

Jebel ESS JBL-PBD-250

Solar Charge Controller
User Manual

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1 About this Manual

The purpose of this chapter is to provide an overview of the manual's content and target audience, facilitating users' comprehension of its contents.

1.1 Content Introduction

The present manual is applicable to the Jebel ESS JBL-PBD-250 solar charge controller products (hereinafter referred to as PBD). It encompasses the following key contents:

- **Safety Notice**

The safety concerns related to PBD.

- **Product Description**

The function, structure, and principle of PBD, as well as the size and packaging of PBD, along with its operational mode and other relevant information.

Product Transportation and Storage

The transportation mode of the product and the storage-related precautions.

- **Product Installation**

Conditions for PBD installation, required tools, mechanical and electrical installation of PBD, communication connections, and other relevant information.

- **The product is powered on for the first time**

The information regarding essential procedures to be conducted during the initial power-on of the PBD.

- **Man-machine interface operation guide**

Interface display information of the LCD touch screen for PBD, operation setting method and other information.

- **Operation**

Information such as PBD startup and shutdown steps.

- **Product Maintenance**

Routine maintenance of PBD, waste disposal and other information.

- **Attachments**

The technical data, quality assurance terms, and contact information of PBD.

1.2 Applicable personnel

The applicable personnel should possess the following qualifications:

- Only professional electricians or individuals with professional certifications are authorized to carry out transportation, installation, and other operations of this product;
- The operators must have a comprehensive understanding of the composition and working principle of the entire energy storage system.
- The operators should be fully acquainted with the user manual for this product;
- The operators should be fully familiar with the relevant standards of the country/region where the project is located.

1.3 Manual Use

Before installing or using the equipment, it is essential to thoroughly review this manual. It is recommended to keep this manual and relevant information readily accessible alongside the product components for easy reference by authorized personnel. Please note that the contents of this manual will be continuously updated and revised; therefore, there may be occasional inconsistencies or errors with respect to the actual product. The purchased product shall prevail over any discrepancies found herein. For further assistance, users can contact the local distributor or access the latest version of this manual through our website www.nastechsolar.com.

2 Safety Notice

2.1 Symbol Instructions

In order to ensure the safety of users' personal belongings and property during installation, as well as to maximize the efficiency and optimal usage of this product, pertinent information is provide in the manual emphasized through appropriate symbols. The following enumerates the symbols that may be utilized this manual. Please carefully review them to enhance your utilization of this manual.

	**DANGER** DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates there is potential risk, if not avoided, could result in equipment malfunction and property damage.
	**Caution,risk of electric shock** When battery bank connecting point are exposed, there will be DC voltage in the equipment DC side; and when output breaker is on, there is a potential risk of electric shock.
	**Caution, risk of fire hazard** Suitable for mounting on concrete or other non-combustible surface only.
	**Protective conductor terminal** The inverter has to be firmly grounded to ensure the safety of personnel.
	Risk of electric shock, Energy storage timed discharge Electrical shock danger exists in the capacitor; the cover shall be moved at least 5 minutes later after all powers are disconnected.

2.1 Usage Notice

All PBD installation and service personnel must undergo training to ensure their familiarity with general regulations for working on electrical equipment. Additionally, they should be well-versed in safety codes and requirements.

● Prior to usage, it is essential to thoroughly read this manual. Failure to operate the equipment according to the instructions provided may result in a void of quality assurance by the company.

● Only qualified electrical engineers are permitted to operate PBD devices.

● While the device is operational, refrain from touching any other electrical components except when necessary checking device operation information via the display screen.

● All electrical operations must adhere to local standards for electrical operations.

● The utilization of on-grid PBD charge and discharge requires authorization from the local power supply department and should only be carried out by professionals.

2.3 Correct Installation Method

The proper installation of a PBD entails adhering to all instructions outlined in the owners' manual pertaining to equipment transportation, installation, electrical connection, and operation. Jebel ESS shall not be held liable for any damages resulting from improper usage of the equipment.

The PBD possess an IP20 protection progress and is specifically designed for indoor installations. During the installation process, it it imperative to carefully review the information provided in the user manual, particularly Chapter 5 titled "Product Installation".

Additionally, ensuring appropriate utilization of the equipment necessitates attentiveness towards:

● Acknowledging safety instructions listed herein and below;

● Heeding guidelines presented within the PBD user manual;

● Considering technical data associated with this device.

2.4 Operator

Only electricians who have received training and approval from the power supply company are authorized to install and conduct test runs on a PBD. Prior to installation, all installation and service personnel must undergo training and become familiar with the fundamental safety requirements for operating electrical equipment. Additionally, installation and service personnel should be knowledgeable about relevant local regulations and safety protocols.

2.5 Important Precautions



Note1: Static electricity can cause damage to PBD

Due to the electrostatic discharge, it has the potential to result in irreversible damage to the internal components of PBD.

Note2: Usage restrictions

Direct connection of life AIDS and medical devices with PBD is prohibited!

Note3: Tool precautions

Prior to powering on, thoroughly inspect for any installation tools or other unnecessary items left inside the PBD.

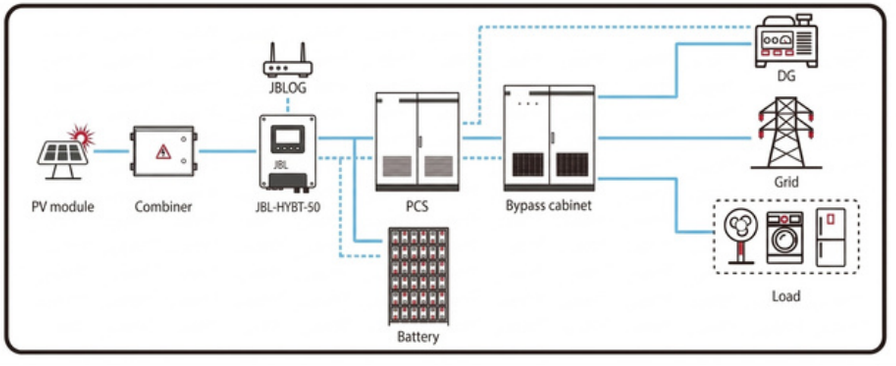
Note4: Maintenance precautions

Ensure the PBD has been safely powered off during maintenance and all live machine components have been discharged before proceeding.

3 Product Description

3.1 Optical Storage System

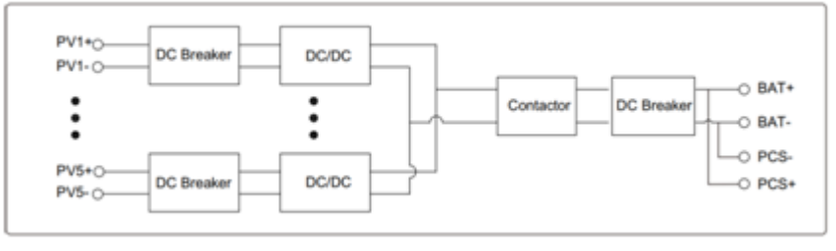
The PBD series, manufactured by Jebel ESS, is a solar charge controller system designed to efficiently distribute photovoltaic direct current to energy storage batteries. Currently, the PBD is predominantly utilized in conjunction with PCS energy storage systems, as illustrated in the following diagram:



PBD+PCS+bypass system diagram

3.2 Electrical Principle of Controller

The JBL-PBD-250 is a first-level BOOST booster circuit designed to match the battery output and utilize boost voltage for efficient battery charging.



Electrical Schematic Diagram of JBL-PBD-250

3.3 The layout of the main components

3.3.1 External components

The main external components of PBD include: LED indicator light, LCD touch screen and start stop knob, emergency stop button and other parts.

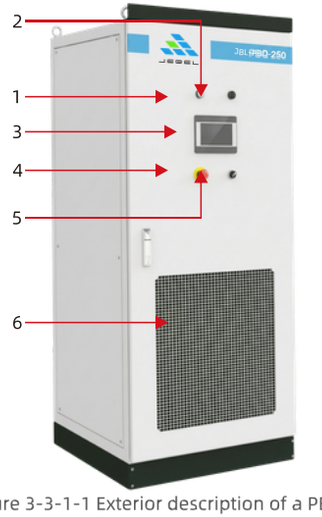


Figure 3-3-1-1 Exterior description of a PBD

S/N	Part Name	Descripition
1	POWER	When the PBD system is normally powered, this indicator runs and is bright yellow
2	FAULT	When the PBD is faulty, this indicator is running and bright red
3	Touch Screen LCD	Display PBD running information, execute control commands and parameter settings, etc
4	EMERGENCY STOP	For PBD emergency shutdown
5	Start-stop knob (OFF/ON)	Control PBD switch machine: turn ON first to ON, turn OFF to off
6	Dust mesh	Prevent dust from getting inside the PBD

Figure 3-3-1 Part description

Indicator

The PBD adopts intelligent design. At the top end of the inverter power supply are 2 LED lights showing the main state of the machine running, through the LED indicator can view the current PBD working state.



Figure 3-3-1-2 LED indicators

LED	Meaning
POWER	When the PBD system is powered normally, this indicator is on
FAULT	When the PBD is working malfunctionally, this indicator is on

Table 3-3-2 LED operating status

Emergency STOP

Attention!

The emergency stop button is only used in emergency situations, such as: the system has a more serious fault, fire, leakage, serious error in operation and other phenomena that need to stop immediately!



Figure 3-3-1-3 Emergency stop button

The emergency Stop button instantly disconnects the PBD from all external connections, thereby putting the PBD in a safe state. By pressing the emergency stop button, the device will be locked in the "off" position. Only by eliminating all faults, turning the emergency stop button clockwise again, and then closing the AC/DC circuit breaker, can the machine be restored to normal operation.

Start stop knob

The start-stop knob is used to control turning PBD on and off.



Figure 3-3-1-4 Start stop knob

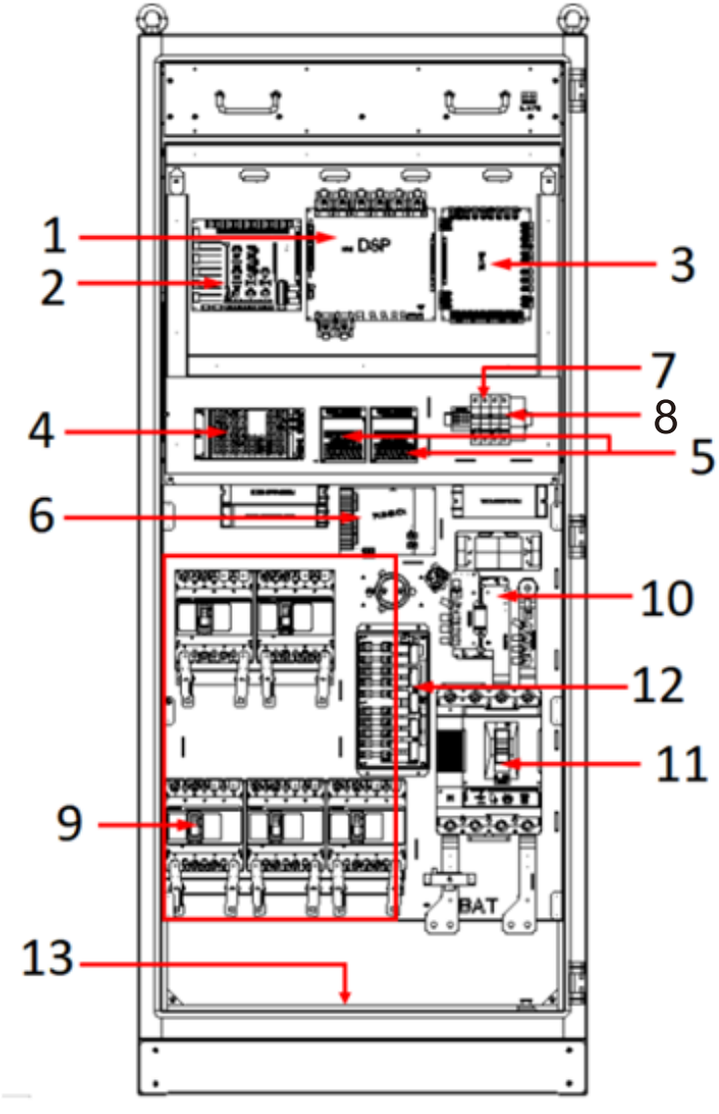
Touch screen

Display PBD real-time operating data, fault information records and other information, see Chapter 7 for details.

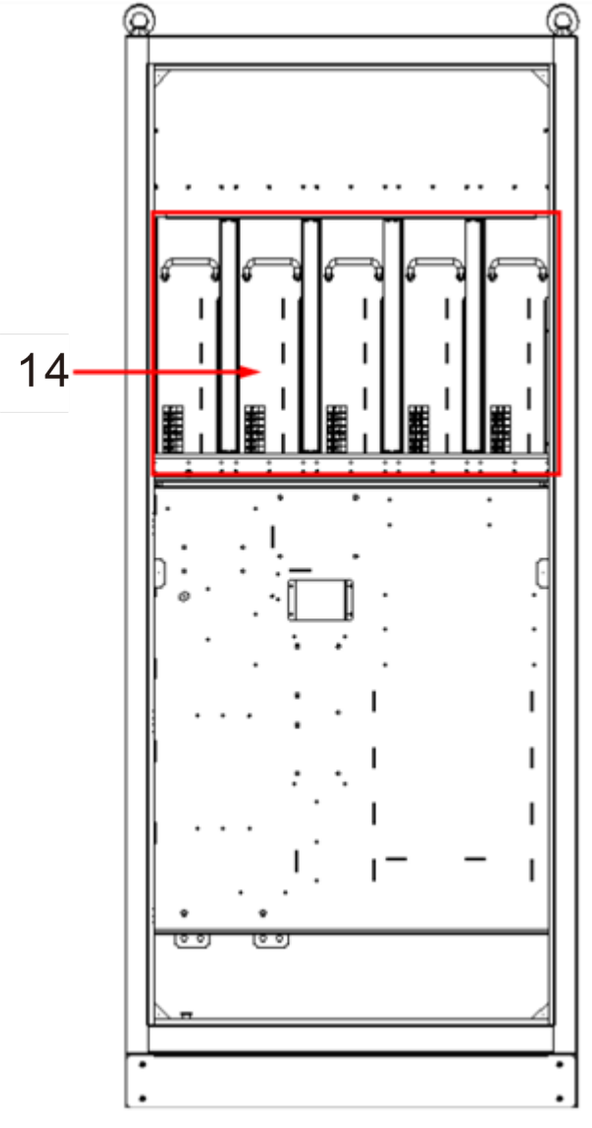
3.3.2 Internal Components

The internal components of PBD include: photovoltaic circuit breaker, battery circuit breaker, power supply micro-break, PV lightning protection, PCB board, etc.

The following is the JBL-PBD-250 front and back internal parts diagram.



JBL-PBD-250 front interior parts diagram



JBL-PBD-250 back interior parts diagram

S/N	Name	Instructions
1	Control board	The main control board has a communication interface
2	Sample Picking board	Sampling voltage, current and temperature of the sampling PCB for JBL-PBD-250
3	Interface board	Power supply conversion, input and output interface PCB board
4	Homemade power supply	Power a fan
5	Jin Shengyang power supply	Power the control board
6	BUCK board	Buck DC high voltage to power PCB board
7	Miniature circuit breaker	Control board power switch
8	Ac fan switch	AC220 on and off
9	PV Breaker	Control the disconnect of the PV from the machine
10	Battery main relay	After soft start, close main relay
11	Battery breaker	Control the disconnection of the battery from the machine
12	Lightning Shield	P1 to P5 lightning protection
13	Ground row	Machine grounding copper row
14	Modules	5 modules containing IGBT, capacitors, inductors, etc.

3.4 Operation mode

The current operation mode needs to be used with PCS energy storage machine. The JBL-PBD-250 output end is connected to the PCS battery end for use. The mode selection needs to be selected on the PCS screen. The JBL-PBD-250 itself does not own a battery.

3.4.1 Failure Mode

When the PBD fails, the contactor on the input and output side will be immediately disconnected and shut down into the fault state, thus ensuring the safety of the system. At the same time, PBD will continuously monitor whether the fault is eliminated, and if the fault is not eliminated, it will keep the fault state; It can be restarted after the fault has been eliminated.

3.4.2 Permanent Fault Mode

When the PBD has a relatively serious fault, the PBD power supply will immediately disconnect the AC and DC side contactor and enter the permanent fault state to ensure the safety of the system. When the permanent fault information is detected for three consecutive times, all switches will be disconnected. For example, the PBD module of the PBD is faulty. When the PBD enters this permanent failure mode, please do not repair the PBD without permission, you should contact the personnel of the local dealer, or you can call Jebel ESS for help.

3.4.3 Abnormal output power



When the ambient temperature is too high, the output power of the energy storage PBD will normally decrease. If this happens frequently, however, check the cooling side of the PBD or place the PBD in a better ventilated area. Clean the fan dust if the PBD fan is dirty, and seek help from professional services if there is a problem inside the PBD.

3.5 Notice of load usage

Now PBD series are used with PCS energy storage machine, PBD only output DC, the output needs to be connected to the battery for voltage regulation, in order to normal use. Remember: PBD can not run without battery connection to the output end.

Model	JBL-PBD-250
Rated power (kW)	250
MAX DC load (kW)	250

If the DC load power is greater than the rated output power of the selected model, it is recommended to use multiple PBDS for parallel use.

3.6 Dimensional size and weight

Model	JBL-PBD-250
Dimensions (W/H/D)	850X1900X650mm
Weight (net/gross) (kG)	289/339

Table 3-8 Dimensions of PBD

3.7 Packaging Information

S/N	Name	Units	Quantity	Instructions
1	PBD Complete Machine	piece	1	Include cabinet keys
2	User manual	piece	1	
3	Certificate of conformity	piece	1	
4	Factory Test report	piece	1	

Table 3-9 Product packaging information

Product Transportation and Storage 4

4.1 Transportation of the Product

The user is only allowed to use the transportation method described in the User's manual when transporting the PBD, taking into account the weight of the PBD and its non-centered center of gravity. The center of gravity is marked on the packing case.

Danger!

PBD is very heavy, when transporting PBD, there must be qualified lifting equipment and personnel. PBD must be vertically transported in the horizontal plane according to the center of gravity identifier. The inclination of PBD relative to the vertical placement can not exceed 10 degrees during transportation. It is not allowed to invert the equipment or transport in a horizontal position. If you can not lift and transport PBD correctly, may lead to serious safety of life, property losses and PBD damage.

4.2 Inspection and storage of products

Users should check carefully before signing for PBD sent by the transportation company. Check the items received with the items listed in the delivery notice, and if any defects or damage are found, immediately notify the transportation company and ask it to appraise the equipment. You can ask Jebel ESS for help if needed.

Attention!

The device can only be stored in a package, so make sure that its interior is protected from dust and moisture, and if it is stored for a long time, the PBD must be stored in a dry environment to waterproof the PBD.

5 Product Installation

5.1 Requirements for installation conditions

In order to ensure that the machine can work normally, the installation environment and requirements are as follows:

- The protection level of PBD is IP20, and the product is electronic equipment, so do not place it in a humid place.
- Install indoors to avoid sunlight and rain.
- Better ventilation around the machine.
- Clean installation environment.
- The equipment will produce some noise during operation, and try to install it in places far from residents' lives.
- Install the ground to ensure that it will not shake, and the support surface should meet the load-bearing requirements of PBD.
- The installation position should ensure easy maintenance.
- The ambient temperature is between -25℃ and 55℃.
- The machine should reserve enough space to ensure ventilation and heat dissipation.

PBD is recommended to be installed in the distribution room. The floor, space, cable ditch, air duct, ventilation equipment and all protective measures need to be strictly designed and meet the following requirements

- **Foundation Requirements**

This PBD shall be installed on a flat ground or channel steel support structure with a surface of flame retardant material, and the ground shall not be dented or tilted. The foundation must be solid, safe and reliable. The foundation must have the load-bearing capacity to bear the weight of PBD.

- **Space Requirements**

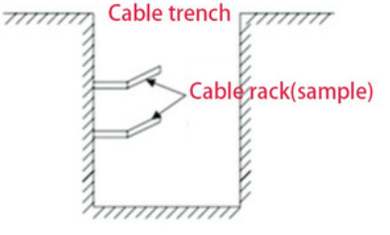
- When installing a PBD, a proper distance from the wall or other equipment must be maintained in order to meet the requirements of the narrowest maintenance passageway, escape route, and ventilation.



- The space in front of the PBD installation position should be ensured to be greater than 1.5m, the space in the back should be ensured to be greater than 0.8m, and the space in the top should be ensured to be greater than 0.8m to facilitate installation, heat dissipation and maintenance.

- **Cable trench design**

- PBD cables are connected from the bottom to the line. It is recommended that PBD cables and external cables be routed through the cable trench for easy installation and maintenance.



- Cable trench is usually designed and constructed by the construction side in accordance with relevant standards, taking into account the weight and size of the device. Good electrical connections are required between the cable trench and between the cable trench and the ground electrode.

● **Wiring Specifications**

● The cables used in the system can generally be divided into power cables and communication cables. When laying communication cables, keep them away from power cables and keep them at right angles at the intersection. Keep the length of the cables as short as possible and keep them away from the power cables. It is recommended that the insulation impedance of BT+ and BT- at the DC end to the ground be greater than 1MΩ.

● Power cables and communication cables should be placed in different cable trenches to avoid power cables and communication cables long distance and walking lines to reduce electromagnetic interference caused by instantaneous changes in output voltage. The distance between power cables and communication cables should be greater than 0.2m. When the wires are cross distributed, the cross Angle should be 90 degrees, and the distance can be appropriately reduced.

● **Ventilation requirements**

● PBD operation will produce a lot of heat, when the ambient temperature is too high will affect the electrical performance of the equipment, and even damage the equipment, so in the design of the control room need to fully consider the release of these heat, to ensure the normal and efficient operation of the equipment.

● **Ventilation environment**

In order to meet the ventilation requirements of PBD, the installation environment must meet the following conditions:

1.PBD should be avoided in places with poor ventilation conditions and low air flow.

2.The air intake should be adequately supplemented with air.

● **Ventilation equipment**

In order to ensure the safe, reliable and efficient operation of the equipment, the ambient temperature of the equipment must be within the range of -25 ° C ~ 55 ° C, so it is necessary to be equipped with an appropriate ventilation device to dissipate the heat generated by the equipment. It is recommended that the ventilation volume of the PBD installation space be at least 3665m^3/h above;

1. There must be ventilation facilities in the distribution room to ensure that the waste heat energy generated by PBD is discharged from the equipment to meet the maximum allowable environmental temperature. This can be achieved by installing exhaust devices (such as fans, ventilation ducts, etc.);

2. In order to ensure the balance of pressure, a fan can be added to the outlet of the air outlet pipe.

3. The direction of the outlet should be selected according to the actual situation of the local wind direction;

4. Pay attention to dust-proof measures and rainproof design of air inlet and air outlet;

5. If it is necessary to add ventilation pipes, the size of the ventilation pipes should be based on the size of the air volume and should be designed by professionals.

● **Other protection**

PBD has an IP20 protection progress and is suitable for installation in a dry, clean power station environment. Also be aware that avoiding house leaks that damage PBD. Depending on EMC requirements and noise levels, PBD should be installed in an industrial environment.

5.2 Tools and spare parts required for machine installation

The following tools and parts are required for installation:

- Lifting crane, forklift or forklift truck (with PBD weight bearing capacity).
- Torque wrench.
- Screwdriver.
- Wire strippers.
- Terminal press machine.
- Hot hair dryer.
- Megohm meters and multimeters.

5.3 Mechanical Installation

5.3.1 Transportation of the whole machine with packaging

● **Relevant precautions**

PBD adopts integral transport mode, the user can lift the PBD from the bottom by forklift, or moved by crane, crane.

Note 1: The PBD is a whole unit and must not be broken down during transportation or installation. Faults caused by modifications not authorized by Jebel ESS are not covered by the warranty.

Note 2: The PBD should not be tilted, violently swayed, or subjected to sudden forces, such as sudden dropping or lifting, during movement.

Note 3: Read the stated parameters carefully to select the appropriate transport and storage location.

Users are advised to use a forklift to move the PBD as much as possible.



Before moving the PBD cabinet to the intended position, it is recommended to lay the DC input and AC power cables first, because these cables are relatively thick, once the PBD cabinet is installed, it will be difficult to perform cable routing operations.

In order to ensure that the PBD is in a better state of protection during transportation, transport with packaging as far as possible, and follow the package Loaded with a variety of signs for transport, packaging signs illustrated as follows:

ICONS	A sign
	Center of gravity identification
	Lifting sign
	Face up, no PBD horizontally, tilted, or upside down
	Handle with care to avoid damage to PBD caused by too intense collision friction in the transportation environment
	Take care against moisture to protect your PBD from rain or moisture

Unpacked PBDS can be moved using forklifts, cranes, or forklifts or cranes. When moving, pay attention to the weight marked on the package and ensure that the forklift, crane or forklift or crane has sufficient carrying capacity. The center of gravity of PBD is symmetrical before and after, left and right, and the lower part of the position, and the support or lifting points should be arranged reasonably during transportation.

Forklift transport mode is the standard transport method. When transporting, the center of gravity of the box should fall between the two forks of the forklift. The large size of the PBD may block the driver's view and should be cooperated by auxiliary personnel.

5.3.2 Shipping PBD without packaging

● Remove the PBD packaging

Follow these steps to remove the equipment shipping packing box.

Step 1: Remove the wooden sides and top plate of the packing case;

Step 2: Remove the peripheral packaging materials on the machine;

Step 3: Remove the fastening screws between the machine and the pallet.

1) Remove the front and rear cover plates of the base;

2) unscrew the fastening nut connecting PBD to the bottom of the wooden tray;

3) Remove the screw to separate the PBD from the transport wooden pallet.

● Mobile installation of bare machine

Unpacked PBD can be moved using forklifts, cranes, rails or cranes. If the location of the dismantled package is a little far from the final installation location, it can be transported with the bottom wooden pallet first.

If the PBD bottom wooden pallet has been removed, when using a forklift truck to move the PBD, it is necessary to remove the front and rear cover plates of the base first, and make the center of gravity fall in the middle of the two forklifts, and then carry out lifting, as shown in the figure below:



Dangerous!

When moving PBD with a forklift, the action must be slow and light to avoid excessive PBD vibration, or impact with other objects, so as not to cause damage to personal safety and PBD.

If the lifting method is used to move, please pay attention to the lifting position, the lifting Angle needs to be guaranteed 70°, and pay attention to the center of gravity position of PBD.

Pay attention to:

- Always pay attention to the center of gravity of PBD.
- Take necessary auxiliary measures to ensure the safety of transportation personnel.
- Take necessary auxiliary measures to ensure that the equipment is delivered to the final installation site in good condition.

5.4 Electrical Installation

5.4.1 Input and output requirements

Danger!

- PBD may be subject to high voltage electric shock. Only electricians with professional skills can operate PBD.
- All operations connected to the equipment must be performed in the no-voltage state.
- If you connect the wrong input and output terminals, you will damage the PBD!

Failure to follow this warning information may result in serious injury, significant property damage, or even death.

● **Battery Components**

The open circuit voltage of the positive and negative electrodes of the JBL-PBD-250 battery module should not exceed 850V. Otherwise, the device will be in the over-voltage protection state and cannot work normally.

● **Cable Requirements**

Model	JBL-PBD-250
PV	Each bus diameter: 35mm²
Battery	Each bus diameter: 180mm²
Output	Each bus diameter: 180mm²
Ground wire	16mm²
Communication wire	Shielding cable: 0.75mm²

5.4.2 DC side cable

Danger!

PBD only exists DC input and output, need to ensure that the positive and negative poles are not connected, should be measured with a multimeter to determine the polarity, and then the corresponding access to the positive and negative input and output of PBD; JBL-PBD-250 internal so the module fan takes power in PV1, if the access to photovoltaic modules less than 5, PV1 must be connected to photovoltaic modules.

The methods for connecting DC cables are as follows:

Step 1: Disconnect the power distribution circuit breaker on the upper DC side and ensure that no power is connected to the DC side.

Step 2: Use a multimeter to measure the open circuit voltage of the battery assembly to ensure that it is within the allowable range.

Step 3: Use a multimeter to confirm the positive and negative electrodes.

Step 4: Peel the insulation off the end of the cable.

Step 5: Crimp the wiring brass nose.

1. Place the stripped copper core part into the crimping hole of the copper nose.

2. Use a terminal press to press the copper nose tightly. The number of crimps should be at least two.

Step 6: Install the heat shrink tubing.

1. Select the heat shrink sleeve that is more in line with the size of the cable, and choose a length of about 5cm.

2. Put the heat shrink tubing on the copper nose to cover the pressure hole of the copper nose completely.

3. Use a hot hair dryer to tighten the heat shrink tubing.

Step 7: Connect the "battery-Input +" end of the PBD to the positive end of the Battery assembly with a cable.

1. Select bolts that fit the wiring nose.

2. Securely connect the copper noses at both ends of the cable to the battery-Input + end of the PBD and the positive end of the Battery assembly.

3. Tighten the bolts using a screwdriver or wrench.

Step 8: Connect the "battery-input -" end of the PBD to the negative terminal of the Battery assembly using the same cable as in Step 7.

Step 9: Cable the "PV-Input +" end of the PBD to the positive terminal of the PV module as described in Step 7.

Step 10: Connect the "PV-Input -" end of the PBD to the negative electrode of the PV module with a cable as in Step 7.

Step 11: Make sure the cable is securely connected.

5.4.4 Connect the ground cable

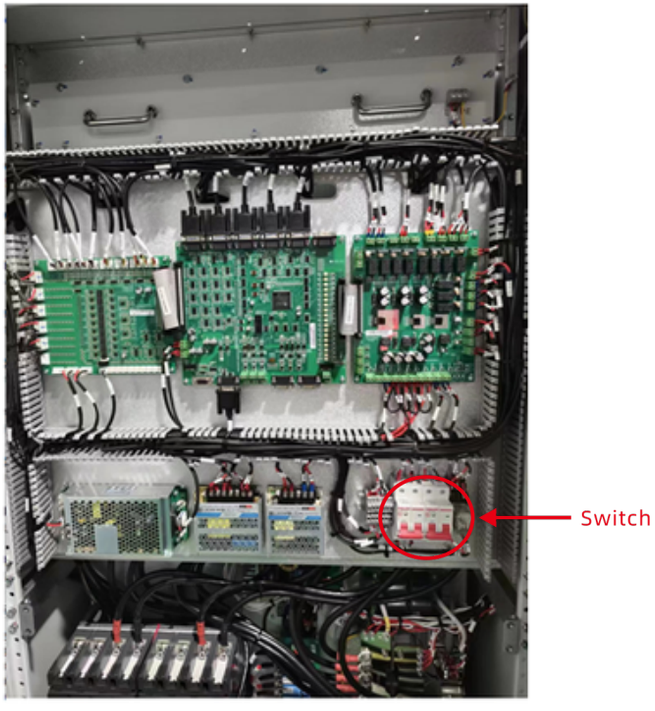
For safety, all PBDS need to be grounded through the PE conductor. The PE copper bar in the PBD cabinet has been reliably connected to the PBD shell in the cabinet, and the PE ground copper bar must be reliably connected to the equal potential connection device in the installation site or the electrical control room when making PE connection. The diameter of the grounding cable must be at least half of the diameter of the AC output cable, and the grounding resistance must be no higher than 4 ohms.

The inlet and outlet of the cable shall be placed at the bottom of the PBD. After all the cable connections are completed, the inlet and outlet of the cable shall be sealed with fireproof mud to prevent dust and small animals from entering the PBD.

The PE copper bar on the connection of a few wires, that is PBD internal individual devices need to be grounded, please do not change privately, so as not to cause the risk of electric shock!

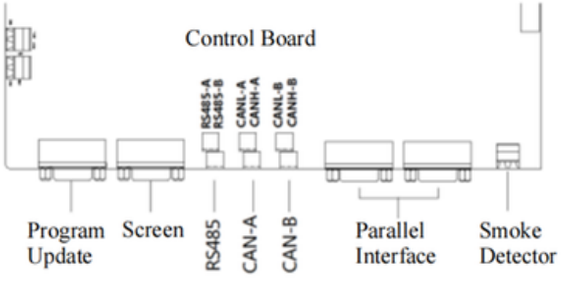
5.4.5 Connecting fan power cables

The top fan of JBL-PBD-250 requires AC-220V AC for power supply, and AC-220 needs to be connected to the position of the relay below. After the connection is completed, the relay switch needs to be turned on.



5.5 Communication

The Jebel ESS PBD series uses a variety of communication methods.



● **RS485 Monitoring and communication**

1. Energy storage controller and energy storage controller through RS485 line communication, and finally connected to our company's JBLOG "through the network upload to the server, can remotely monitor the real-time operation of a single/multiple energy storage controller. The two ends of the RS485 communication cable use wiring terminals, the two ends of the parallel wiring terminals to make RS485 communication cable, the true length should not exceed 1000 meters, in order to ensure the transmission quality, please use the special twisted pair shielded communication cable. The 4Bt flag port of the energy storage controller is located in the internal control board of the machine, please distinguish "A ", "B ".

2. If JBLOG is not used for monitoring, the user's own monitoring equipment needs to be compatible with Jebel ESS's 485 communication protocol.



● **PBD-CAN communication**

1. When the energy storage controller is used with the PBD, it needs to communicate with the PBD. The Can-B communication interface of the PBD is connected to the energy storage controller Can-B.

2. The position of the communication interface of the PBD is the same as that of the energy storage controller series. Please distinguish "L" and "H". Incorrect connection may cause normal communication.

● **BMS-CAN communication**

1. When the energy storage controller is equipped with the energy storage battery with BMS management system, it needs to communicate with the BMS. The energy storage controller and BMS communication sampling CAN communication mode. The CAN communication interface of the BMS is connected to the CAN-A of the energy storage controller, and communication CAN be realized after docking with the communication protocol.

2. Terminals are used at both ends of CAN communication cable, and parallel terminals are connected to make CAN communication cable. It is recommended to use special shielded communication cable to reduce communication interference and improve the stability of system operation

3. The CAN-A interface of the energy storage controller is located on the internal control board of the machine. Please distinguish between "L" and "H". Incorrect connection will cause failure of normal communication.

4. If the user does not use the BMS battery system produced by Jebel ESS, the user's own BMS battery system needs to be compatible with Jebel ESS's BMS communication protocol.

● **Parallel communication (parallel customized special)**

1. When two energy storage controllers of the same model are used in parallel, parallel communication is required. The parallel communication adopts DB9 communication wire connection, which is a random accessory when the parallel system is used. The parallel scheme has a special parallel interface.

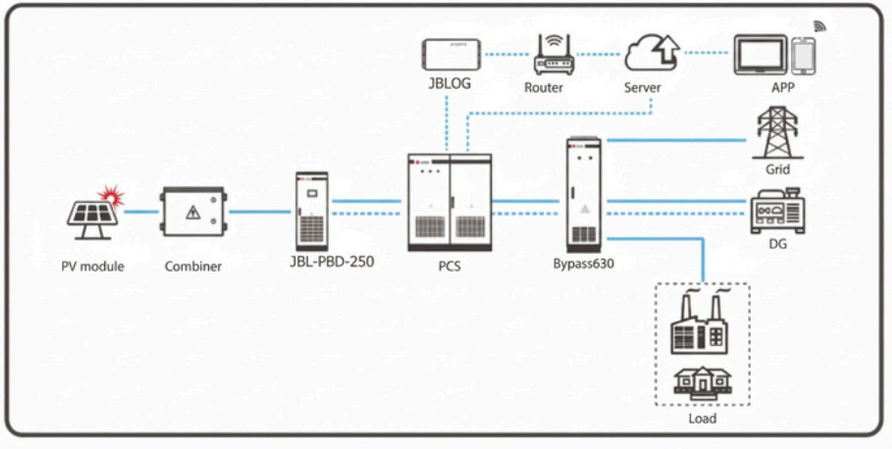
2. In parallel use, the DB9 communication line is used to connect the parallel interfaces of the two energy storage controllers. One of the two parallel interfaces on the control board can be selected, which is the reserved interface.

The parallel function is a special function, please set and enable this function under the guidance of Jebel ESStechnicalpersonnel.

5.6 Single and Parallel system Cable and CAN communication cable

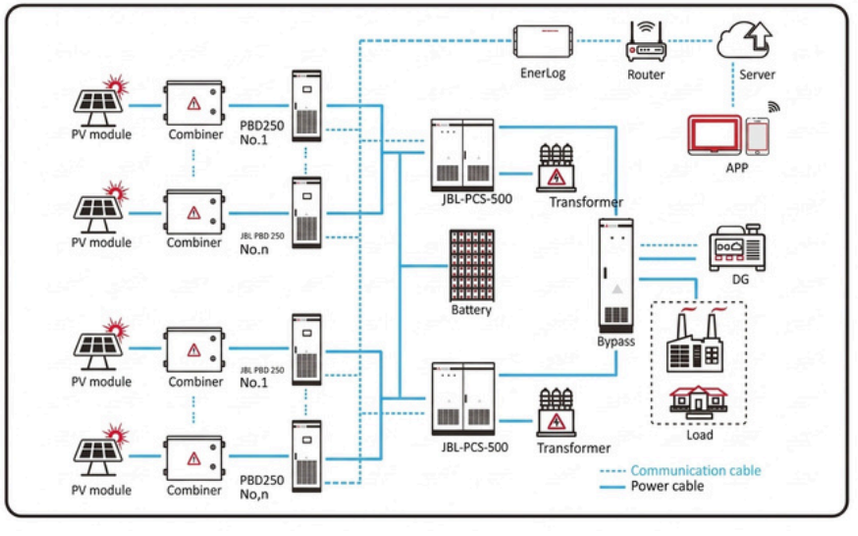
5.6.1 Connecting Cables to the single System

The following is the system wiring diagram of single-machine PBD with PCS energy storage machine:

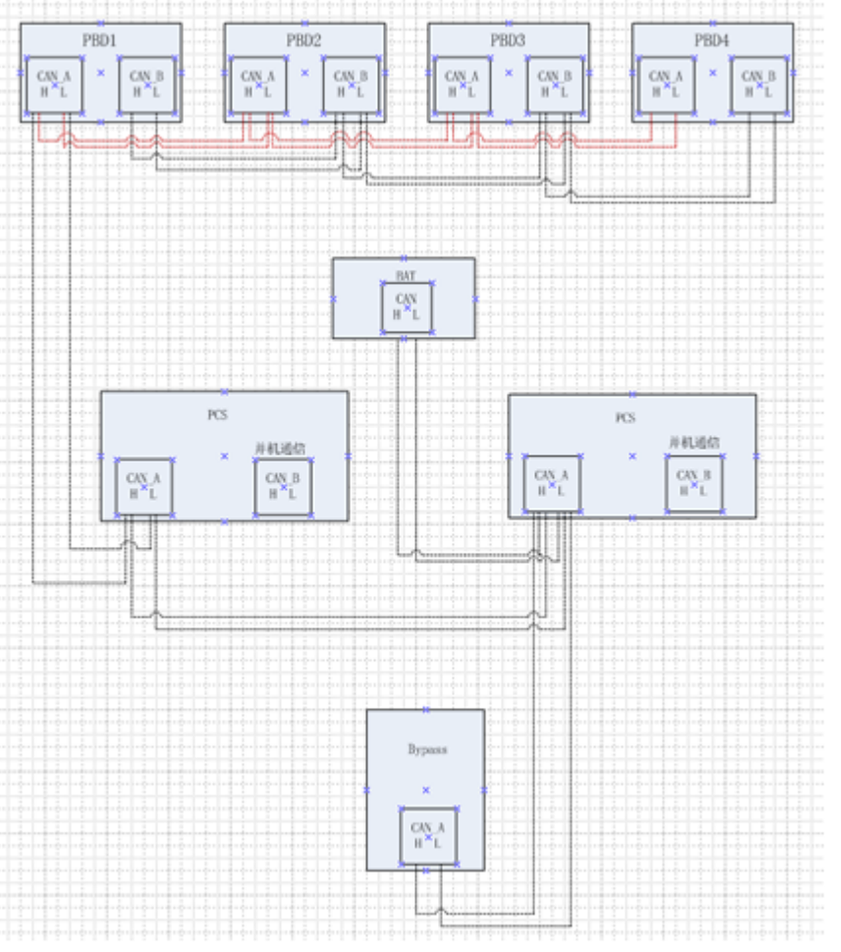


5.6.2 Connecting cables for parallel system and CAN communication

The wiring diagram of 4 PBD parallel systems with 2 PCS parallel systems is listed below. The output ends of multiple PBDS are connected together and then connected to the PCS battery end.



The following picture shows the wiring diagram between the CAN communication of the above system, including the connection mode and port of CAN communication when multiple PBDS are combined. If there is only one or more PBDS, the CAN connection port remains unchanged, and the port above the connection to PCS remains unchanged.



6 Power on the PCS for the first time

6.1 Check before running

Before the PBD is put into operation, its installation should be inspected by at least two staff members following the items listed in the following table to ensure that the installation is correct.

Mechanical installation item inspection

- PBD no deformation, damage condition
- The bottom of PBD is fixed and the support is stable and reliable
- The PBD is surrounded by plenty of space
- The temperature, humidity and ventilation conditions of the environment in which PBD is located meet the requirements
- Cooling air circulation is smooth
- Cabinet seal protection is complete and reliable

Electrical installation inspection

- Complete and solid PBD grounding
- The battery voltage matches the rated output voltage of the PBD
- The PBD DC input and output are correctly connected to the positive and negative terminals, and the tightening torque meets the requirements
- Connect the cables correctly and keep a certain distance from other cables
- Cable numbers are marked correctly and clearly
- The insulation protective cover is complete and reliable, and the hazard warning label is clear and firm

Other checks

- Tighten all useless conductive parts with insulating cable ties
- There are no remaining tools, parts, conductive dust from drilling, or other foreign objects inside the cabinet
- There is no condensation of moisture or freezing inside the cabinet

6.2 Power On

The PBD uses DC power supply.

- **Battery powered**

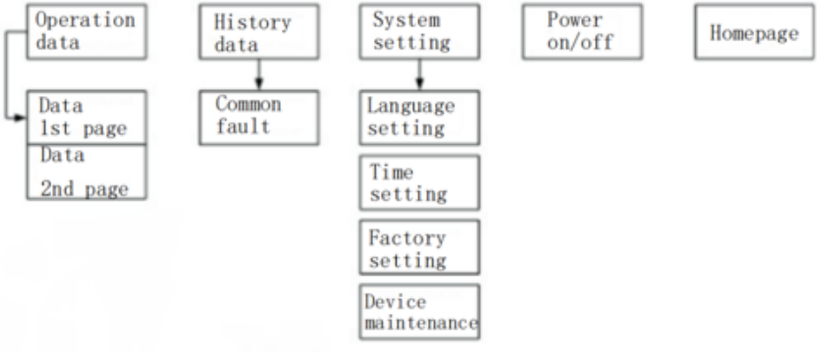
Power on can use battery power, close the battery circuit breaker, LCD should light up.

Do not turn on the device immediately after power-on. Check the fault information page and check whether the operation Settings meet the actual conditions. For details, see Chapter 7.

Man-Machine Interface 7

7.1 Introduction to Touch Screen

You can view the PBD running information and set the PBD running parameters on the LCD touch screen. In order to facilitate operation, the following provides the logical structure distribution diagram of the LCD menu.



PBD LCD menu logical structure distribution

After the LCD is powered on, the startup screen is displayed. The home screen is displayed in about 15 seconds. At this time, you can start to operate related keys to consult information and set parameters.

The upper right of each page displays the communication status between the LCD and the PBD control board (√ when the communication is normal, × when the communication is faulty), the station number of the communication terminal where the PBD is located, the system time, etc.

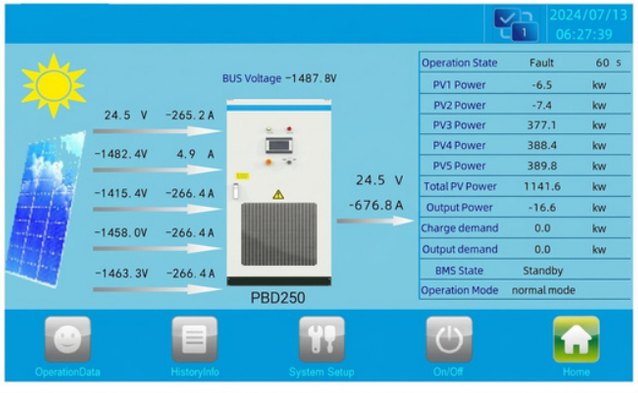
There are five common function keys at the bottom of each page: "Running data", "historical data", "System Settings", "switch on and off" and "Home". Through these five commonly used keys, users can easily and quickly operate. The submenu buttons corresponding to the above five commonly used keys are displayed on the left side of the interface. The selected buttons are marked in green.

7.2 Touch Screen Operations

7.2.1 Home Page

Click the "Home page" button under any other interface to enter the page.

In this page there are: equipment running status, input and output voltage, current and other information. You can switch to other pages by using common function keys at the bottom of the LCD.



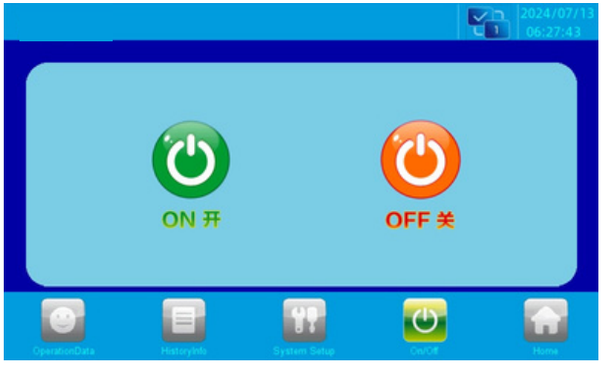
7.2.2 Switch on/Off page

Click [Switch on/off] button in any other interface to enter the page.

In this page there are: power on button, power off button. It is used to select startup or shutdown operation.

Power ON: You must turn the start knob to ON and then click "ON" to power on successfully.

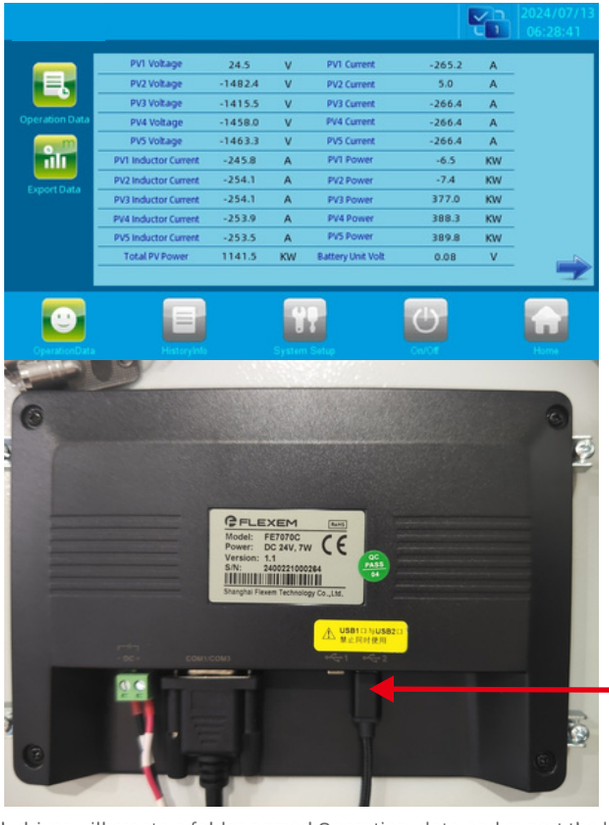
Power off: You can click "OFF" to shut down, or you can directly turn the start stop knob to OFF to shut down.



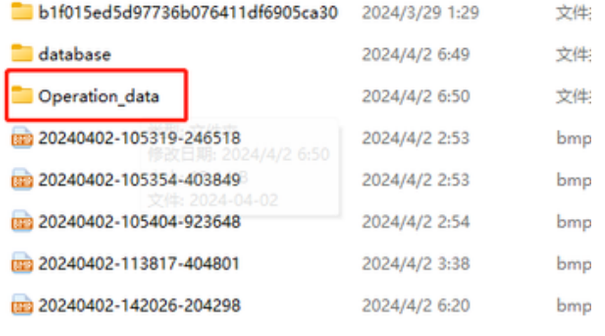
7.2.3 Running data

Click the "Operation data" button at the bottom of any other interface to enter the "operation data" menu.

Export data: Find the USB interface at the back of the screen, insert the USB flash drive, click the data export submenu, and export the seven days of PBD running data to the USB flash driver.



The USB flash driver will create a folder named Operation_data and export the live run data saved in the LCD memory as an Excel file and import it into the folder



Operation data: Displays the current energy storage power generation parameters and real-time data, including photovoltaic voltage and current, battery voltage and current, output voltage and current, current power, temperature in the chassis, and total power generation time (real-time update).







7.2.4 System Settings

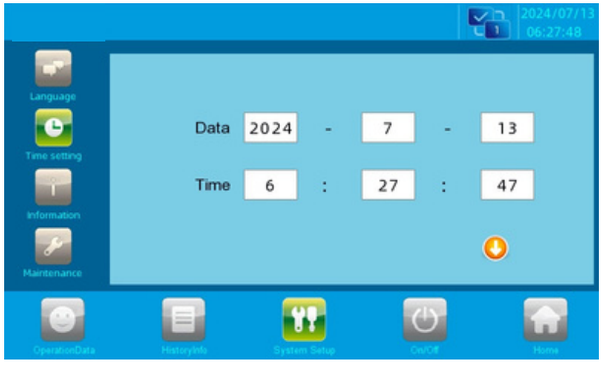
Click [System Settings] button in any other interface to enter the submenu of "System Settings".

The sub-menus include: language setting, time setting, device information, device maintenance. Press the button on the left side to enter the corresponding sub-menu interface. The "Language Settings" interface is displayed by default.

Language Setting: Select the interface language under this page. Currently, onlyChinese and English are supported.



Time Setting: Set the system time on this page. (If the time and date displayed on the LCD are different from the actual local time and date, you can change them here.)



Device information: This page displays the manufacturer, serial number, software and hardware version information, and factory date information. The information cannot be modified.



Device maintenance: This interface requires a password to log in, and the password is provided by technical support. Only electricians or maintenance personnel who are fully familiar with the composition and working principle of the entire device system can operate this operation, so as to avoid damage to personal safety and PBD performance. Please exercise caution.

After entering the correct password, you can enter the submenu of "Equipment Maintenance". The sub-menus are: Protection parameters, calibration parameters, power grid management, factory Settings. The "Protection Parameters" screen is displayed by default.

1.Protection Parameters:



This page for the machine protection parameter Settings, such parameters will be set in the machine factory, need to change, to confirm with the professional can be changed.

MPPT voltage upper and lower limits: the selection range of photovoltaic voltage, the highest open circuit voltage of photovoltaic configuration is less than the upper limit value, photovoltaic voltage is less than the lower limit value, will stop photovoltaic output, the need for reasonable configuration of photovoltaic panels.

PV voltage upper limit: PV voltage is higher than the set value, the machine will report PV over-voltage fault, the machine can not run.

Upper and lower limit of output voltage: If the output voltage is higher than the upper limit or lower than the lower limit, the fault will be reported and the operation will stop.

Upper limit of PV current, upper limit of PV inductance current, upper limit of output inductance current, upper limit of output current: If the current exceeds the set value, the corresponding fault information will be reported and the machine will stop running.



This page for the machine protection parameter Settings, such parameters will be set in the machine factory, need to change, to confirm with the professional can be changed.

Check Time: When the machine is powered on, it needs to detect the time, which determines whether the machine is successfully soft started. After the inspection time is over, the contactor is sucked, the machine is successfully powered on, and the machine enters the normal working state.

Output Power upper Limit: the upper limit of the external output power of the machine, using the percentage setting, the maximum output power is the set upper limit.

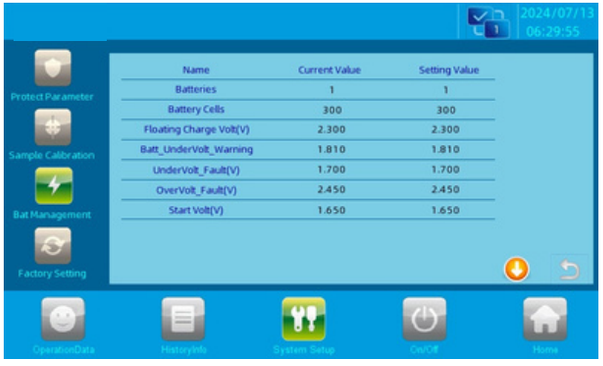
PV starting voltage: The minimum voltage value for MPPT to track.

PV start power: If PV is less than this power, restart MPPT for tracking.

Output power setting: Set this value when PBD is running EMS mode, and the maximum output power of PBD is output according to this value

Bus voltage protection: If the bus voltage is higher than the set value, the machine will report the bus over-voltage fault and stop running.

Module over-temperature protection value: If the module temperature is higher than the set value, the machine will report the PV module over-temperature fault and stop the operation.



The page will be set via the technical protocol before leaving the factory

This page is the battery parameter setting page, battery is an important part of the energy storage control system, battery parameters need to be carefully confirmed to be consistent with the actual situation, (if there are different battery parameters, contact professionals to set).

Number of battery strings: The number of battery components in parallel. If 2V/200Ah, 240 string 2 parallel, then the number of packs is 2.

Number of battery cells: The number of batteries in each string of battery assemblies. If 2V/200Ah, 240 string 2 parallel, then the number of cells is 240.

Floating charge voltage setting: The voltage value of the floating charge cell of the battery. When the battery cell voltage reaches this set point, the number of PBD output is 0.

Battery undervoltage alarm: The cell voltage value when the battery undervoltage alarm is generated. When the battery unit voltage reaches the undervoltage alarm point, the PBD reports an undervoltage alarm.

Battery undervoltage protection: the value of the cell voltage when the battery undervoltage protection. When the battery voltage reaches this set point, PBD will protect and stop.

Battery overvoltage protection: the overvoltage unit voltage value of the battery, when the battery voltage reaches this set point, PBD will protect and stop.

Battery starting voltage: PBD can only start when the PBD battery cell voltage is higher than the starting voltage.

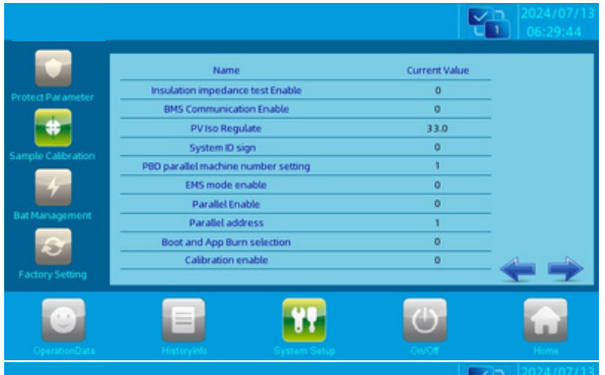
The unexplained parameters are factory default parameters. Do not modify them.

If the plan is changed later, please modify the parameters under the guidance of Jebel ESS staff.

2. Calibration parameters:



This page is the calibration value of the sampling coefficient, when the sampling is inaccurate, you can calibrate through the value, strictly prohibit customers to calibrate the coefficient, when the sampling is inaccurate, you need to contact professionals for operation.





Allowable modification points:

BMS communication Enable: When the battery has BMS communication, set it to 1; Otherwise, set it to 0.

System identification identifier: The parameter is set to the same value when the PBD of the same energy storage system is combined.

PBD parallel number setting: the number of PBDS in the system.

Parallel enable: If a system has multiple PBDS, set this parameter to 1.

Parallel address: This is the address at which the PCS receives PBD data and must start with 1.

3.Factory Settings:



Serial number: The serial number of the equipment, generally recorded on the machine nameplate.

Safety setting: Safety selection, default parameters, do not modify.

Model setting: Select the model of the energy storage controller, please choose according to the actual model, do not modify at will. Due to slight differences in the design of different models, model errors will lead to failure to start and clear parameter Settings, to avoid unnecessary losses. If you need to modify the parameters due to special reasons, please modify under the guidance of Jebel ESS after-sales personnel. The modification takes effect after the model is restarted.

Set the number of the communication station: If the RS485 communication needs to be performed, the 485 address needs to be changed.

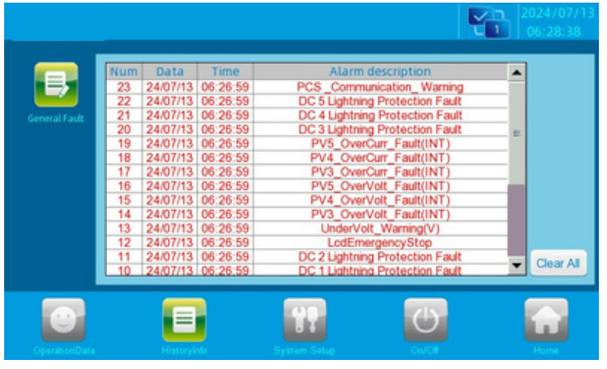
The parameters on this page are important parameters and factory preset parameters. Please do not modify them without the consent of Jebel ESSpersonnel.

> The page without explanation is factory preset parameter. Do not modify it.
>
> If the plan is changed later, please modify the parameters under the guidance of Jebel ESS staff.

7.2.5 Historical Data

Click the "Historical Information" button at the bottom of any other interface to enter the "historical data" submenu.

The submenu is: Common history failures.



Common History failures: Slide the progress bar up and down to see all the details of common history failures. Delete to clear the table.

See Table 7.3 for more information on common failures.

7.3 CD Display Information Schedule

Fault Information Record

No	Information	
	English	Chinese
1	PV_Inverse_Failure	Pv接反永久故障
2	EEPROM_Write_Failure	EEPROM写永久故障
3	EEPROM_Read_Failure	EEPROM读永久故障
4	MainContactor_Failure	主接触器永久故障
5	RISO_Failure	绝缘阻抗永久故障
6	PV1_VoltHigh_Fault	PV1过压故障
7	PV2_VoltHigh_Fault	PV2过压故障
8	PV1_CurrHigh_Fault	PV1过流故障
9	PV2_CurrHigh_Fault	PV2过流故障
10	BAT_OverVolt_Fault	电池过压故障
11	BAT_UnderVolt_Fault	电池欠压故障
12	OUT_OverVolt_Fault	输出过压故障
13	OUT_OverCurr_Fault	输出过流故障
14	PV_L1_OverCurr_Fault	PV电感1过流故障
15	PV_L2_OverCurr_Fault	PV电感2过流故障
16	BMS_Communication_Fault	BMS通讯故障
17	BMS_Fault	BMS故障
18	PV_L1_OverCurr_Fault(INT)	PV电感1过流故障(INT)
19	PV_L2_OverCurr_Fault(INT)	PV电感2过流故障(INT)
20	OUT_L1_OverCurr_Fault(INT)	输出电感1过流故障(INT)
21	OUT_L2_OverCurr_Fault(INT)	输出电感2过流故障(INT)
22	PV1_OverVolt_Fault(INT)	PV1过压故障(INT)
23	PV2_OverVolt_Fault(INT)	PV2过压故障(INT)
24	BAT_OverVolt_Fault(INT)	电池过压故障(INT)
25	OUT_OverVolt_Fault(INT)	输出过压故障(INT)
26	BUS_OverVolt_Fault(INT)	母线过压故障(INT)
27	PV1_OverCurr_Fault(INT)	PV1过流故障(INT)
28	PV2_OverCurr_Fault(INT)	PV2过流故障(INT)
29	OUT_OverCurr_Fault(INT)	输出过流故障(INT)
30	PV_L3_OverCurr_Fault(INT)	PV电感3过流故障(INT)

No	Information	
	English	Chinese
31	PV_L4_OverCurr_Fault(INT)	PV电感4过流故障(INT)
32	PV_L5_OverCurr_Fault(INT)	PV电感5过流故障(INT)
33	PV1_OCP_Fault	PV电感1过流故障（Trip）
34	PV2_OCP_Fault	PV电感2过流故障（Trip）
35	PV3_OCP_Fault	PV电感3过流故障（Trip）
36	PV4_OCP_Fault	PV电感4过流故障（Trip）
37	PV5_OCP_Fault	PV电感5过流故障（Trip）
38	DC1_Thunder_Fault	直流1防雷器故障
39	DC2_Thunder_Fault	直流2防雷器故障
40	OUT_SoftStart_Fault	输出软启故障
41	PV_Module_OverTemp_Fault	PV模块过温故障
42	LowTemp_Fault	低温故障
43	BUS_Insulation_Fault	母线对地绝缘阻抗故障
44	EPO_Stop	紧急停机
45	KeyEmergencyStop	手动关机
46	LcdEmergencyStop	LCD关机
47	OUT_MainContactor2_Fault	输出主接触器故障
48	PV_Module_OverTemp_Fault	PV模块过温故障
49	Fault_Feedback_Warning	脱扣告警
50	Temp_Derating_Warning	过温减载告警
51	BAT_UnderVolt_Warning	电池欠压告警
52	PCS_Communication_ Warning	PCS通信警告
53	PV3_VoltHigh_Fault	PV3过压故障
54	PV4_VoltHigh_Fault	PV4过压故障
55	PV5_VoltHigh_Fault	PV5过压故障
56	PV3_CurrHigh_Fault	PV3过流故障
57	PV4_CurrHigh_Fault	PV4过流故障
58	PV5_CurrHigh_Fault	PV5过流故障
59	PV_L3_OverCurr_Fault	PV电感3过流故障
60	PV_L4_OverCurr_Fault	PV电感4过流故障

No	Information	
	English	Chinese
61	PV_L5_OverCurr_Fault	Pv电感5过流故障
62	PV3_OverVolt_Fault(INT)	PV3过压故障(INT)
63	PV4_OverVolt_Fault(INT)	PV4过压故障(INT)
64	PV5_OverVolt_Fault(INT)	PV5过压故障(INT)
65	PV3_OverCurr_Fault(INT)	PV3过流故障(INT)
66	PV4_OverCurr_Fault(INT)	PV4过流故障(INT)
67	PV5_OverCurr_Fault(INT)	PV5过流故障(INT)
68	DC3_Thunder_Fault	直流3防雷器故障
69	DC4_Thunder_Fault	直流4防雷器故障
70	DC5_Thunder_Fault	直流5防雷器故障

7.3.1 Troubleshooting Methods and Steps After a fault occurs

The following is the troubleshooting procedure:

1. Observe the fault information on the screen.

2. Observe the operating data of the screen for any anomalies.

3. If the running data appears normal, try restarting the screen. Whether the machine can restart, if the machine can restart, the fault has been eliminated. If the operating data shows an anomaly, see if there is a way to measure the actual value and then contact a professional.

4. If step 3 does not turn the machine back on, power it on again and then turn it back on again.

5. If you cannot restart the machine again, the fault cannot be automatically eliminated and you need to contact a professional.

Note: When the machine fails, the customer needs to record the working condition of the machine failure clearly, such as: the machine runs in the grid or off the grid, how much load, etc.; This is convenient to troubleshoot the problem; If the machine has a serious fault, such as: circuit breaker to break, please contact the professional, do not restart.

Run the Machine 8

8.1 Run on startup steps

After the installation and system Settings are checked, you can start up and run.

● First run

Perform the following steps for the first run:

1. Close PBD_PV, battery, OutPut, and power supply microbreak switches.

2. Check whether the sampled data on the screen is abnormal and consistent with the actual data;

3. After the check is correct, turn the knob switch to "ON", click "Start" on the LCD "Switch on" page, and wait for the machine to enter "running mode";

4. When running, observe whether the screen display data is normal, whether there is fault information, whether the machine has abnormal sound and odor; If there is any abnormal situation, please stop the machine immediately for inspection.



Warnings!

When checking, it needs to be powered off to ensure the machine does not exist power supply, please be safe.

Manual shutdown

In the working process, you can click the shutdown button on the LCD, or directly turn the knob switch to "OFF", PBD stops working.



Warnings!

1. After manually shutting down the device by clicking the LCD Shutdown button, you must manually turn it ON via the Power button (ON) on the LCD; Turn OFF through the knob switch to "off", first turn the PBD knob switch to "ON", click the "on" button in the LCD "switch on" page to turn on, otherwise PBD can not automatically turn on.

2. PBD is still charged after manual shutdown.

8.2 Complete the test run

Perform the following test steps after PBD is running:

Step 1: Check whether there is any abnormality in PBD, such as excessive noise, excessive heat, abnormal odor or smoke.

Step 2: Measure whether the output voltage and current of PBD are stable.

Step 3: Operate the LCD to check whether the working display is normal and accurate.

Step 4: Test whether it conforms to the preset operation logic.

At this point, the PBD trial operation process is complete, and you can enter the daily operation and maintenance process.

8.3 Shutdown and power-off Procedure

Warnings!

After the PBD is completely powered off, the PBD will still be live, be sure to completely disconnect all external connections and wait at least 5 minutes if you need to do so.

1. Turn OFF the knob switch by turning it to "Off".
2. Disconnect the DC total input switch PV input and Battery input.
3. Disconnect the output switch output.

Warnings!

It is normal for the PBD to generate an alarm during the power-off process. You can continue with the power-off procedure.

9.1 Routine Maintenance

9.1.1 Maintenance and repair

All maintenance and repair operations on the PBD can only be performed when the PBD is safely disconnected from the PV module, battery module, power grid, when it is confirmed that these power sources will not be connected again and wait at least 5 minutes or more.

Only professional technicians who are familiar with the operation of the system should perform such operations.

- **Break circuit breaker**

Operate the PV input and Battery input DC switches to disconnect the PBD from the PV module and the battery module, and operate the output switch to disconnect the PBD from the outside. Make sure the PBD is not accidentally reconnected. Use a multimeter test to make sure the device has been disconnected and that there is no voltage. Even if the PBD has been disconnected from the main power supply and the battery and photovoltaic modules, some components (such as capacitors) in the PBD still have residual voltage, and the discharge is relatively slow. Therefore, after the circuit breaker is disconnected, please wait at least 5 minutes and use a multimeter to measure the safety before continuing the operation.

- **Maintenance and modification**

Only personnel authorized by Jebel ESS are allowed to maintain and modify PBDS, and to ensure personal safety, only use original parts provided by the manufacturer. If you use non-original parts, you will not be able to guarantee compliance with the relevant certification guidelines in terms of electrical safety, EMC, etc.

- **Functional and safety parameters**

Do not change PBD parameters without authorization from your local power supply company and without instructions from Jebel ESS. Unauthorised changes to functional safety parameters may cause injury or damage to the person or PBD, in which case Jebel ESS will not provide warranty service.

Attention!

1. After powering off, wait 5 minutes to confirm that it is safe before performing repair work.
2. Use a multimeter to measure and ensure that it is safe before disassembling.

9.1.2 Replacing the air filter

Clean the dust on the top of the PBD regularly and clean or replace the air intake air filter. Power off the PBD during the process of replacing the air filter.

How to replace the air filter:

The dust filter cotton on the door panel can be directly extracted upward for cleaning and replacement.



In order to ensure the normal operation of PBD, the air filter needs to be cleaned regularly.

9.1.3 Perform regular maintenance

PBDS must undergo regular maintenance work to ensure their normal operation and service life.

Table 7-2 lists the recommended routine maintenance periods and tasks.

Maintenance Items	Cycles
Read the data from the data collector	Monthly
Clean the power module radiator	Monthly
Check the inside of the cabinet for dust, moisture, or condensation	Monthly
Check for loose cable connections and tighten screws if necessary	Monthly
Check warning labels and add or replace them promptly if necessary	Monthly
Manually inspect AC/DC circuit breakers	Monthly
Check the emergency stop button as well as the stop function of the LCD	Monthly
Check the machine for abnormal noises during operation	Weekly
Check the battery assembly for abnormalities, bulges, and smoke	Daily

Table 7-2 Routine maintenance tasks of periodic machines



Ensure that all switches on the DC side of the PBD and battery components are turned off.

After the DC switch of the PBD is turned off, some components of the PBD still have residual voltage. Please wait at least 5 minutes before maintaining the PBD to prevent electric shock!

9.2 Waste Disposal

PBD will not cause pollution to the environment, the component materials and components of the product meet the environmental protection requirements, Jebel ESS according to the environmental protection requirements, users at the end of the use of PBD, shall be in accordance with the local laws and regulations to dispose.

10.1 Product Specifications

Note: JBL-PBD-250 does not have its own battery, the output is connected to PCS DC side or battery

Specifications	JBL-PBD-250
Input (PV)	
Recommended photovoltaic power (KW)	250
MPPT voltage range (V)	480 ~ 850
Maximum input current (A)	500 (100*5)
Number of MPPT	5

Note: When JBL-PBD-250 is configured with photovoltaic and battery, pay attention to the pressure difference before and after the stage, JBL-PBD-250 is a booster circuit, the open voltage of photovoltaic configuration needs to be smaller than the lowest discharge point of the battery, to ensure that the pre-stage voltage will not be greater than the post-stage voltage.

10.2 Jebel ESS Factory Warranty

● **Warranty Period**

The warranty period of this product is five years, if otherwise specified in the contract, the contract shall prevail.

During the warranty period of Jebel ESS products, users should take the initiative to present the invoice and date of purchase to the service personnel of Jebel ESS Company during maintenance. At the same time, the nameplate identification on the product should be clearly visible, otherwise the user has the right not to repair.

● **Warranty per piece**

During the warranty period, Jebel ESS will repair or replace the product free of charge; The customer shall allow Jebel ESS a certain amount of time to repair the faulty machine.

● **Waivers of liability**

Under the following circumstances, the Company has the right not to provide quality assurance:

1.Products without Jebel ESS logo.

2.products or parts have exceeded the warranty period of Jebel ESS materials.

3.Accidents caused by failure to fill the working rings prescribed by the product or wrong installation, storage and use according to the instructions.