



# User Manual

## Home Energy Storage LFP Battery



Power generation data  
monitoring platform and APP



PT-ESS-W5120  
5.12kWh



PT-ESS-W10240  
10.24kWh



PT-ESS-W14400  
14.4 kWh

**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.

	<p><b>⚠ DANGER</b></p> <p>Failure to comply with the instructions with this symbol may result in a serious accident, causing death or a severe injury.</p>
	<p><b>⚠ WARNING</b></p> <p>Failure to comply with the instructions with this symbol may result in a serious accident, causing a severe injury.</p>
	<p><b>⚠ CAUTION</b></p> <p>Failure to comply with the instructions with this symbol may result in minor or moderate injury.</p>
	<p><b>NOTICE</b></p> <p>Provides information considered important but not hazard-related. The information relates to property damage.</p>
	<p>Read instruction before use</p>
	<p>Risk of electric shock</p>
	<p>Operate as specified by the manual</p>
	<p>Do not reverse connect the positive and negative port</p>
	<p>Do not place at the children or pet touchable area</p>

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.

### Risks of fire

- Do not expose the battery 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.

	<p><b>⚠ CAUTION</b></p>
	<ul style="list-style-type: none"> <li>▪ 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.</li> <li>▪ Do not combine Lithium Batteries with other brands or chemistries; Do not mix Lithium Batteries from different installations, clients, or job sites.</li> <li>▪ Do not disassemble or modify the battery. If the battery housing is damaged, do not touch exposed contents.</li> <li>▪ The embedded BMS in the battery is designed for 48VDC system, please DO NOT connect battery in series. If the battery is stored for long time, it is required to charge every six months and the SOC should be no less than 90%.</li> </ul>

## 2. Product Introduction

51.2V series lithium iron phosphate battery system has been designed to provide power backup for home solar storage system.

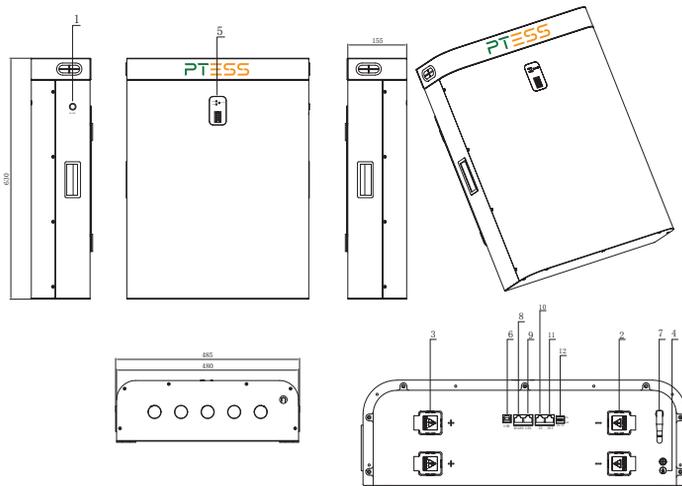
This system has the characteristics of high system integration, well reliability, long service life, and wide operating temperature range.

### 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.

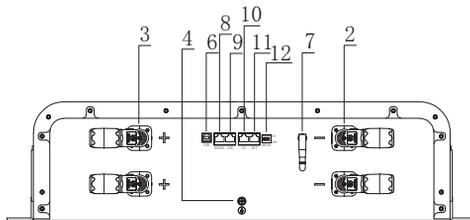
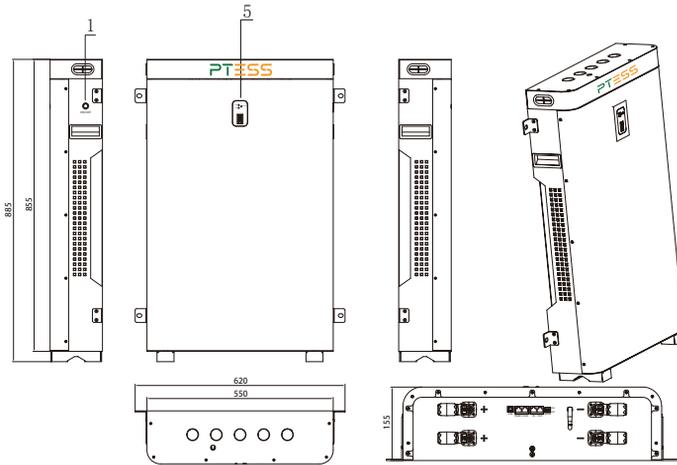
#### PT-ESS-W5120

Lithium Battery Module 5.12kWh



PT-ESS-10240

Lithium Battery Module 10.24kWh



PT-ESS-W14400

Lithium Battery Module 14.4kWh

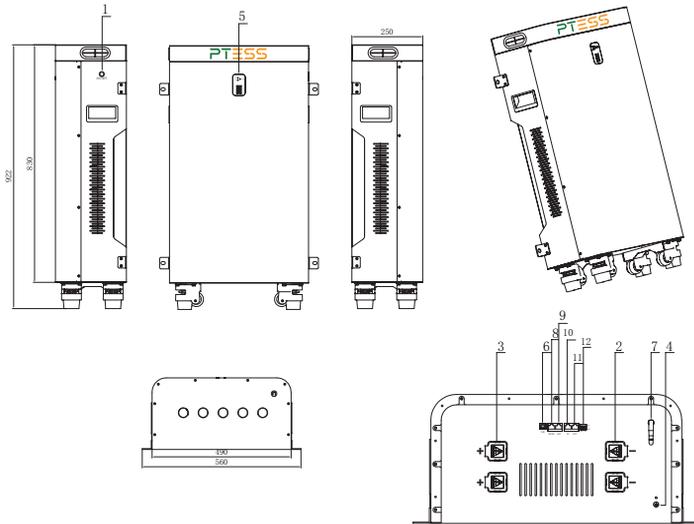


Figure 2-1: Front Panel Function Introduction

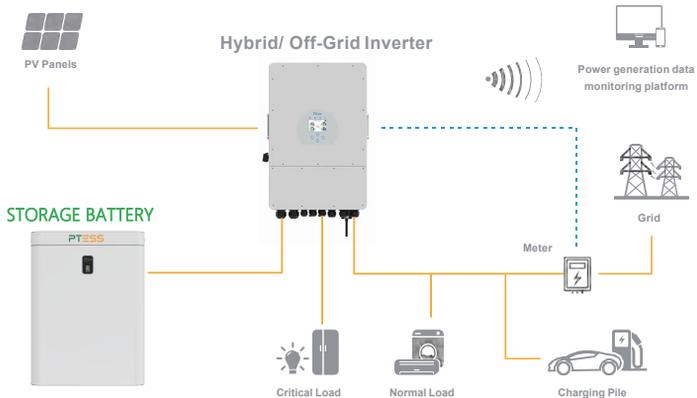
Item	Name	Definition
1	Power Switch	ON/OFF.must be in the“ON”state when battery in use
2	Positive Terminal	Battery output positive or parallel positive line
3	Negative Terminal	Battery output negative or parallel negative line
4	Ground terminal	Connect the ground cable
5	LED Indicator	Working Status of battery
6	USB	Communication port,battery connection to host computer
7	WIFI Sticker	View and monitor battery status information online
8	RS485	Inverter communication port, supports RS485 communication
9	CAN	Inverter communication port, supports CAN communication
10	CAN(IN)	Battery to battery CAN parallel communication in ports
11	CAN(OUT)	Battery to battery CAN parallel communication out ports
12	RES-SW	120Qm end-resistor for parallel CAN communication

## 2.2 Product Specifications

**Table 2-1: Product Specifications**

	PT-ESS-W5120	PT-ESS-W10240	PT-ESS-W14400
<b>BATTERY MODULE SPECIFICATION</b>			
Battery/Cell Type	LFP		
Nominal Voltage (Vdc)	51.2V	51.2V	51.2V
Nominal Capacity (Ah)	100Ah	200Ah	280Ah
Total Energy (Wh)	5120	10240	14400
Max. Charge and Discharge Current (A)	100	150	160/200
Recommend Charge and Discharge Current (A)	50	80	100
Recommend DOD	90%		
Operating Voltage Range (Vdc)	43.2-57.6		
Discharge Cut-off Voltage (V)	40		
Parallel	Up to 33 connected in parallel		
Calendar Life	20 years @25°C, 15 years @35°C, 10 years @45°C		
Cycle Life	≥6000 cycles at 90% DOD		
Warranty	5 years (designed lifetime 15 years)		
<b>COMMUNICATION</b>			
Display	SOC status indicator		
Communication	CAN(IN&OUT) between modules in Parallel, CAN bus/RS485 to inverter, USB to PC Monitoring		
WiFi Function	Wifi for APP and Platform Monitoring		
<b>STANDARD COMPLIANCE</b>			
Safety (Cell level)	UL1642 / IEC62619 / CE / ROHS / MSDS / UN38.3		
Safety (Module level)	IEC62619 / CE / ROHS / MSDS / UN38.3		
<b>MECHANICAL SPECIFICATIONS</b>			
Dimensions (W x H x D) (mm)	485*630*155	550*855*155	495*830*250
Weight (kgs)	50	95	120
Mounting	Wall mounted	Floor Standing	Floor Standing
Operating Temperature <sup>61</sup> Charge/Discharge (°C)	-20 to +55		
Storage Temperature (6 months between recharge) (°C)	-20 to +35		
Cooling Method	Natural convection		
Noise (at 1m distance) (dBA)	<25		

## Hybrid Solar System

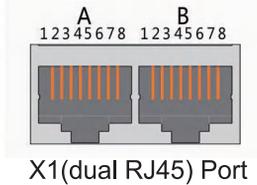


Pin Definition

2.3 CAN / RS485-1 Communication Interface Definition:

CAN port definition

PIN Out Config	
PIN 1	NC(empty)
PIN 2	NC(empty)
PIN 3	CGND
PIN 4	CAN1H
PIN 5	CAN1L
PIN 6	CGND
PIN 7	NC(empty)
PIN 8	NC(empty)



RS485 port definition

PIN Out Config	
PIN 1	RS485-B1
PIN 2	RS485-A1
PIN 3	RS485-GND
PIN 4	NC(empty)
PIN 5	NC(empty)
PIN 6	RS485-GND
PIN 7	RS485-A1
PIN 8	RS485-B1

A

B

2.4 LED Status Indicators

State	Normal / alarm / protection	RUN	ALM	The power level indicates the LED				Explain
		●	●	●	●	●	●	
Shut down	Dormancy	off	off	off	off	off	off	All off
Await the opportune moment	normal	Flash, 1	off	According to the electricity instruction				stand by
	report an emergency	Flash, 1	Flash, 3					Module low voltage
Charge	normal	Lighting	off	According to the electricity instruction (Power level indicates maximum LED flash 2)				Alarm when overvoltage/light off
	report an emergency	Lighting	Flash, 3					If there is no charging, the indicator is in standby state
	Overcharge protection	Lighting	off	Lighting	Lighting	Lighting	Lighting	Stop charging
	Temperature, overcurrent, and failure protection	off	Lighting	off	off	off	off	
Discharge	normal	Flash, 3	off	According to the electricity instruction				Stop discharge
	report an emergency	Flash, 3	Flash, 3					
	Undervoltage protection	off	off	off	off	off	off	
	Temperature, over-current, short-circuit, Reverse connection and failure protection	off	Lighting	off	off	off	off	Stop discharge
Lose efficacy		off	Lighting	off	off	off	off	Stop charging and discharging

2.5 LED working status indication

The state		Charge				Discharge			
Capacity indicator light		L4	L3	L2	L1	L4	L3	L2	L1
SOC(%)	0~25%	off	off	off	Flash, 2	off	off	off	Lighting
	25~50%	off	off	Flash, 2	Lighting	off	off	Lighting	Lighting
	50~75%	off	Flash, 2	Lighting	Lighting	off	Lighting	Lighting	Lighting
	75~100%	Flash, 2	Lighting	Lighting	Lighting	Lighting	Lighting	Lighting	Lighting

### 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.

	 <b>WARNING</b>
	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.

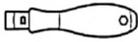
#### 3.1 Parts List

Check the parts during unpacking.

Table 3-1: Parts Lists

No.	Items	Appearance	Usage	Qty.	Remarks
1	Battery		Provide power	1	PT-ESS-W5120
					PT-ESS-W10240
					PT-ESS-W14400
2	Mounting Accessories		Hanging the battery on the wall	1	PT-ESS-W5120
			fixing the battery to the wall	4	PT-ESS-W10240 PT-ESS-W14400
3	RJ45 communication line 1500mm		Communication cable for battery parallel	1	
4	Red&Black Power line 1200mm		Power cable for battery parallel	2	4AWG PT-ESS-W5120 2AWG PT-ESS-W10240 PT-ESS-W14400
5	RJ45 communication line 1500mm		Communication cable connect with hybrid inverter	1	
6	M6*12* 4 bolts		Fix the power cable on battery	4	
7	Stainless steel anti-collision bolt M10x80x4		Fix the mounting frame on the wall	4	
8	Ground Screw M5X10X1		Fix the Grounding cable	1	
9	User manual	/	/	1	

### 3.2 Recommended Tools and Instruments



Torque Screwdriver



Phillips Screwdriver



Hexagon Wrench



Phillips Screwdriver



Slotted Screwdriver



Torque Wrench



Tape Measure



Driller



Pencil or Marker

#### NOTE:

Use properly insulated tools to prevent accident tale electric shock or short circuits. If insulated tools are not available, cover the entire exposed metal surfaces of the available tools, except their tips, with electrical tape.

### 3.3 Safety Gear

It is recommended to wear the following safety gear when dealing with the battery pack.



Safety gloves



Safety goggles



Safety shoes

### 3.4 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.

	<b>▲ WARNING</b>
	<ul style="list-style-type: none"> <li>▪ Be sure to use insulated tools (torque wrench, extension, socket, etc.).</li> <li>▪ All the instruments must be insulated and no metal articles (e.g., watch, ring) should be present in the installation area.</li> <li>▪ All power switches must be turned off in advance.</li> <li>▪ Prepare a CO<sub>2</sub> fire extinguisher, a first aid kit, and an AED (automated external defibrillator) before installation.</li> </ul>

	<b>▲ WARNING</b>
	<p>Arc Flash and Shock Hazard Insulated tools are required for any work on this energized equipment.</p>

	<b>▲ WARNING</b>
	<p>Sharp Edges Wear gloves and other protective gear to prevent injury.</p>

	<b>▲ WARNING</b>
	<p>Pinch Point Use caution when working in the enclosure to prevent injury.</p>

	<b>▲ CAUTION</b>
	<p>Heavy Object Can cause muscle strain or back injury. Use lifting aids and proper lifting techniques when moving trays, batteries and other heavy objects.</p>

## 4.1 Installation Location

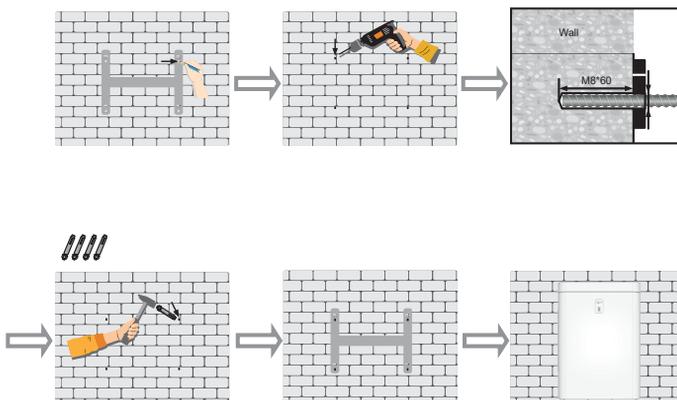
Make sure that the installation location meets the following conditions:

- The installation site must be suitable for the size and weight of the battery.
- Must be installed on a firm surface to sustain the weight of battery.
- The area is water proof.
- There are no flammable or explosive materials in proximity.
- The ambient temperature is within the range from 0°C to 45°C.
- The temperature and humidity is maintained at a constant level.
- There is minimal dust and dirt in the area.
- Installation must be vertical or tilted backwards by maximum 15° - avoid forward or sideways tilt.

## 4.2 Wall-mounted for PT-ESS-W5120

1. Choose suitable firm wall with thickness greater than 80mm.
2. Use the mounting frame as a template, mark the hole position.
3. Drill 4 holes according to the hole position, it is  $\varnothing 10$  with depth 60mm.
4. Hammer the M8 screws to the above holes, and screw the nut.

**Note: Position screws flush to the wall - leave 10 to 20 mm exposed.**



### 4.3 Floor-wheeled for PT-ESS-W14400

1. Transport battery modules to the installation location.
2. Place the battery modules near the wall.
3. Lock the wheels to keep the battery from moving and fix the battery on the wall with bracket and screws.
4. After installation, tighten all bolts.

How to install wheel on battery?



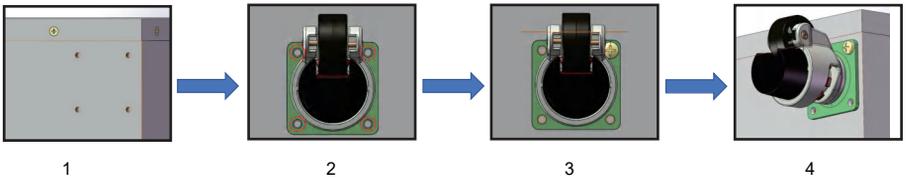
Accessories:



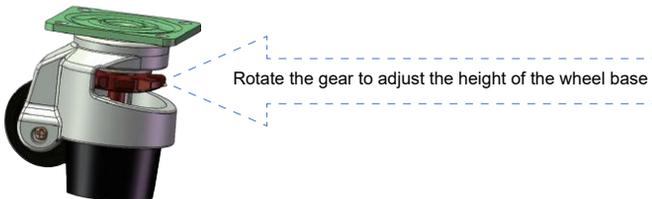
(4\*M6 Screws)



(4\*Wheels)



**Note:**



#### 4.4 Floor-standing for PT-ESS-W10240

1. Transport battery modules to the installation location.
2. Place the battery modules near the wall.
3. Fix the battery on the wall with bracket and screws.
4. After installation, tighten all bolts.



## 5. Cable Connection

### 5.1 Single Battery Connection

	<p style="text-align: center;"><b>NOTICE</b></p> <ul style="list-style-type: none"> <li>▪ 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.</li> </ul>
	<p style="text-align: center;"><b>⚠ CAUTION</b></p> <ul style="list-style-type: none"> <li>▪ Before connection, make sure to close the battery.</li> <li>▪ Please follow the instructions to protect the module BMS against damage.</li> <li>▪ DO NOT deviate from the sequence of steps below.</li> <li>▪ Exercise extreme caution prevent the terminals from contacting anything except their intended mounting points.</li> <li>▪ 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.</li> <li>▪ 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</li> </ul>
	<p style="text-align: center;"><b>NOTICE</b></p> <ul style="list-style-type: none"> <li>▪ When tightening the screws, make sure they are at a straight angle from the battery module terminals to avoid damage to the nuts inside.</li> <li>▪ Assemble the screws using a Phillips-head within the fastening torque of less than 8.0 Nm (81.5 kgf-cm).</li> </ul>
	<p style="text-align: center;"><b>IMPORTANT</b></p> <ul style="list-style-type: none"> <li>▪ The power terminals, such as "+," "-", of the module are covered with the protecting cover to guard against a short circuit.</li> <li>▪ You must remove the insulation cover prior to connecting and reattach the insulation cover immediately after connecting.</li> </ul>

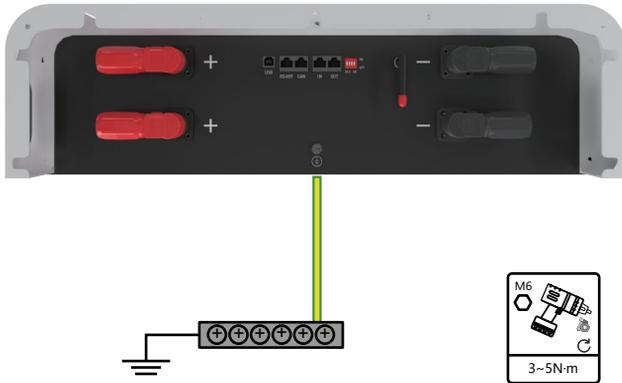


Figure 5-1: Install the Grounding Wire

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

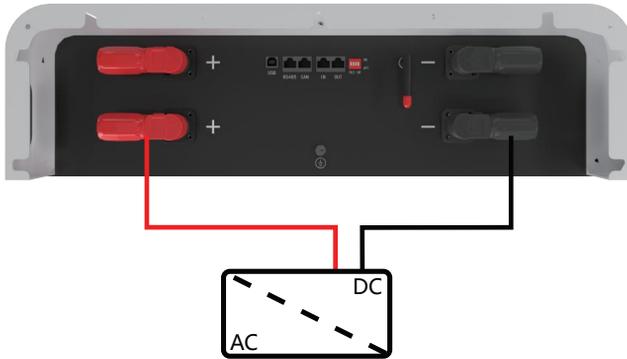


Figure 5-2: Single Battery Connection

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.

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.
- 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 box' communication line between battery and computer.

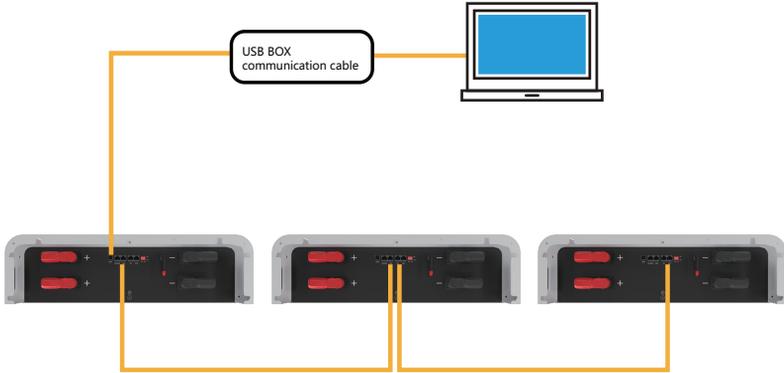


Figure 5-3: Communication Cable Connections between Battery and Computer

### 5.2 Connect Cables of the Multiple Batteries in Parallel

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

1.As shown in Figure 5-4, following the cable connection method of the single battery, connect the positive and negative cables between the Battery 1 and the busbar, Battery 2 and the busbar, and Battery N and the busbar respectively.

**Note:** To ensure the current balance, please use cables with the same diameter and length for each battery.

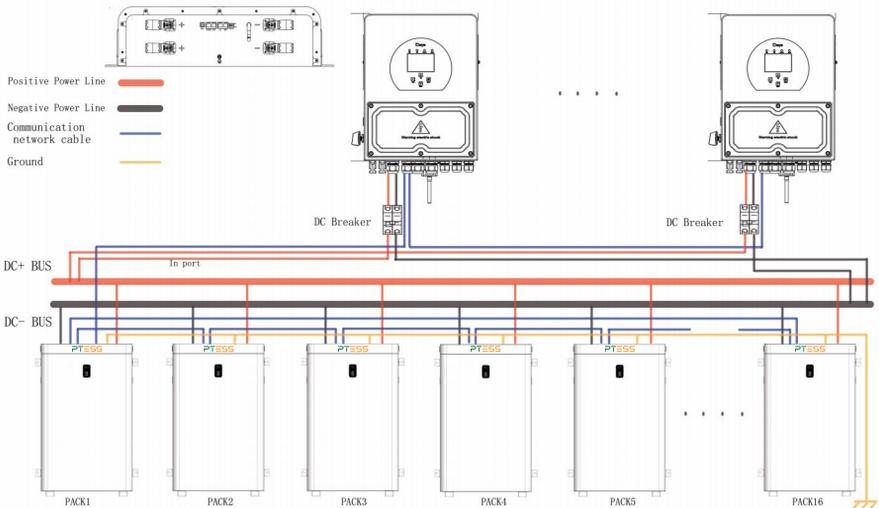


Figure 5-4: Multiple Batteries Connections

As shown in Figure 5-4, The CAN port realizes parallel operation and is connected using a standard Rj45 network cable. The automatic addressing output terminal of the upper level is connected to the automatic addressing input terminal of the lower level.

**Note:**

1.In order to improve the stability of parallel CAN bus communication between batteries , a “RES-SW” switch is needed ,please operate it with the following introduction (as shown in figure 5-5)

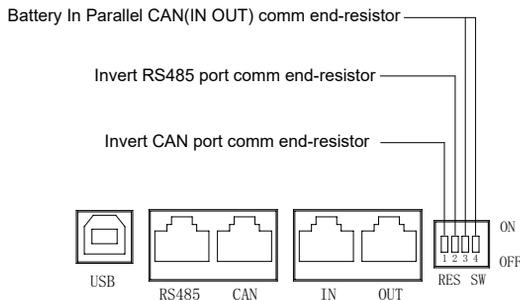


Figure 5-5: Operation of RES-SW switch introduction

1.1.When battery parallel quantity < 16pcs,we need to turn on No.3 or No.4(any one is ok) only with the last slave battery;

1.2. When battery parallel qty ≥16pcs,we need to turn on No.3 or No.4(any one is ok) with the master and last slave battery.

1.3.When the inverter without end-resistor function we have to turn on No.1 or No.2 as well, otherwise the communication between inverter and battery can not work.

1.3.1 No.1 means CAN port communication between battery and inverter

1.3.2 No.2 means the RS485 port communication between battery and inverter

2.To ensure the current balance, please use power cables with the same diameter and length for each battery when connect with the busbar.

3.For safety and longer life of battery pls always set Max. charge and discharge current of battery on inverter is 50A for PT-ESS-W5120 and 80A for PT-ESS-W10240 and 100A for PT-ESS-W14400.

4.The CAN Port of the first battery must be connected to the inverter's battery communication interface, otherwise the inverter cannot communicate with the batteries.

5.The CAN Port of the first battery must be connected to the inverter's battery communication interface, otherwise the inverter cannot communicate with the batteries.

### 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

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. The green working light on the front panel of the battery flashes, indicating that the battery system is normal.

## 7. Inspection, Cleaning and Maintenance

### 7.1 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.

## 7.2 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.

## 7.3 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.

## 7.4 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.

## 7.5 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 0.2C<sub>10</sub>A current, and then charge with 0.2C<sub>10</sub>A 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.

# 8. Troubleshooting

To determine the status of the battery system, users must use additional battery status monitoring software to examine the protection mode. Refer to the installation manual about using the monitoring software. Once the user knows the protection mode, refer to the following sections for solutions.

Table 8-1: Troubleshooting

Fault Type	Fault Generation condition	Possible Causes	Troubleshooting
BMS fault	The cell voltage sampling circuit is faulty. The cell temperature sampling circuit is faulty	The welding point for cell voltage sampling is loose or disconnected. The voltage sampling terminal is disconnected. The fuse in the voltage sampling circuit is blown. The cell temperature sensor has failed.	Replace the BMS.
Electrochemical cell fault	The voltage of the cell is low or unbalanced.	Due to large self- discharge, the cell over discharges to below 2.0V after long term storage. The cell is damaged by external factors, and short circuits, pinpricks, or crushing occur.	Replace the battery.
Overvoltage protection	The cell voltage is greater than 3.65 V in charging state. The battery voltage is greater than 58.4 V.	The busbar input voltage exceeds the normal value. Cells are not consistent. The capacity of some cells deteriorates too fast or the internal resistance of some cells is too high.	If the battery cannot be recovered due to protection against abnormality contact local engineers to rectify the fault.
Under voltage protection	The battery voltage is less than 40V. The minimum cell voltage is less than 2.5V	The mains power failure has lasted for a long time. Cells are not consistent. The capacity of some cells deteriorates too fast or the internal resistance of some cells is too high.	Same as above.
Charge or discharge high temperature protection	The maximum cell temperature is greater than 60 °C	The battery ambient temperature is too high. There are abnormal heat sources around	Same as above.
Charge low temperature protection	The minimum cell temperature is less than 0 °C	The battery ambient temperature is too low.	Same as above.
Discharge low temperature protection	The minimum cell temperature is less than -20 °C	The battery ambient temperature is too low.	Same as above.

By checking the above data and sending the data to the service personnel of our company, the service personnel of our company will reply the corresponding solution after receiving the data.

## 9. Inverter Communication

NOTE: The PTESS battery’s BMS comes factory preloaded with multiple inverter brand protocols. The default brands are listed below and only require connection with communication cable to the applicable interface port. (i.e. RS485 or CAN). Communication is established automatically. The 2 methods listed below are for default inverters (Method 1) or manually selecting inverter (Method 2) using the BMS tool with a hostcomputer through the USB port.

### BMS basic functions

Protection and Alarm	Management and Alarm
Charge/Discharge End	Cells Balance
Charge Over Voltage	Intelligent Charge Model
Discharge Under Voltage	Charge/Discharge Current Limit
Charge/Discharge Over Current	Capacity Retention Calculate
High/Low Temperature(cell/BMS)	Administrator Monitor
Short Circuit	Operation Record
Power Cable Reverse	

### 9.1 Inverter Protocol Codes

#### BMS Protocol

RS485 Protocol	
Protocol name	Compatible protocol
Local	BMS Protocol
Voltronic	MOTOMA/Opti_Solar/SAKO/Phocos
Growatt	Growatt / SMK
SOLAX	Solax
LTW	LT-POWER
PACE	PACE
MUST	MUST
SRNE	SRNE/PACE/EPEVER
Baykee	Baykee
SMK	SMK
AFORE	AFORE

CAN Protocol	
Protocol name	Compatible protocol
PYLON	PYLON/DEYE/Sunsynk/Solis/TBB/LUXPower/SOFAR/Megarevo/Invnt/Afore
Local	BMS Protocol
GOODWE	SOLARFAM
Growatt	Growatt
SOLAX	SOLAX
Sofar	Sofar
Luxpower	Luxpower
MUST	MUST
LTW	LTW
Victron	Victron
Sorotec	Sorotec
SOLARFAM	SOLARFAM
IMEON	IMEON
Schneider	Schneider
INHENERGY	INHENERGY
SMA	SMA/Sofar/Studer

**Note:** Compatible tests with different brands of inverter are continuously, updates of this list will be periodically.

## 9.2 Method 1: Communication with Factory Default Inverters

Step 1: Select the appropriate communication cable according to the brand of inverter. Some inverter brand cables come supplied with the battery. If your inverter brand cable is not supplied, please contact us to get the detailed information how to make the correct RJ45 cable. Insert the RJ45 connector of the battery end (CAN/RS485) and the inverter end (CAN/RS485) into the interfaces on both sides.

Step 2: Turn on the battery first and once it is running then turn on the inverter. The battery is configured by factory default to communicate with DEYE, Solis, Luxpower, Sofar, Afore, TBB inverters (CAN Port) and default with Local (RS485 Port). The battery will automatically select and communicate with one of these inverters.

Step 3: After successful communication between battery and inverter, battery status will be displayed on inverter: voltage, current, SOC, temperature, etc.

## 9.3 Method 2: Communication via Manual Selection of Inverters

**NOTE:** In order to manually switch BMS protocols you will need the BMS Tool and USB serial cable. Please contact PTESS or visit our website for further details. The BMS protocol only needs to be changed on the master battery. When communicating with other brands of inverters such as: Growatt, Solax, Goodwe, Sorotech, LTW, MUST, SMA, etc

Step 1: Turn on the battery and ensure the BMS is powered up and not in sleep state. Take the RJ45 end of the USB cable (not provided) and plug it into the battery USB port. Then plug the USB side of cable into your host computer/laptop

Step 2: Place the BMS monitoring software file on your desktop and unzip the file (Windows Microsoft.NET Framework 2.0 or above). The software does not need to be installed. Only double click the main program icon BMS Tool (.exe file) to run and use. Enter the password (pls contact PTESS).

Step 3: Click "Parameter information" at the top system page, then click "Read All" to read the battery parameter. Select the inverter protocol at the "Protocol type" (RS485 or CAN). Click the "Write All" button to set the protocol. Once the protocol system displays, the selection is complete.

Step 4: Select the appropriate communication cable according to your inverter brand. Insert the RJ45 connector of the battery end (CAN/RS485) and the inverter end (CAN/RS485) into the interfaces on both sides. Restart the battery first and ensure it is running. Then switch on the inverter. The battery will automatically communicate with the inverter corresponding to the selected protocol.

## 10. Battery recovery

Aluminum, copper, lithium, iron and other metal materials are recovered from discarded LiFePO<sub>4</sub> 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 NaAlO<sub>2</sub>. After filtration, the filtrate is neutralized with sulfuric acid solution and precipitated to obtain Al(OH)<sub>3</sub>. When the pH value is above 9.0, most of the aluminum precipitates, and the obtained Al(OH)<sub>3</sub> 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 Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> and Li<sub>2</sub>SO<sub>4</sub>, 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)<sub>3</sub>, and the remaining solution is precipitated with saturated Na<sub>2</sub>CO<sub>3</sub> solution at 90°C. Since FePO<sub>4</sub> is slightly dissolved in nitric acid, the filter residue is dissolved with nitric acid and hydrogen peroxide, which directly precipitates FePO<sub>4</sub>, separates impurities such as carbon black from acid solution, leaches Fe(OH)<sub>3</sub> from filter residue respectively, and precipitates Li<sub>2</sub>CO<sub>3</sub> with saturated Na<sub>2</sub>CO<sub>3</sub> 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