

Spring series LFP Battery

Version: 1.0



User Manual










Spring series LFP Battery SE-G5.1 Pro-B

Read and follow these instructions!

The following precautions are intended to ensure your safety and prevent property damage.

Before installing this product, be sure to read all safety instructions in this document for proper installation.

	⚠ DANGER Failure to comply with the instructions with this symbol may result in a serious accident, causing death or a severe injury.
	⚠ WARNING Failure to comply with the instructions with this symbol may result in a serious accident, causing a severe injury.
	⚠ CAUTION Failure to comply with the instructions with this symbol may result in minor or moderate injury.
	NOTICE Provides information considered important but not hazard-related. The information relates to property damage.
	Read instruction before use
	Risk of electric shock
	Operate as specified by the manual

This product is designed to an integrated system, which must be performed by a qualified person trained in electrical engineering and familiar with the characteristics and safety requirements of lithium batteries. Do not use this product if you are unsure if you possess the necessary skills to complete this integration.

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1. Precautions

1.1 General Safety Precautions

The product provides a safe source of electrical energy when operated as intended and as designed. Potentially hazardous circumstances such as excessive heat or electrolyte mist may occur under improper operating conditions, damage, misuse and/or abuse. The following safety precautions and the warning messages described in this part must be observed.

If any of the following precautions are not fully understood, or if you have any questions, contact us for guidance.

Risks of explosion

- Do not subject the battery to strong impacts.
- Do not crush or puncture the battery.
- Do not dispose of the battery in a fire.

Risks of fire

- Do not expose the battery to temperatures in excess of 60 °C.
- Do not place the battery near a heat source such as a fireplace.
- Do not expose the battery to direct sunlight.
- Do not allow the battery connectors to touch conductive objects such as wires.

Risks of electric shock

- Do not disassemble the battery.
- Do not touch the battery with wet hands.
- Do not expose the battery to moisture or liquids.
- Keep the battery away from children and animals.


Risks of damage to the battery

- Do not allow the battery to encounter liquids.
- Do not subject the battery to high pressures.

1.2 Installation Precautions

Please be aware that a battery presents a risk of electrical shock including high short-circuit current. Follow all safety precautions while operating the batteries.

- Remove watches, rings, and other metallic accessories.
- Use tools with insulated handles in order to avoid inadvertent short circuits.
- Wear rubber gloves and safety boots.
- Do not put tools or any metal parts on the top of the batteries.
- Disconnect charging source and load before connecting or disconnecting terminals.
- When moving batteries and wear all appropriate safety clothing and equipment.
- Do not open or mutilate the batteries.

	CAUTION
	<ul style="list-style-type: none"> ▪ Verify polarity at all connections before energizing the system. Reverse polarity at the battery terminals will void the Warranty and destroy the batteries. Do not short circuit the batteries. ▪ Do not combine Lithium Batteries with other brands or chemistries; Do not mix Lithium Batteries from different installations, clients, or job sites. ▪ Do not disassemble or modify the battery. If the battery housing is damaged, do not touch exposed contents.

2. Product Introduction

51.2V series lithium iron phosphate battery system has been designed to provide power backup for remote or outside telecom plants like Access Terminals, Base Transceiver Stations, and Base Station Controllers. This system has the characteristics of high system integration, well reliability, long service life, and wide operating temperature range.

2.1 Front Panel Function Introduction

In order to operate the product correctly, please carefully view the function of the front panel of the battery.

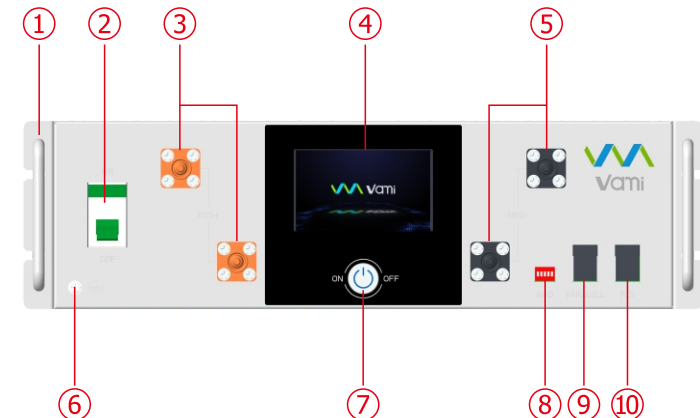


Figure 2-1: Front Panel Function Introduction

- | | |
|----------------------|------------------|
| 1. Handle | 6. Earth Wire |
| 2. Breaker | 7. Switch |
| 3. Battery Negative+ | 8. DIP Switch |
| 4. Display Screen | 9. Parallel Port |
| 5. Battery Negative- | 10. PCS Port |

2.2 Product Specifications

Table 2-1: Product Specifications


Main Parameter		SE-G5.1 Pro-B
Battery Chemistry		LiFePO4
Capacity (Ah)		100
Scalability		Max. 64 pcs pack (327kWh) in parallel (Max. 32 pcs no external setup)
Nominal Voltage (V)		51.2
Operating Voltage(V)		43.2~57.6
Energy (kWh)		5.12
Usable Energy (kWh) ^[1]		4.61
Charge/Discharge Current (A)	Recommend ^[2]	50
	Max. ^[2]	100
	Peak(2mins,25°C)	150
Other Parameter		
Recommend Depth of Discharge		90%
Dimension (W/H/D, mm)		445*133*540
Weight Approximate(kg)		45
Master LED indicator	5LED(SOC:20%~100%)	
	3LED (working, alarming, protecting)	
IP Rating of enclosure		IP20
Working Temperature		Charge:0°C ~ 55°C Discharge:-20°C ~ 55°C
Storage Temperature		0°C ~ 35°C
Humidity		5%~95%
Altitude		≤2000m
Cycle Life		≥6000(25°C±2°C,0.5C/0.5C,90%DOD,70%EOL)
Installation		Wall-Mounted, Floor-Mounted, Rack-Mounted (19-inch standard cabinet, cabinet depth ≥600mm)
Communication Port		CAN2.0, RS485
Certification		UN38.3, IEC62619, CE,UKCA, VDE2510-50, FCC, UL1973, UL9540A, REACH, ROHS

[1] DC Usable Energy, test conditions: 90% DOD, 0.5C charge & discharge at 25°C. System usable energy may vary due to system configuration parameters.

[2] The current is affected by temperature and SOC.

3. Unpack the Battery







The battery and the related accessories are packed in the carton box. Use tools to open the packing box. After open the packing box, confirm the product components according to the parts list.

	⚠ WARNING
	Violent unpacking is strictly prohibited. If the battery system is found to be broken, deformed or other abnormal conditions, the user shall immediately stop using the battery and contact us.

3.1 Parts List

Check the parts during unpacking.

Table 3-1: Parts Lists

No.	Items	Appearance	Usage	Qty.	Remarks
1	Battery		Provide power	1	
2	3U-LBCable150		Pair of 150mm 4AWG Battery power cable(both ends have waterproof terminals) and one 250mm RJ45 communication cable for battery parallel.	1	
3	3U-LPCable1500		Pair of 4AWG DC power cable (one end has a waterproof terminal, the other end is M10 copper terminal) and one RJ45 communication cable connect with hybrid inverter. The default length is 1500mm.	1	
4	10AWG yellow-green ground line 300mm		Battery ground line	1	
5	M6*16 Cabinet bolt		Fix the battery on the rack or cabinet	4	
6	Battery Rack Fixed Ears and M4*8 bolt		Used for battery fixing with 19inch rack or cabinet	2 ears 6 bolts	









7	Simple stacking bracket		Used for battery stacking and securing	4pcs	
8	Wall bracket		Used for battery pack wall mounting	2	
9	M6 Expansion		Fixed Wall bracket	4	
10	User manual	/	/	1	

Table 3-2: Recommended Tools and Instruments

No.	Items	Usage	Appearance
1	Phillips Screwdriver or Bit	To fasten battery and assemblies	
2	Box Cutter	Opening boxes	
3	Insulated Torque Wrench	Installing cables and busbars	
4	Insulated Sockets	Installing cables and busbars	
5	Battery Tester	Measure battery module's voltage	





3.2 Visual Inspection of the Modules

After transporting the modules to the installation location, check for:

- Physical damage to the exterior
- Damaged or protruding screws

4. Battery Installation

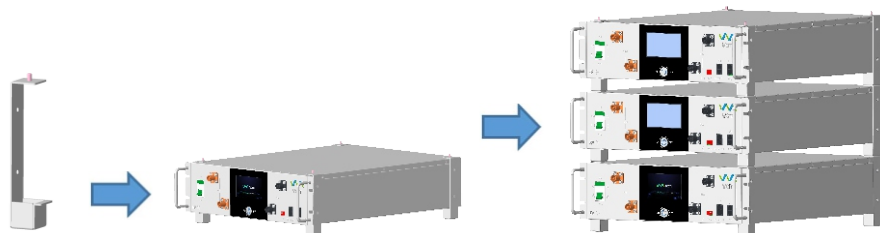
This system must be installed by qualified, trained workers familiar with the required instruments.

	⚠ WARNING
	<ul style="list-style-type: none"> ▪ Be sure to use insulated tools (torque wrench, extension, socket, etc.). ▪ All the instruments must be insulated and no metal articles (e.g., watch, ring) should be present in the installation area. ▪ All power switches must be turned off in advance. ▪ Prepare a CO₂ fire extinguisher, a first aid kit, and an AED (automated external defibrillator) before installation.
	⚠ WARNING
	<p>Arc Flash and Shock Hazard</p> <p>Insulated tools are required for any work on this energized equipment.</p>
	⚠ WARNING
	<p>Sharp Edges</p> <p>Wear gloves and other protective gear to prevent injury.</p>
	⚠ WARNING
	<p>Pinch Point</p> <p>Use caution when working in the enclosure to prevent injury.</p>
	⚠ CAUTION
	<p>Heavy Object</p> <p>Can cause muscle strain or back injury.</p> <p>Use lifting aids and proper lifting techniques when moving trays, batteries, and other heavy objects.</p>

4.1 Battery Module Installation

1. Transport battery modules to the installation location.
2. Place the battery modules on the bracket or rack or cabinet.
3. Fix the battery on the bracket or rack. Using the bracket or cabinet bolt to fix the battery into the bracket or rack.
4. After installation, tighten all bolts.

Installation method 1: With simple bracket installation



Use the 6 screws of M4*8 to fix the battery pack Fixed Ears the both sides battery, as show in Figure.



M4*8 screws

Use the 6 screws of M4*8 to fix the battery pack Fixed Ears the battery both end.

Note the allowable installation modes.



5. Cable Connection

5.1 Single Battery Connection

	<div>NOTICE</div> <ul style="list-style-type: none"> Before connect the cable with the inverter, the worker must confirm the output switch of the inverter has been turn off, to prevent the risk of fire or electric shock.
	<div>CAUTION</div> <ul style="list-style-type: none"> Before connection, make sure to close the battery. Please follow the instructions to protect the module BMS against damage. DO NOT deviate from the sequence of steps below. Exercise extreme caution prevent the terminals from contacting anything except their intended mounting points. Terminals and their connected wires have either positive or negative polarity (Positive: +; Negative: -). The polarity of a terminal or a wire connected to the terminal is on the front of each module. Exercise extreme caution to prevent the terminals and/or wires with opposite polarity from contacting with each other. The maximum voltage of the battery is no more than 60V, which is higher than the safe voltage of 36V. Therefore, we still recommend that the battery terminals or other exposed parts should not be directly touched during the
	<div>NOTICE</div> <ul style="list-style-type: none"> When tightening the screws, make sure they are at a straight angle from the battery module terminals to avoid damage to the nuts inside. Assemble the screws using a Phillips-head within the fastening torque of less than 8.0 Nm (81.5 kgf•cm).
	<div>IMPORTANT</div> <ul style="list-style-type: none"> The power terminals, such as "+," "-", of the module are covered with the protecting cover to guard against a short circuit (Shown in Figure 5-1). You must remove the insulation cover prior to connecting and reattach the insulation cover immediately after connecting.

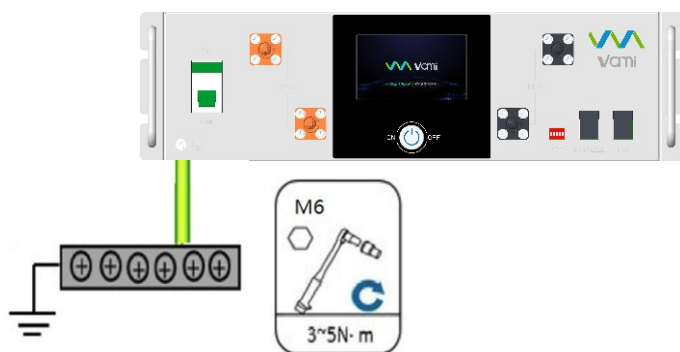


Figure 5-1: Install the Grounding Wire

Step 1 Wear the protective gloves.

Step 2 Install the battery ground cable.

Step 3 Install negative and positive power cables for the battery.

- 1) Remove the protective cover from the battery power wiring terminal.
- 2) Connect the negative power cable to the battery.
- 3) Connect the positive power cable to the battery.
- 4) Install the other end of the battery power cables at a battery route and the corresponding busbar in the power system.
- 5) Reinstall the protective cover on the battery power wiring terminals.

Connect the inverter:

- 1) Remove the protecting cover.
- 2) Take-down positive fixing bolt by the Phillips Screwdriver and connect the positive output cable between the battery positive terminal of the battery and the inverter. After connecting the battery, fastening bolt immediately to avoid dropping.

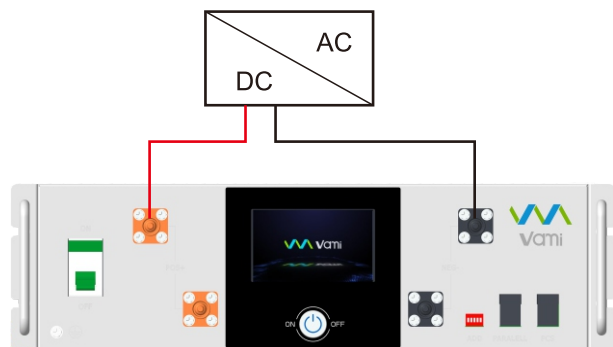


Figure 5-2: Single Battery Connection

- 3) Take-down negative fixing bolt by the Phillips Screwdriver and connect the negative output cable between the battery negative terminal of the battery and the inverter. After connecting the battery, fastening bolt immediately to avoid dropping.
- 4) Install the protecting cover.
- 5) Sort the cables and fasten the battery cables to the perforated bracket with cable ties.
- 6) Communication Line Connection

As shown in Figure 5-3, when monitoring the battery by the computer, connect the 'USB convert CAN Box communication line between battery and computer.

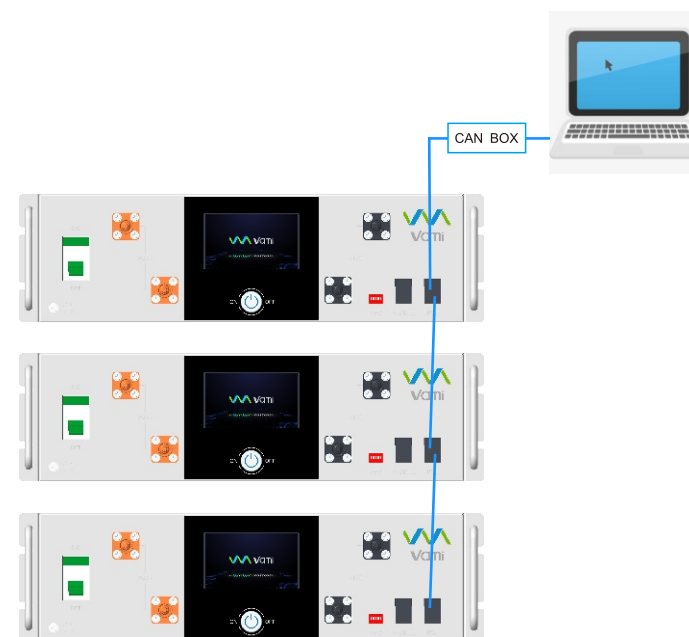


Figure 5-3: Communication Cable Connections between Battery and Computer

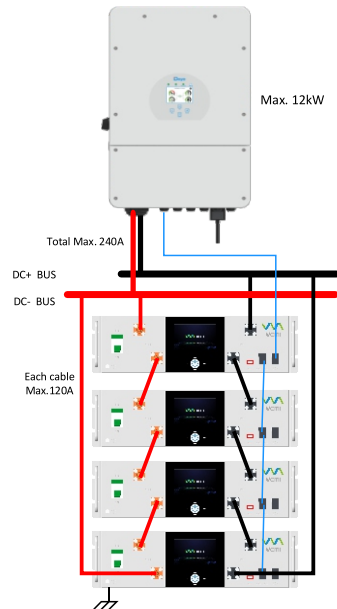
5.2 Connect Cables of the Multiple Batteries in Parallel

5.2.1. When multiple batteries in parallel, the cable connecting procedures are follows.

1. Parallel mode1 (4 batteries suitable for scenarios where the inverter power $\leq 12\text{kW}$)

For 4 batteries, it should be noted that the maximum current of **the first battery is 240A** (inverter power must not exceed 12kW), exceeding 240A will cause heating of the connectors and cable, and In severe cases, it will cause a fire accident.

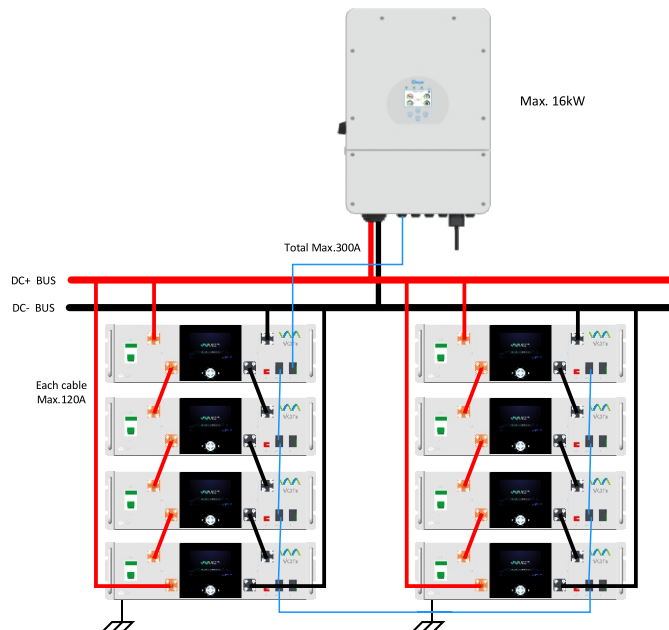
Schematic diagram of parallel connection of low-power system batteries:



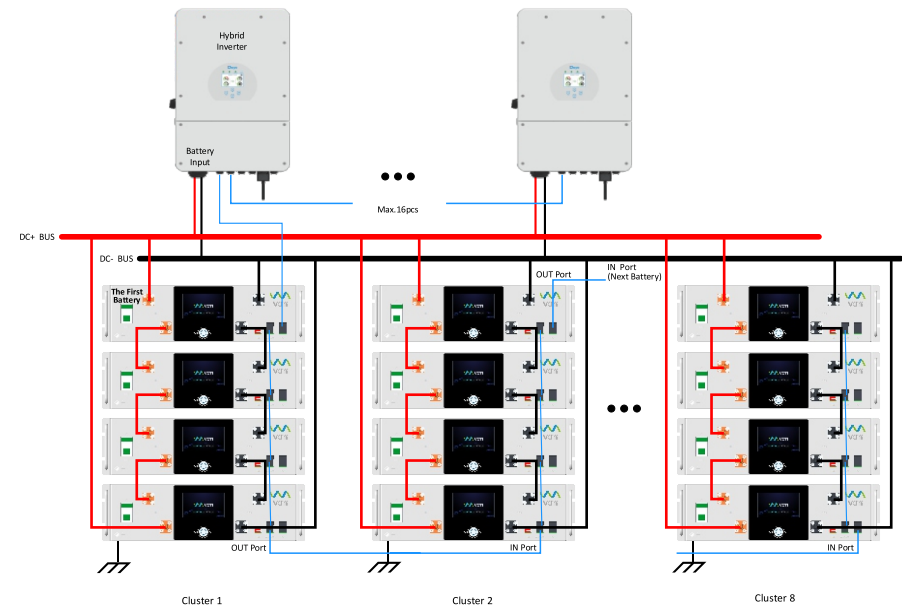
If the inverter power exceeds 12kW, the parallel mode must be used mode 2!

2. Parallel mode2 (It is suitable for scenarios where the inverter power > 12kW)

Schematic diagram of parallel connection of high-power system batteries:



Or larger capacity systems:



5.2.2. As shown in 5.2.1, connect the communication line (a standard RJ45 network cable) between the adjacent batteries.

Note: The **PCS Port** of the first battery must be connected to the inverter's battery communication interface, otherwise the inverter cannot communicate with the batteries.

Note: The **OUT Port** of the first battery is connected to the **IN Port** of the next battery, and so on, connecting the communication of multiple batteries together, otherwise multiple batteries will not be able to communicate correctly.

5.2.3. Connect the communication line between battery and inverter

(1) PCS Port Definition

Definition of PCS Port Pin

No.	PCS Port Pin
1	485-B
2	485-A
3	-
4	CANH
5	CANL
6	-
7	485-A
8	485-B



(2) IN Port Definition

Definition of IN Port Pin

No.	PCS Port Pin
1	CANL
2	CANH
3	DI+
4	DI-
5	DI-
6	DI+
7	CANH
8	CANL



(3) OUT Port Definition

Definition of Out Port Pin

No.	Out Port Pin
1	CANL
2	CANH
3	DO+
4	DO-
5	DO-
6	DO+
7	CANH
8	CANL



5.3 Visual Inspection of the Connection

After connecting the battery, check for:

- Usage of positive and negative cables.
- Connection of the positive and negative terminals.
- All the bolts are tightened.
- Cables fixation and the appearance.
- The communication cable is connected correctly.
- The installation of the protecting cover.

6. Activate the Product

6.1 Start the Battery

- Hang the battery on the wall as shown on 4.1.
- In accordance with the connection stated in Part 5.
- Close the Air Switch first, and then turn on the Power Button to prevent battery short-circuit protection failure caused by the pre-charge function.

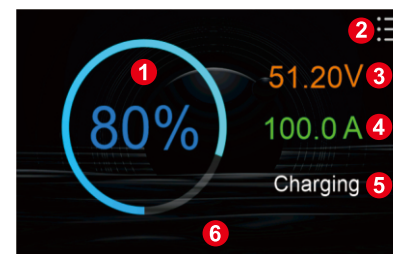
Start the Battery:

After installation, wiring, and configuration are completed, you must check all the connection. When the connections are correctly, and then press power button to activate the battery. There is no indicator, you need to determine according to the LCD display.

7. LCD Display

7.1 Main Screen

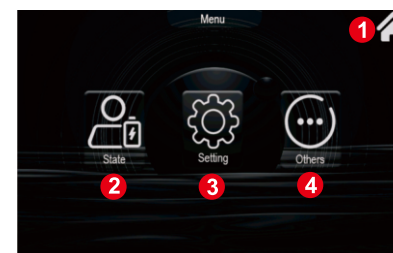
The LCD is touchscreen, below screen shows the overall information of the battery. Swipe to return to the system menu interface.



- | | |
|-------------------------|---|
| 1. Battery SOC | 4. Battery current |
| 2. Go to Menu page | 5. Battery charging or discharging status |
| 3. Battery pack voltage | 6. Error message |

7.2 System Menu

This page shows you the selections of Battery state, Setting and Others. It displays battery state, Setting items and others.



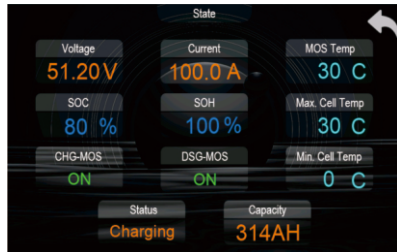
- | | |
|-----------------------------|-----------------------|
| 1. Return to Main page | 3. Go to Setting page |
| 2. Go to Battery State page | 4. Go to Others page |

NOTE:

- 1). Swipe left to return to Main page
- 2). Swipe right to enter the Parallel Data page

7.3 Battery State

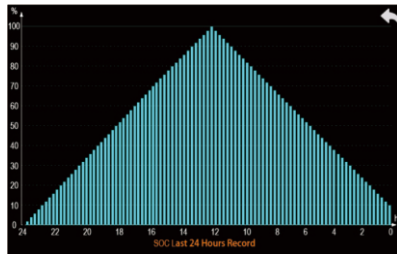
This page displays battery pack voltage, current, soc/soh, temperature, mos state and battery capacity.



- 1).Swipe left to return to the System Menu interface
- 2).Swipe right to enter the SOC Curve page

7.4 SOC Curve

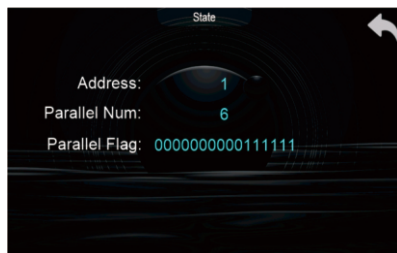
This page shows you the SOC record of last 24 hours.



- 1).Swipe left to return to the Battery Status page
- 2).Swipe right to enter the Parallel Data page

7.5 Parallel Data

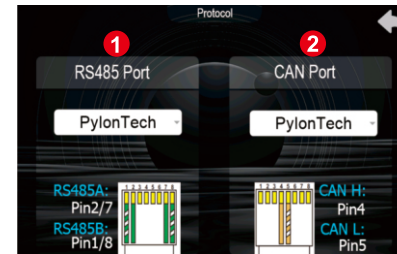
This page shows you the detail of parallel system including local address and parallel status.



- 1).Swipe left to return to the SOC Curve page
- 2).Swipe right to enter the Battery Status page

7.6 Protocol

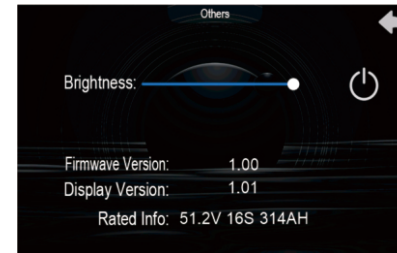
This page shows you the protocol of RS485 port and CAN port. Swipe to return to the system menu interface.



- 1.The protocol setting of RS485 port
- 2.The protocol setting of CAN port

7.7 Others Menu

This page shows you the operation of LCD brightness, firmware version and rated information of battery pack. Swipe to return to the system menu interface.



8. Inspection, Cleaning and Maintenance

8.1 General information

- The battery product is not fully charged. It is recommended that the installation be completed within 3 months after arrival;
- During the maintenance process, do not re-install the battery in the battery product. Otherwise, the performance of the battery will be reduced;
- It is forbidden to dismantle any battery in the battery product, and it is forbidden to dissect the battery;
- After the battery product is over-discharged, it is recommended to charge the battery within 48 hours. The battery product can also be charged in parallel. After the battery product is connected in parallel, the charger only needs to connect the output port of any product battery.
- Never attempt to open or dismantle the battery! The inside of the battery does not contain serviceable parts.
- Disconnect the Li-Ion battery from all loads and charging devices before performing cleaning and maintenance activities
- Place the enclosed protective caps over the terminals before cleaning and maintenance activities to avoid the risk of contacting the terminals.

8.2 Inspection

- Inspect for loose and/or damaged wiring and contacts, cracks, deformations, leakage, or damage of any other kind. If damage to the battery is found, it must be replaced. Do not attempt to charge or use a damaged battery. Do not touch the liquid from a ruptured battery.
- Regularly check the battery's state of charge. Lithium Iron Phosphate batteries will slowly self-discharge when not in use or whilst in storage.
- Consider replacing the battery with a new one if you note either of the following conditions:
 - The battery run time drops below 70% of the original run time.
 - The battery charge time increases significantly.

8.3 Cleaning

If necessary, clean the Li-Ion battery with a soft, dry cloth. Never use liquids, solvents, or abrasives to clean the Li-Ion battery.

8.4 Maintenance

The Li-Ion battery is maintenance free. Charge the battery to approximately > 80% of its capacity at least once every year to preserve the battery's capacity.

8.5 Storage

- The battery product should be stored in a dry, cool, and cool environment;
- Generally, the maximum storage period at room temperature is 6 months. When the battery is stored over 6 months, it is recommended to check the battery voltage. If the voltage is higher than 51.2V, it can continue to store the battery. In addition, it is needed to check the voltage at least once a month until the voltage is lower than 51.2V. When the voltage of the battery is lower than 51.2V, it must be charged according to the charging strategy.
- The charging strategy is as follows: discharge the battery to the cutoff voltage with 0.2C₁₀A current, and then charge with 0.2C₁₀A current for about 3 hours. Keep the SOC of the battery at 40-70% when stored;
- When the battery product is stored, the source of ignition or high temperature should be avoided and it should be kept away from explosive and flammable areas.

9. Fault Code Table

When fault event happens, battery will cut off output, and the LCD displays the fault code.

Fault Code	Fault information	Trouble shooting
E01	Battery Over Voltage	The battery voltage is abnormally high, Please stop charging , restart the battery, if the error happens again,contact after-sales service.
E02	Battery Low Voltage	The battery voltage is abnormally low,please charging.
E03	Over Charge Current	The charge current is too large. Reduce the charge current, if the error happens again,contact after-sales service.
E04	Over Discharge Current	The discharge current is too large. Reduce the load power, if the error happens again,contact after-sales service.
E05	Cell Over Voltage	The cell voltage is abnormally high, Please stop charging , restart the battery, if the error happens again,contact after-sales service.
E06	Cell Low Voltage	The cell voltage is abnormally low,please charging.
E07	Cell Over Temperature	The cell temperature is abnormally high, Please stop charging , Let stand for 1 hour, if the error happens again,contact after-sales service.
E08	Cell Low Temperature	The cell temperature is abnormally low, if the ambient temperature is not below -20 °C, contact after-sales service.
E09	BMS Over Temperature	The BMS temperature is abnormally high, Please stop charging and discharging , Let stand for 1 hour, if the error happens again,contact after-sales service.
E10	BMS Low Temperature	The BMS temperature is abnormally low, if the ambient temperature is not below -20 °C, contact after-sales service.

E13	Parallel Commucation Fail	Communication failure, check parallel wiring and dip, restart the battery,if the error happens again, contact after-sales service.
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10. Battery recovery

Aluminum, copper, lithium, iron and other metal materials are recovered from discarded LiFePO₄ batteries by advanced hydrometallurgical process, and the comprehensive recovery efficiency can reach 80%. The specific process steps are as follows:

10.1 Recovery process and steps of cathode materials

Aluminum foil as collector is amphoteric metal. Firstly, it is dissolved in NaOH alkali solution to make aluminum enter the solution in the form of NaAlO₂. After filtration, the filtrate is neutralized with sulfuric acid solution and precipitated to obtain Al (OH)₃. When the pH value is above 9.0, most of the aluminum precipitates, and the obtained Al (OH)₃ can reach the level of chemical purity after analysis.

The filter residue is dissolved with sulfuric acid and hydrogen peroxide, so that lithium iron phosphate enters the solution in the form of Fe₂ (SO₄)₃ and Li₂SO₄, and is separated from carbon black and carbon coated on the surface of lithium iron phosphate. After filtration and separation, the pH value of the filtrate is adjusted with NaOH and ammonia water. First, iron is precipitated with Fe (OH)₃, and the remaining solution is precipitated with saturated Na₂CO₃ solution at 90 °C. Since FePO₄ is slightly dissolved in nitric acid, the filter residue is dissolved with nitric acid and hydrogen peroxide, which directly precipitates FePO₄, separates impurities such as carbon black from acid solution, leaches Fe (OH)₃ from filter residue respectively, and precipitates Li₂CO₃ with saturated Na₂CO₃ solution at 90 °C.

10.2 Recovery of anode materials

The recovery process of anode materials is relatively simple. After the separation of anode plates, the purity of copper can be more than 99%, which can be used for further refining electrolytic copper.

10.3 Recovery of diaphragm

The diaphragm material is mainly harmless, and has no recycling value.

10.4 List of recycling equipment

Automatic dismantling machine, pulverizes, wet gold pool, etc.

11. Transportation Requirements

The battery products should be transported after packaging and during the transportation process, severe vibration, impact, or extrusion should be prevented to prevent sun and rain. It can be transported using vehicles such as cars, trains, and ships.

Always check all applicable local, national, and international regulations before transporting a Lithium Iron Phosphate battery.

Transporting an end-of-life, damaged, or recalled battery may, in certain cases, be specially limited or prohibited.

The transport of the Li-Ion battery falls under hazard class UN3480, class 9. For transport over water, air and land, the battery falls within packaging group PI965 Section I.

Use Class 9 Miscellaneous Dangerous Goods and UN Identification labels for transportation of lithium-ion batteries which are assigned Class 9. Refer to relevant transportation documents.

Lithium batteries and lithium-ion cells are regulated in the U.S. in accordance with Part 49 of the Code of Federal Regulations, (49 CFR Sections 105-180) of the U.S. Hazardous Materials Regulations.



Figure 10-1: Class 9 Miscellaneous Dangerous Goods and UN Identification Label