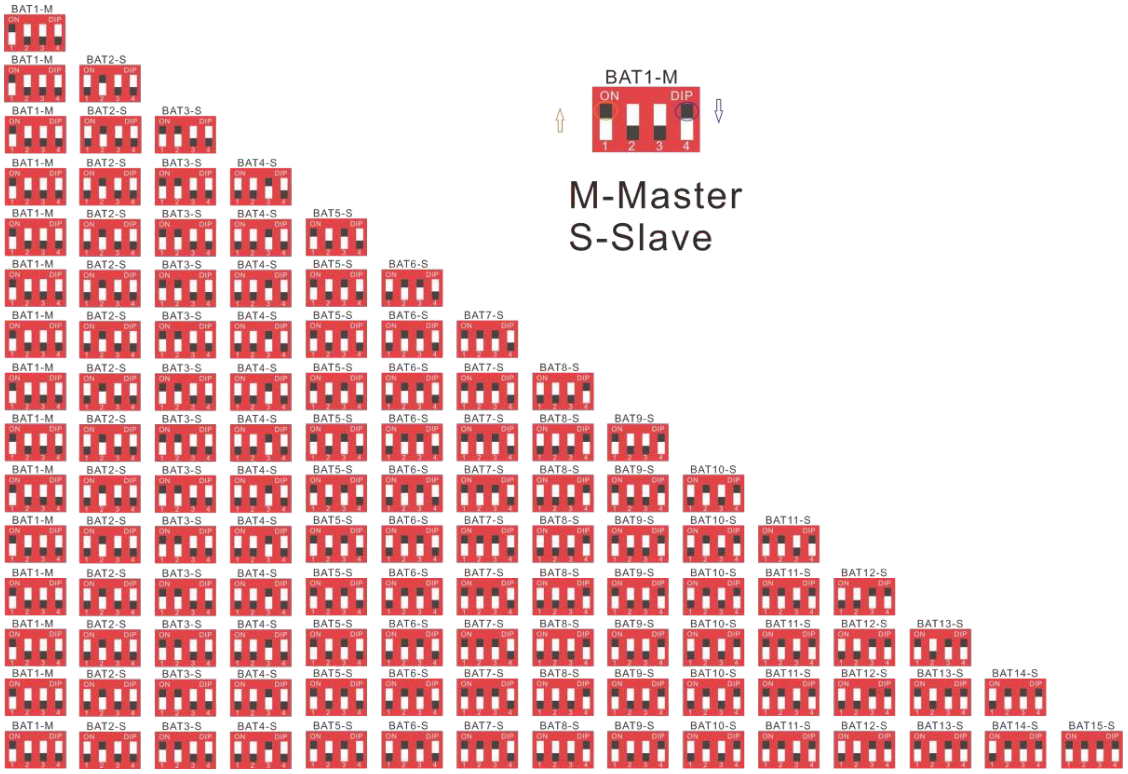



Figure12

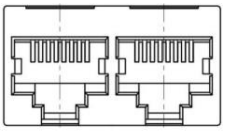
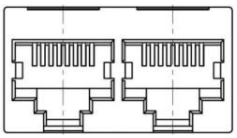
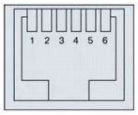
- Step7:

Set the address of pack.this a important step,you can see there is 4bit or 8bit coder in bottom of Pack.please set as bill 1 and 2.

4 bit CODER: this is Binary CODER,Calculated by 8 4 2 1 BCD code.PACK 1 set as Master(BCD 1 0 0 0),see bill1.It support 15 PCS pack(max) in parallel.Address "0" is only used for single mode.



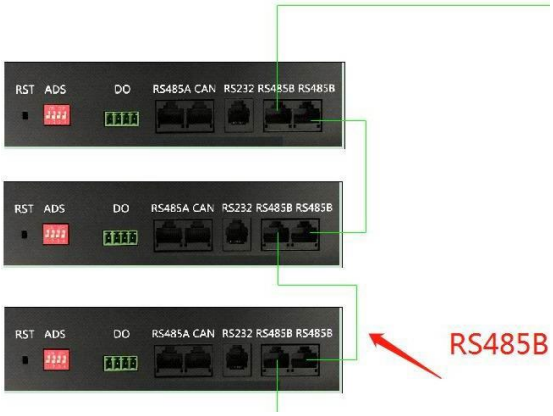

this is 4bits coder and communication port.CAN port and RS485A port can be selected as the same time.


| | | | | | |
|---|---|---|---|---|---|
| Parallel communication |  | RS485B-8P8C | | RS485B-8P8C | |
| | | RJ45 | | RJ45 | |
| | | 1,8 | RS485-B | 9,16 | RS485-B |
| | | 2,7 | RS485-A | 10,15 | RS485-A |
| | | 3,6 | GND | 11,14 | GND |
| | | 4,5 | NC | 12,13 | NC |
| External communication |  | RS485A port | | CAN port | |
| | | RJ45 | | RJ45 | |
| | | 1,8 | RS485-B1 | 9,10,11,14,16 | |
| | | 2,7 | RS485-A1 | 12 | CAN-L |
| | | 3,6 | GND | 13 | CAN-H |
| | | 4,5 | NC | 15 | GND |
| Communication with host computer |  | RS232 RJ11 | | | |
| | | RJ11 | | RJ11 | |
| | | 1 | NC | 4 | RX |
| | | 2 | NC | 5 | GND |
| | | 3 | TX | 6 | NC |

NOTE:The output connected to the communication cable with a waterproof plug is listed according to the order requirements, which are customized products, and are not listed here.

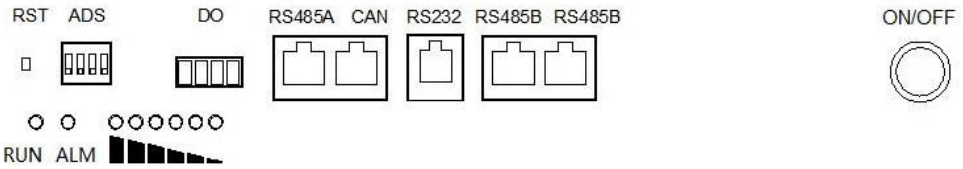
- Step8:

Connect the parallel communication cable (yellow network line).Any Pack has 2 PCS RS485B port for parallel communication, 1 PCS RS485A and 1PCS CAN port for invert er or other device.RS232 port only used for host software and update the firmware.




- Step9:

Start and stop battery pack.Confirm that the operation is correct, and the battery function can be turned on after the wiring is correct ,and You can press down power switch(ON/OFF) 3 second for start battery pack,then turn on switch in the combiner box , the battery start working and output ,it enter standby mode(if there is no power switch,please use a little pole and press down the RESET key 3-6second,likeas follow picture,LED indicate all running status and check it's self).




Note: You need to turn on the low side switch first(Discharge negative); then turn on high side (Discharge positive),if any of pack has mistake or alarm,you'd turn off the switch which connect to this pack,check and reset the pack ,then turn on switch again.Turn off the pack ,you must turn off the high side switch,then turn off low side switch.

- Step10:

Running the device, set the external charger or inverter parameters, please set according to the corresponding operation manual.Can not exceed the rated parameter requirements .

## 4.3 Battery Pack parameters:

| No | Item | General Parameter | |
|---|---|---|---|
| 1 | Combination method | 48V | 51.2V |
| 2 | Rated Capacity(Ah)(typical) | 100/200 | 100/200 |
| 3 | Factory Voltage(V) | 48-50V | 51-53V |
| 4 | Rate power(Wh) | 4800/9600 | 5120/10240 |
| 5 | Charging Voltage(V) recommend/max | 54/54.6V | 57/57.6V |
| 6 | Max Charging Current(A) | 1C/0.5C | 1C/0.5C |
| 7 | Float charge Voltage(V) | 53.5V | 55.5V |

| | | | |
|---|---|---|---|
| 8 | Discharge Cut-off Voltage(V) | <=41V | <=44V |
| 9 | Max Discharging current(A) | 1C/0.5C | |
| 10 | Charging Current limits(A) | 10A | |
| 11 | Charge over Current protect(A) | 100A | |
| 12 | Discharge over Current protect(A) | 100A | |
| 13 | Internal Impedance | ≤100mΩ | |
| 14 | Communication protocol | CAN/485 | CAN/485 |
| 15 | Host software and Communication protocol | RS232/485 | RS232/485 |
| 16 | Operation Temperature Range | Charge:0~55°C | |
| | | Discharge:-20~55°C | |
| 17 | Storage Temperature Range(recommend) | 0°C~25°C | |
| 18 | Combination method | 48V | 51.2V |
| 19 | Rated Capacity(Ah)*Parallel | PACK*Parallel | PACK*Parallel |
| 20 | Factory Voltage(V) | 48-50V | 51-53V |
| 21 | Charging Voltage(V)recommend/max | 54/54.6V | 57/57.6V |
| 22 | Max ChargingCurrent(A | 1C/0.5C | 1C/0.5C |
| 23 | Float charge Voltage(V) | 53.5V | 55.5V |
| 24 | Discharge Cut-off Voltage(V) | <=41V | <=44V |
| 25 | Max Discharging current(A) | 100A*Parallel | |
| 26 | Charging Current limits(A) | 10A*Parallel | |
| 27 | Charge over Current protect(A) | 100A*Parallel | |
| 28 | Discharge over Current protect(A) Adjustable | 100A*Parallel | |
| 29 | Internal Impedance | ≤100mΩ | ≤100mΩ |
| 30 | Communication protocol | CAN/485 | CAN/485 |
| 31 | Host software and Communicationprotocol | RS232/485 | RS232/485 |
| 32 | Operation Temperature Range | Charge:0~55°C | |
| | | Discharge:-20~55°C | |
| 33 | Storage Temperature Range(recommend) | 0°C~25°C | |

- Step11:

Monitor all running status,and record all parameters,if there has any mistake,please record it .After start the system,every pack is on ,and led indicate these status.

- Step12:

Stop running battery pack.

When it is necessary to stop the charging and discharging of the battery or troubleshooting, please stop the external equipment first, cut off the input and output circuits, and then press the power switch off each battery pack.

# Appendix 1

## SOC Indicator & Status Indicator Guides

Chart 1: Battery Status

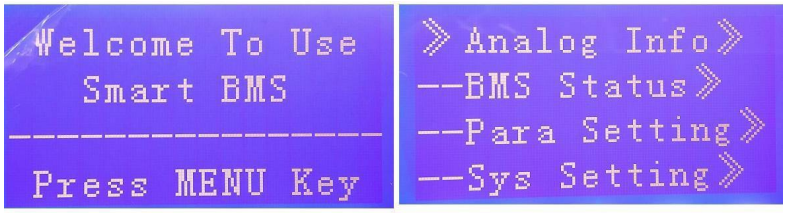
| Status | Normal/ Warning/ Protection | RUN | ALM | Capacity LED | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ● | ● | ● | ● | ● | ● | ● | ● | |
| Shut Down | Shut down | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | All OFF |
| Standby | Normal | Flash | OFF | OFF | OFF | OFF | OFF | OFF | OFF | Standby |
| Charge | Normal | ON | OFF | Based on capacity | | | | | | |
| | Warning | ON | Flash | | | | | | | |
| | Protection | ON | ON | | | | | | | |
| Discharge | Normal | ON | OFF | Based on capacity | | | | | | |
| | Warning | ON | Flash | | | | | | | |
| | Protection | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | UVP,OCP... |
| Fault | Protection | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | Stop charging or discharging |

Chart2: LCD screen display.

1. Display rendering

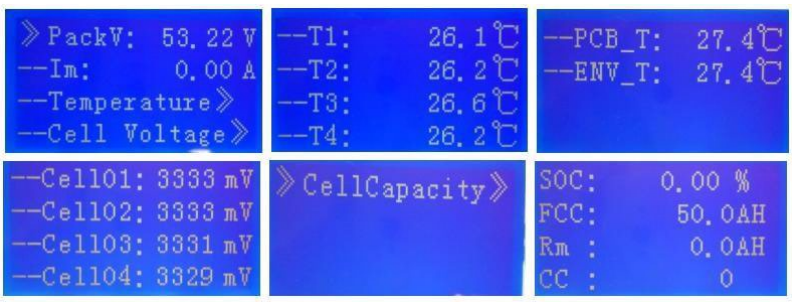

2. Main menu page

After BMS is activated, will show the welcome screen, press the "MENU" button to enter the main menu page. As shown in the figure below：

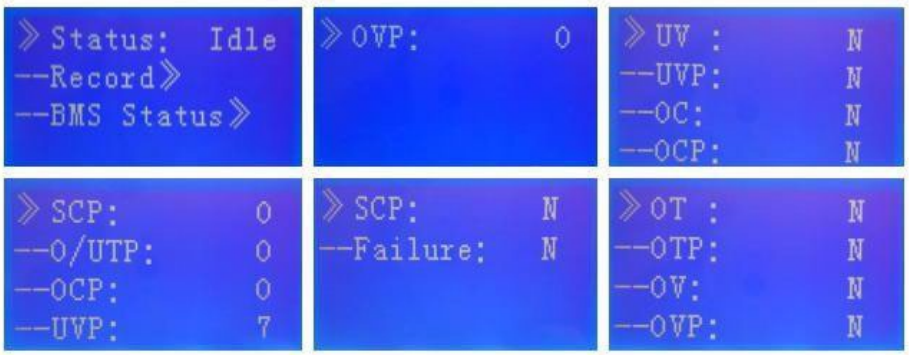



3. Battery parameters page

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



When the cursor "》"is point to"BatteryStatus", press "ENTER" key will enter the page of "Battery Status", As shown in the figure below:




4. Parameter Settings

Screen can not set parameters Baud Rate : 9600 ,Can not be set.


5. Key description

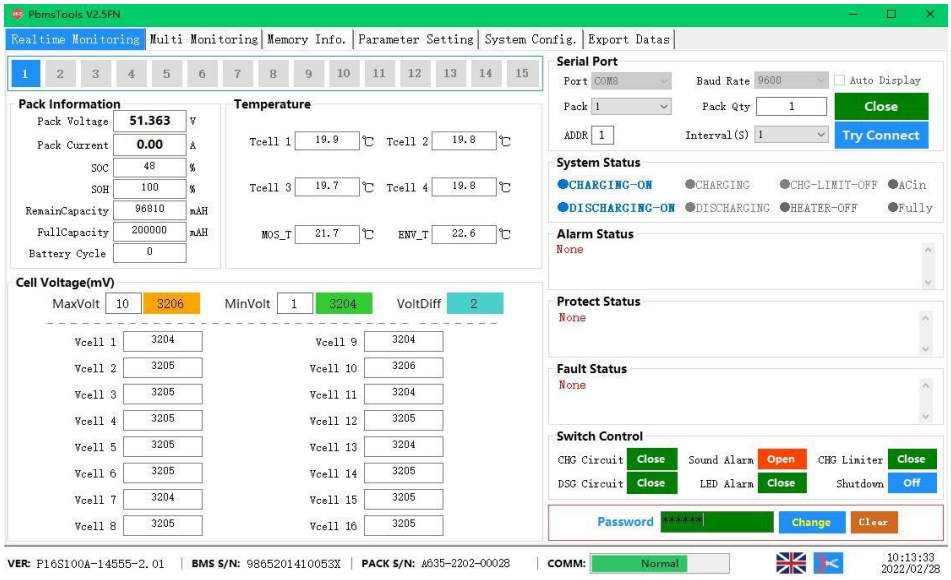
- SW1----MENU, SW2----ENTER, SW3----UP, SW4----DOWN, SW5----ESC.
- Eachitem is "》"or"--"asa beginning, among them"》"showsthe current cursor position, press "UP" or "DOWN" key canmove the cursor position; with"》"end of the project, the contentof the saidprojecthas not shown, press "ENTER" key can enter the corresponding page.
- Press "ESC" key can be returned at the next higher level directory; In any position, press" MENU" key can return to the main menu page.
- When BMS inter sleep mode, press any key, can activate the screen.
- Inter standby mode, with no keystrokes1 minutes later,LCD will enter Shutdownmode press anykey,screen can beactivated.

# Appendix 2

- A host soft operation:

When the equipment manufacturer confirms that it is necessary, it can authorize to provide the customer with the host software and operating instructions.


- B Host soft operation:




# Appendix 3

## Troubleshootin

1 battery pack stop work.
A:turn on switch,be sure it is ON;if battery is low SOC.it need to charging in.
B:Battery pack low volt or enter sleep mode,there you will press down “RST” button3-6 second,or charging in.


2 No communication A :Check whether if communication cable is OK,check RJ45 PIN , CAN :PIN4:CANH,485A-A, PIN5:CANL;485-B
RS485A:PIN2:485A-A,
PIN1:485A-B;
B: Replace the communication line.Please give feedback to the dealer and exchange it.
C:Check inverter or other device which connect to BMS,update it is firmware.
D:If the communication function needs to be upgraded, please consult the agent or manufacturer.

E: confirm your inverter and battery protocol is correct,Different protocol or different connection will make a mistake.

3 Battery pack report SOC is mistake.
A:Inverter received Data from Master BMS ,but it is SOC <total SOC,sample as :9PCS packs has 1800Ah,but inverter read DATA is 1600Ah.So you may check any one is disconnected.check RS485B communication cable(yellow),RS485 communication cable ,replace the cable which is broken.RJ45 PIN:
CAN :PIN4:CANH,
PIN5:CANL; RS485A:PIN2:485-A,
PIN1:485-B;

B:SOC DATA has Large tolerance.
Discharge empty the battery first, then charge it fully with a small current, and learn to discharge. Any pack is mistake ,we advice you read the BMS Data(When we authorize the terminal to use) with host software.then we reset the BMS and calibration.

C:When multiple batteries are connected in parallel, the SOC is different.
We recommend that each pack has a small current discharged and it is emptied until the SOC alarm appears, and then recharged in parallel and fully charged.

4 How to turn on the Pack to discharge. we recommend method is :
A: reset the single pack's BMS,LED will flash and start work B:turn on the power switch on the bottom/front panel;
C:turn on power switch in the combiner box .

⚠ WARNING: The operating parameters of the equipment cannot exceed the rated working voltage and current of the Pack, exceed the rated volt and current,Can cause damage to the Pack or other failures.

5 Inverter or other external device can not connect the battery. we recommend method is :
A:Check whether the working parameters of the device and battery are appropriate, and improper parameters cannot be matched.
B:When the device is turned on, the current is too large, resulting in battery protection. At this time, you should be able to see the LED flashing from the battery panel.in this case,You can adjust your equipment parameters or contact the dealer to solve.
C:it is necessary to update BMS parameters and match the device,then Reset BMS and restart your device.

6 Replace bad Pack.
There is a bad battery pack ,it is need to replace ,please connect your supplier, need professional installers to operate it .We recommend replace all or make pack has same voltage and same specification batteries pack.

NOTE:When replacing the battery, the same module needs to be replaced at the same time, and the voltage should be the same.

7 Need to replace spare parts or emergency maintenance.
Some parts can be obtained from the sales or agency, and the excess parts need to be purchased separately.
Be careful, turn off the power switch before replacing parts.

8 Need to place some safety device for keep a safe environment.
You'd keep a safe case for Pack and external device,Please place safety device , as :fire-fighting sand, fire- fighting blankets, fire-fighting water pipes ,Install Monitor sound, light, electricity, smoke and other equipment.

# WARNING:

Emergency process:
1.The external device catches fire and explodes:
A: Under the condition of ensuring safety, non-operating personnel immediately move to a safe location;
B: Under the condition of ensuring safety, the operator immediately cut off the external power supply of the equipment and the internal power supply.
C:Use fire-fighting equipment for fire-fighting treatment (the use of fire-fighting sand, fire-fighting blankets, fire- fighting water pipes)
D:If you cannot completely extinguish the fire, please call the local fire department for help. E:Keep the accident site data so that the source of the accident can be traced.

2.The Pack catches fir and explodes:
A: Under the condition of ensuring safety, non-operating personnel immediately move to a safe location;
B: Under the condition of ensuring safety, the operator immediately cut off the external power supply of the equipment and the internal power supply.
C:Use fire-fighting equipment for fire-fighting treatment (first the use of fire-fighting sand, fire-fighting blankets, then fire-fighting water pipes for cool the Pack)
D:If you cannot completely extinguish the fire, please call the local fire department for help. E:Keep the accident site data so that the source of the accident can be traced.

# Product Responsibilities and Consulting

We will not be liable for the accidents resulting from operation breaking this specification and user manual.

- 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.
- The shelf life of this product is within 36 months after it is delivered; 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.

In case of any questions, please contact us.

THANK YOU FOR CHOOSING
LET'S DEVELOP TRUST AND BUSINESS