PowerBox 512Vdc Lithium Battery User Manual

Introduction

As a world leading manufacturer of Valve Regulated Lead-Acid (VRLA) batteries, CSB's products are utilized in over 52 countries in UPS, telecommunications, emergency lighting, security and more. CSB is committed to developing the next generation energy storage products and growing its worldwide distribution network. The following document describes best practices to observe and implement when handling and operating CSB Energy Technology Co, Ltd Lithium-Ion High Voltage (PowerBox 512Vdc) batteries. All information is subject to change without prior notification. For the latest information, please contact a CSB representative.

Disclaimer

Images contained in this manual are for illustrative purposes only. These images may not match your installation. The operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe operation of the batteries, please contact your local CSB Energy Technologies, Co, LTD office or your nearest CSB representative BEFORE installation of PowerBox. CSB shall not be held liable for any damage or injury involving its batteries or other hardware if used or operated in any manner or subject to any condition not consistent with its intended purpose or is installed or operated in an unapproved manner or improperly maintained.

Product Families	Battery Model Number(s)
PowerBox	PB-320

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List of Parts

Below is the list of each item expected with each PowerBox system. Each shipment is comprised of 3 pallets. 1 pallet will have a battery cabinet and 2 pallets with batteries, 8 modules on each pallet for a total of 16 modules. Please contact your CSB representative if any parts are missing from your delivery.

No.	Part #	Specification	Unit	Quantity
1	PB-320	Battery Cabinet	PCS	1
2	PB-320-M	Battery Module	PCS	16
3	5023000026031	Copper Bar (125*25*4mm) (Negative and Positive Terminals of Modules)	PCS	12
4	5023000030721	Copper Bar-2 (170*25*4mm) (Negative Terminals of Control box and Module #8 of String 1 or 2)	PCS	2
5	5023000026051	Copper Bar-N (174*25*4mm) (Module#4 and Module#5)	PCS	2
6	5023000026041	Copper Bar-B+ (96*25*4mm) (Positive Terminal of String Module #1 and main positive busbar)	PCS	2
7	5013000010631	Metal Handle (Module front panel, Right side module handle at left side)	PCS	16
8	5626000001671	Copper Bar Protective Cover (Between Module#4 and Module#5, Bottom of Module#1)	PCS	4
9	5626000006161	Front Panel Insulation Baffle (Main control box copper busbar protective cover)	PCS	2
10	5007010013971	Screw M3-10 (Baffle fixing screws for Main control box)	PCS	8
11	5006000000271	Screw M8-20 for Busbar (No.4 use 2pcs, No 8 use 4 pcs)	PCS	6
12	5007070000061	Screw M4-10 (No.7 use 2pcs on the cabinet, No 8 use 2 pcs per cover)	PCS	40
13	5007010031201	Screw M4-8 (for installing the Module mounting brackets. 3pcs)	PCS	48
14	5007010047621	Expansion Bolt M12-110 (Floor Mounting)	PCS	4
15	5609050001711	Location Plate (Floor Mounting)	PCS	1
16	5007010045261	Hexagon Socket Screw (Side face of Rack)	PCS	8
17	5099010038721	Double Pass Hex Socket Stud (Side face of Rack)	PCS	4
18	5619100044001	Battery Module Wire Harness (Modules BMU J1 to J1 and J2 to J2)	PCS	12
19	5619100044961	Communication Harness-3 (Module #4 and #5 BMU J1 to J1and J2 to J2)	PCS	2
20	5619100045861	Terminal Harness (end Module #1)	PCS	2
21	5619100061191	Main Control Box External Wiring Harness-2 (to String Module #8)	PCS	2

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1. About This Manual

This manual describes the assembly, installation, operation, and troubleshooting of the CSB PowerBox PB-320 512Vdc Lithium-Ion High Voltage Battery System. Please read this manual carefully before installation and operation and keep this manual for future reference.

Scope

The main components of a LIB battery are (+) positive and (-) negative plates, separator, Metal container, venting structure, electrolyte, and terminals.

Disclaimer

The "Notice", "Attention", "Warning" and "Danger" in this manual do not represent all the safety precautions to be followed but only serve as a supplement to all the safety precautions. CSB does not accept any liability for any violation of the general safe operation requirements or the safety standards for the design, production and use of CSB PowerBox PB-320.

CSB PowerBox must be used in an environment that complies with the design specifications. If installation instructions are not followed properly, equipment faults may occur, and the resulting product function abnormalities, component damage, personal accidents, and property losses are not covered by the quality assurance of the equipment.

When installing, operating, and maintaining the device, comply with local laws, regulations, and safety code enforcement. The safety precautions in this manual are only supplements to local laws, regulations and requirements. Always consult your local electrical code authority prior to installation to ensure compliance.

2. Battery Safety

****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION.** CSB PowerBox PB-320 is made of Lithium Iron Phosphate chemistry, here to referred as Lithium-ion in this user manual. Lithium-ion batteries are potentially dangerous, and proper precautions must be observed in handling and installation. CSB recommends only knowledgeable and trained personnel can be qualified to work on batteries with proper tools and protective equipment. Keep unauthorized personnel away from the batteries during any operations activities. Any deviation from not following these safety guidelines can result in serious injury or death.


Always Wear Eye Protection


Prevent Electrical Shock


No Open Flames Around Batteries


Hazardous Chemicals Present


Batteries Can Explode


Always Recycle, Do Not Throw into Trash


Electrical Hazards

Battery system presents a risk of electrical shock and high current short circuit. The following precautions must be observed when handling CSB Lithium-Ion batteries:

- Store all batteries beyond the reach of children.
- Remove all personal metal objects from your person (watches, rings, etc.).
- Use insulated tools and gloves.
- Never clean battery terminals with wire brush
- Wear full eye protection and rubber gloves.
- Observe circuit polarities.
- Do not make or break live circuits.
- Do not lay metal tools on top of batteries.
- All connection cables should be well insulated and not able to short electrically. If the cables do cause an electrical short, that may cause smoke or the battery to cause a large destructive fire.

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2. Battery Safety

- Prior to handling batteries on a metal rack/cabinet, assure batteries are not inadvertently grounded by observing the ground fault detecting indicator.
- Do not use the Lithium-Ion batteries at a site that can get moist or immersed in water. Doing so can cause the battery's terminals to corrode, and/or cause electrical shock or fire.
- Do not use any dry fabric or other materials to clean the battery that could cause static electricity. Always use a damp cloth that has had the moisture wrung out of it.
- As appropriate, use an insulating blanket to cover exposed portions of the battery system when performing extended maintenance that could result in personal or equipment contact with the energized conductors.
- Certain types of rectifier circuits used in charging the Lithium-ion battery may not include a line-isolating transformer. In these cases, extreme caution must be exercised when maintaining and collecting data on the battery system.
- Lithium-ion batteries are sometimes enclosed in cabinets with very limited access. Again, extreme caution must be exercised when maintaining and collecting measurements on the battery system.
- Always use the proper charger and the charging regulations set by CSB. Not following CSB guidelines and procedures, or using non-approved charging procedures, can cause the battery to leak electrolyte, heat up, or cause a destructive fire.


Fire, Explosion, and Heat Hazards

Lithium-ion batteries can contain an explosive mixture of hydrogen gas and other toxic elements which can vent and explore under overcharging or physical damage conditions.

- Do not smoke, introduce an open flame, spark, or extreme heat in the vicinity of the battery.
- Do not burn the battery or throw it into a fire. Doing so may cause the battery to explode and toxic gas to be released.
- Prior to handling the battery, touch a grounded metal object, such as the rack, to dissipate any static charge that may have developed on the operator's body.
- Do not charge, discharge, or store batteries in a sealed container. The individual battery should proper space between them to allow for proper cooling. If contained, assure the container, cabinet or room has adequate ventilation to prevent an accumulation of potentially vented gas.
- Never use the Lithium-ion battery together with other types of batteries, such as dry cells and nickel-cadmium batteries. Doing so can cause explosions, fires, or bodily injury.
- When the battery approaches the end of its life, its performance will decrease very fast. The internal exhausted electrolyte may cause a failure. If the battery continues in operation under these conditions, there could be extreme heat, leaking of even explosion.
- If there is any corrosion, cracking, deformation, heat generation, or other abnormalities to the Lithium-ion battery upon its first use after purchase, do not use it. Please call the location where it was purchased. Using the battery with an abnormality can cause the battery to leak fluid, generate heat or explode.

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2. Battery Safety

Battery Chemical Hazards

- Any gelled or liquid emissions from a Lithium-ion battery is electrolyte that is harmful to the skin and eyes. The electrolyte is also electrically conductive and corrosive.
- If the electrolyte contacts the skin, wash the area immediately and thoroughly with water. If electrolyte enters the eyes, wash eyes thoroughly for a 10-minute period with clear water or a special neutralizing eye wash solution and seek immediate medical attention.
- Neutralize any spilled electrolyte with the special solution contained in a "spill kit" or with a solution of 1 pound of bicarbonate of soda to 1 gallon of water.
- Do not disassemble, reassemble, or destroy the battery. Doing so could cause the acid inside the battery to leak and cause severe burns or other accidents.

Battery Recycling and Disposal
Lithium-ion batteries are to be recycled. Batteries contain trace elements of lithium carbonate, iron, and phosphate. Dispose of the battery in accordance with local regulations. Do not dispose of the battery in a landfill, lake, or other unauthorized location.

3. Transportation and Storage

Storage
If the system will not be used for an extended period, power it down according to the "System Shutdown" procedure and store it with a state of charge (SOC) of 45 % ± 5 % at an ambient temperature of 5 °C – 30 °C.

- Recharge the system every 6 months to restore the SOC to 45 % ± 5 %.
- Once every 12 months, perform a full aging cycle followed by recharging to 45 % ± 5 %.

Failure to perform these periodic recharges or aging cycles or leaving the product in a deeply discharged state without prompt recharging, will shorten the battery system's life and degrade its performance. All consequences arising from such neglect are the user's sole responsibility.

Transportation
During transport, the following requirements must be met:

- Battery modules and cabinets shall be shipped separately.
- Modules must be packed in cartons before dispatch, and the state of charge (SOC) must be kept between 20 % and 50 %.
- Protect the cargo from severe vibration, impact, compression, direct sunlight, rain, and never allow it to be inverted.
- During loading and unloading, handle gently—strictly avoid dropping, rolling, or applying excessive pressure.

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4. System Description

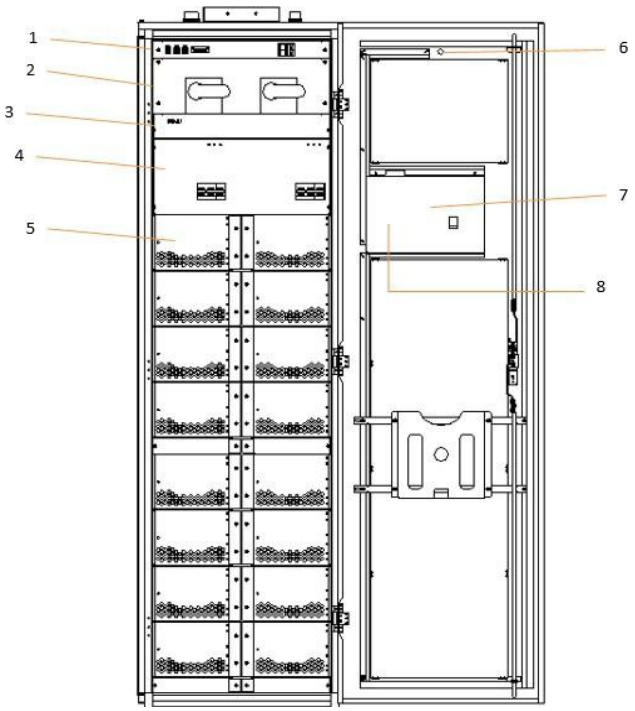
System Description

The CSB PowerBox PB-320 lithium battery energy storage system is arranged as shown in figure below. PowerBox Li-ion battery storage system provides Li-ion battery backup for large and medium power UPSs, and can be matched to UPS battery side topologies with and without N.

The product uses high-cycle performance, excellent charging and discharging characteristics of lithium iron phosphate batteries, with high-rate discharge characteristics, high power density, suitable for large data centers, small and medium-sized data centers and other suitable applications. PowerBox uses modular design, easy to install and maintain; The product can be used in single cabinet (main cabinet only) or multiple cabinets in parallel, and the number of parallel cabinets can be up to 8 (including 16 modules).

Main Cabinet Configuration

1 – Signal Interface (BMS)	5 – Battery Module
2 – PDU	6 – Emergency Buzzer
3 – Monitoring Unit	7 – HMI Screen
4 – Main Control Box	8 – Emergency Stop Button

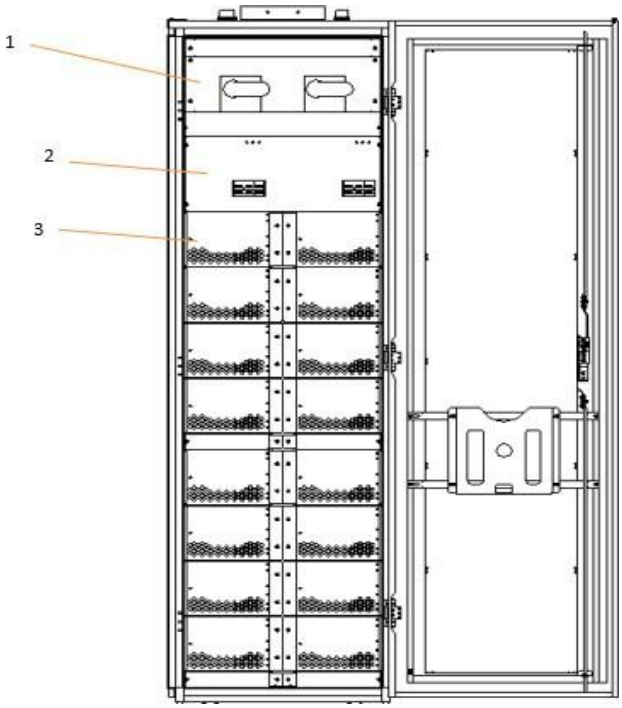


Parallel Cabinet Configuration

PowerBox can connect to eight (8) cabinets fully populated with battery modules. Below is the configuration of parallel cabinets to Main Cabinet.

Parallel Cabinet Configuration

1 – PDU
2 – Master Control Box
3 – Battery Module



PowerBox battery energy storage system consists of a battery module, a main control box, a power distribution unit, a monitoring unit, an HMI display and other components, and the whole is integrated into a 19-inch standard cabinet. Battery modules are connected in series to form a battery module to provide energy. The control box provides centralized battery management. The monitoring unit is responsible for the aggregation of the operating information of each group. The power distribution unit provides power access and abnormal disconnection protection. The HMI display provides parameter setting and status query functions.

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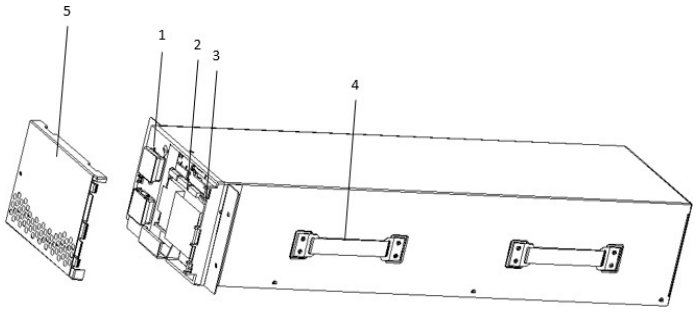
4. System Description

Battery Module

Each CSB PowerBox battery module uses high-rate discharge lithium iron phosphate cells, consisting of 1P20S in series. PowerBox battery modules also contain modular fire protection and battery management unit (BMU).

Battery Module Configuration

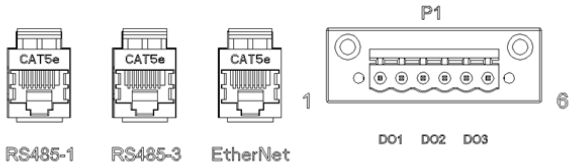
1 – Power Terminals (+/-)	5 – Front Cover
2 – BMU	
3 – Signal Port	
4 – Handle	



Battery Module Specifications

Nominal Voltage	64Vdc
Capacity	70Ah@1C/1C, 100%DOD、25°C
Nominal Charge	≤70A(1C) @25°C
Rated Discharge	≤70A(1C) @25°C
Max. Discharge	≤350A(5C) @25°C
Operating Temp.	0°C~40°C
Humidity	5%-95%RH
Cooling	Natural cooling
Weight	49.5kg
Dimensions	222mm x 850mm x 160mm
Communication	CAN
BMU	Voltage acquisition, temperature acquisition,

Signal Interface Unit (BMS Connections)

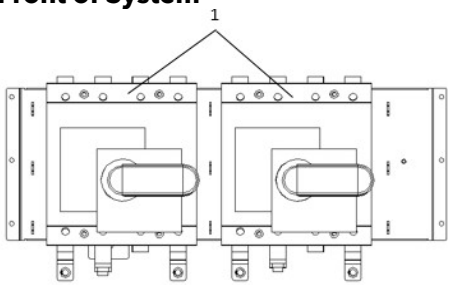


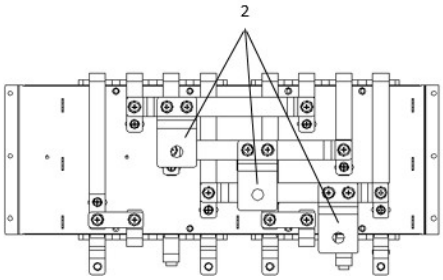
Port	Feature	Details
Ethernet	Connect to background surveillance. 1 of 2	See HMI Page about IP address settings
RS485-1		BMS for parallel unit
RS485-3	Connect UPS, communication interaction	BMS for parallel unit
DO1	Connect UPS, parallel chargers	Dry Contact
DO2	Fault Information	Dry Contact
DO3	Open	Open

Power Distribution Unit (PDU) Layout

1 – Main Circuit Switch	2 – Output Power Connections

Front of System





Back of System

5. System Preparation

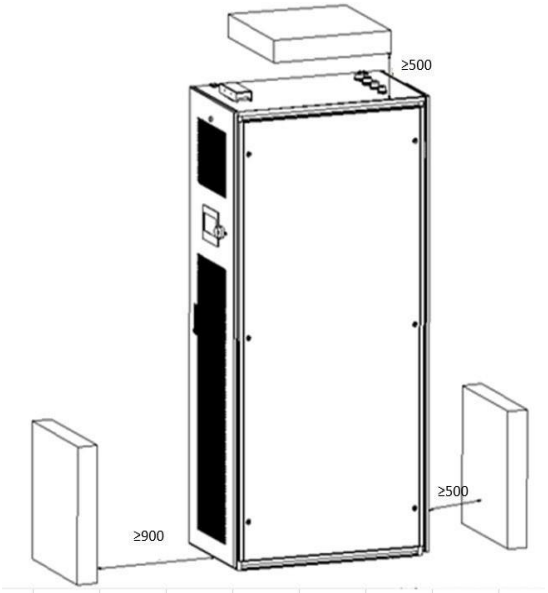
Site Requirements

Do not install CSB PowerBox in extreme temperatures both high (exceeding ____C) and low temperatures (exceeding _____C) or humid places beyond the technical specifications. Keep away from water, heat sources, and flammable or explosive materials. Do not install in an environment with direct sunlight, dust, volatile gases, corrosive substances, and high salt content.

Do not install in an operating environment with metal conductive dust. The bearing capacity of the foundation must be no less than 16kN/ m².

Installation Space

During product installation, space for personnel operation, maintenance, ventilation, and installation space for product outlet cables and inter-cabinet cables must be reserved, as shown in Figure____ below. Reserve at least 500mm cable installation space on the top of the cabinet. Cables between cabinets are routed at the top, and cable troughs are reserved. Reserve at least 900mm space in front of the cabinet for ventilation and operation. Reserve at least 500mm ventilation and operating space behind the cabinet. The cabinet bottom installation base is reserved for fixing the positions based on the cabinet installation holes.



Tools Required

Below is a list of tools required to install CSB PowerBox

- Electric Forklift Truck
- Hand Forklift Truck
- Ladder
- Rubber Mallet
- Hammer Drill
- Insulated Adjustable Wrench
- Drill Hole Opener
- Heat Gun
- Wire Crimping Pliers
- Needle Nose Pliers
- Wire Cutters
- Wire Stripper
- ESD Gloves
- Protective Gloves
- Insulating Gloves
- Insulating Protective Shoes
- Insulated M6 Torque Screwdriver
- Insulated Philips Screwdriver
    - (M3-M8)
- Insulated Flat Head Screwdriver
    - (2mm-5mm)
- Insulated Torque Wrench
    - (M6, M8, M12, M4, M16)

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5. System Preparation

Cable Preparation

The power cables of each cabinet are connected to the bus cabinet or the UPS.

You can calibrate the cables based on the power used routing path, length, and environment. Table below lists the recommended cables and size ratings. Consult your local electrical code authority for further guidance on compliance with cable sizing

Category	Spec.	Junction	Description.
Power	90℃ copper flexible cable single core >600V	+	Double module: ≥240 (mm2); Single battery cabinet load≤ 300kW; Single module: ≥120 (mm2); Single battery cabinet load ≤ 150kW; Connect to the UPS battery side
		N	
		-	
		PE	≥120 (mm2) Connected to the ground network
Comm	CAT 5 shielded 4 x 24AWG shielded twisted pair >300V	RS485-1 RS485-3	Connect to user monitoring platform (optional), UPS communication, Ethernet communication
		Ethernet	
Signal	90℃ copper flexible with 2 cores 0.75 (mm2) shielded twisted pair >300V	DO1	Connect to UPS, chain signal
Supply	90 °C copper flexible cable 2 core 1.5 (mm2) >450V	L1	Connects to the output branch of the UPS
		L2	

Handling and Unpacking

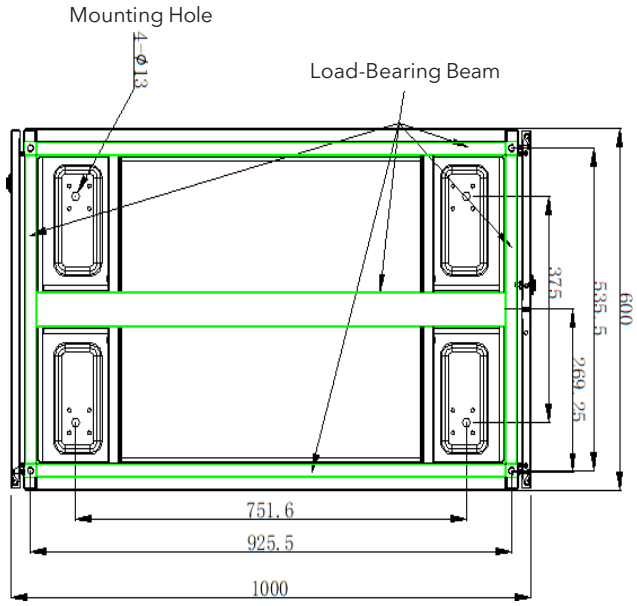
Use a forklift to transport the cabinet and battery module to the specified location. Remove the outer packing of the cabinet. A complete PowerBox system will comprise of 3 total pallets. 2 pallets for battery modules, 1 pallet for the cabinet. Each battery pallet is packed with one pallet of 8 modules.

Visually inspect the cabinet and check whether the cabinet is damaged during transportation. In case of damage, please inform the carrier immediately and reject shipment for acceptance. Contact CSB representative immediately if your shipment is damaged for assistance. Review the shipped packing list to see if the accessories are complete and correct. If you find the shipment is missing or the model does not match, please contact your CSB representative immediately.

After confirming that the cabinet is in good condition, remove the packing tape securing the cabinet and pallet, and remove the bolts securing the cabinet. Move the cabinet to the installation position.

Base Preparation

A prefabricated foundation is required for the cabinet base. Reserve installation holes according to the dimensions shown in figure below



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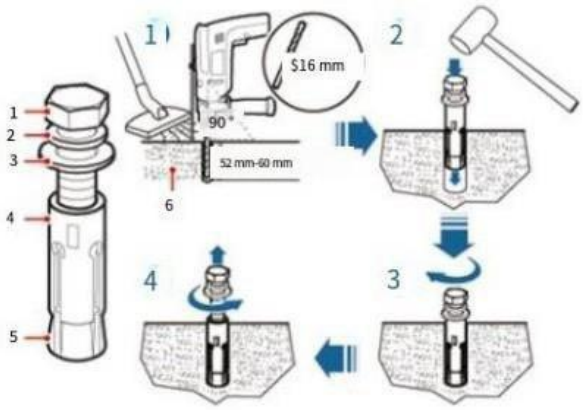
5. System Preparation

Floor Mounting

Mark the drilling positions according to the mounting holes in the cabinet. Use a 16mm impact drill bit to drill holes to a depth of 52-60mm.Slightly tighten the expansion bolt and place it vertically into the hole. Tap the expansion bolt with a rubber mallet until the expansion tube is fully inserted into the hole (no higher than 5mm above the ground). Partially tighten the expansion bolt, remove the bolt, and remove the flat spring washer. Align the cabinet with the installation holes, and secure the cabinet to the corresponding holes using M12x115 expansion bolts, as shown in figure below



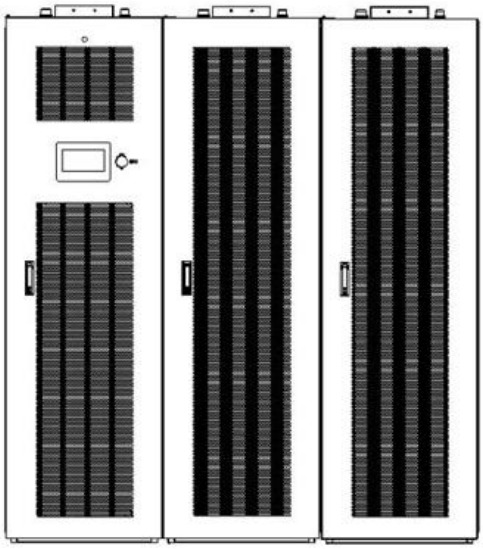
(1) M12 bolts (2) Spring washer (3) Flat pad

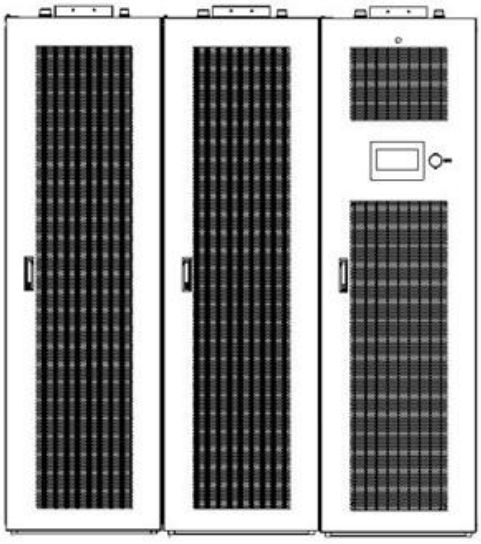
(4) Expansion tube (5) Expansion nut (6) Cement floor

Installing Multiple Cabinets

If multiple cabinets are used together, select one of the preceding installation solutions. There are two modes for installing multiple cabinets: combining cabinets and installing adjacent cabinets. Install cabinets one by one, numbered in sequence.

After confirming that the cabinet is in good condition, remove the packing tape securing the cabinet and pallet, and remove the bolts securing the cabinet. Move the cabinet to the installation position.

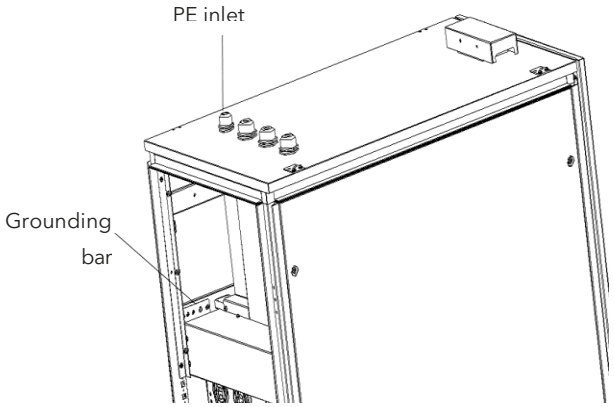




6. Cable Installation

Cable Installation – Grounding

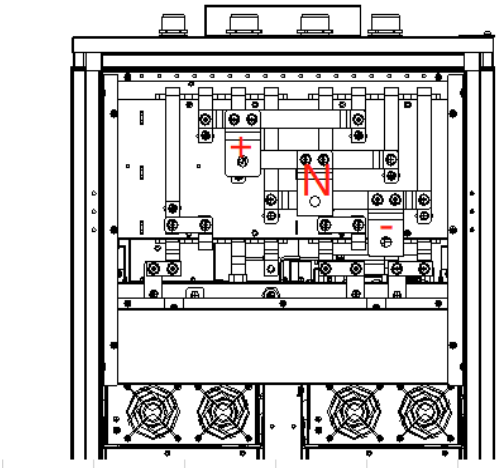
Remove the protective cover of the PDU cabinet at the rear of the cabinet and the square nut of the ground cable hole. Prefabricate ground cables outside the cabinet. Remove the sealant plug from the ground cable based on the size of the ground cable and route the ground cable through the nut and rubber ring. Connect the ground cable to the ground bar in the cabinet, as shown in figure below. The mounting screw is M8*20 with a torque of 22N.m.



Grounding Cable Diagram – Multiple Cabinets

Cable Installation – DC Power

Remove the protective cover plate of the PDU cabinet behind the cabinet and the corresponding power line hole gland nut. Prefabricate the power cable outside the cabinet. Remove the sealing plug of the gland head according to the size of the cable and pass the cable through the gland nut and rubber ring in turn. Connect the cables to the "+", "N", and "-" rows in the cabinet, as shown in figure below. The installation screws of the double-module cabinet are M14*30 with a torque of 135N.m, and the installation screws of the single-module cabinet are M8*20 with a torque of 22N.m.



When multiple cabinets are in parallel, the power cable can be evaluated according to the wiring capacity of the battery side of the UPS to assess whether it is directly connected or needs to be transferred through the convergence cabinet, depending on the site conditions to choose the wiring method. When multiple cabinets are in parallel, the distance from the power cable of the battery cabinet to the UPS or the convergence cabinet should be the same as far as possible, and the difference in length should not be more than 10%.

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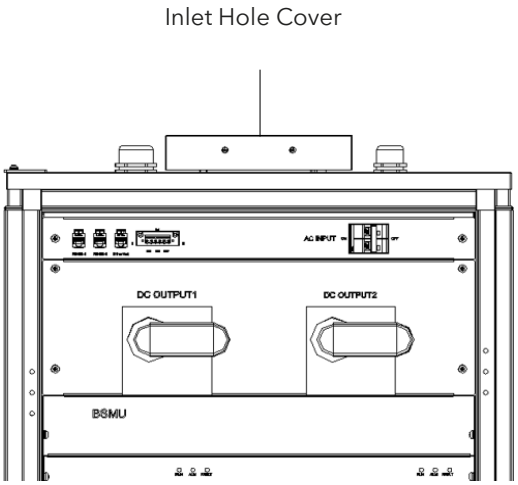
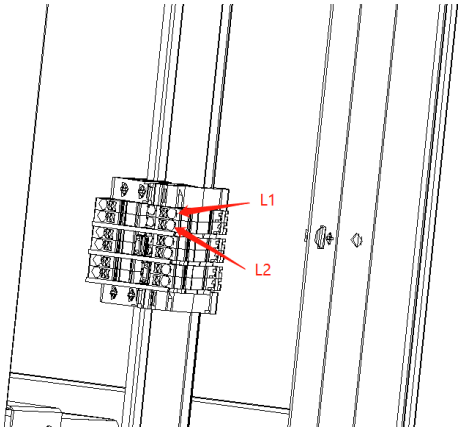
6. Cable Installation

Cable Installation – AC Power

Remove the protective covers from the front and rear panels of the PDC and the cable entrance holes on the top of the cabinet, as shown in Figure below

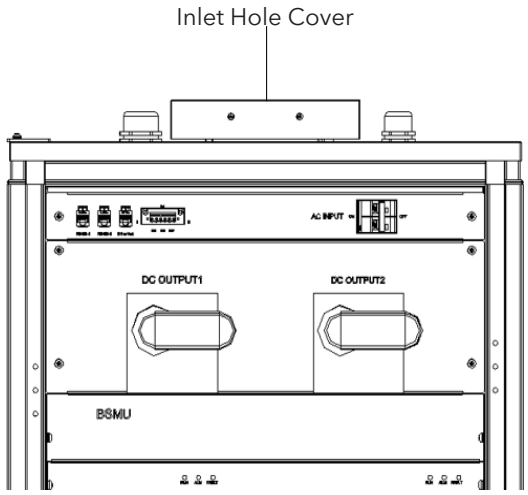


Prefabricate the power supply harness outside the cabinet. Use E1512 tubular terminals for terminals. Route the power cable through the signal cable hole and route the power cable from the front of the cabinet to the terminal block at the rear of the cabinet. Connect the cable to the secondary circuit of the UPS output side (220V). The circuit breaker provides leakage protection. The power supply cable is connected to the terminal block as shown in the figure. Do not close the switch before wiring! Restore the removed protective panel.



Cable Installation – Communication

Remove the protective cover from the cable inlet hole on the cabinet top, as shown in Figure



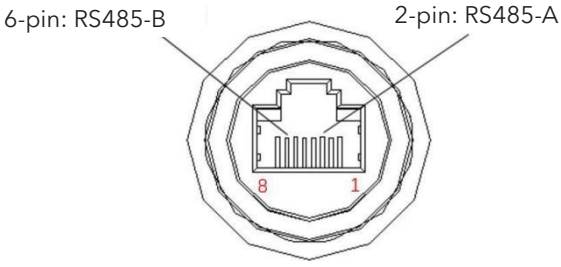
Bind cables near the edge of the cabinet. Connect to the corresponding port as required:

Install signal cables for UPS chain dry contacts

- Connect the start-stop signal cable with the UPS chain charger to port "DO1", and the signal is normally open dry contact; When the battery system is full, it changes from a normal open point to a normal closed point. Cable terminals use E7510 tubular terminals.

Install the UPS communications cable

- When the battery system communicates with the UPS, connect the communication cables to ports PIN4-RS485A and PIN5-RS485B on the panel. An RJ45 connector is used for the cable terminal. Figure shows the pin：



6. Cable Installation

Cable Installation – Communication (Cont.)
The BMS monitoring platform can communicate via RS485 or Ethernet：

- Connect cables to ports PIN4-RS485A and PIN5-RS485B on the panel for RS485 communication. Use RJ45 crystal head terminals.
- Connect the cable to the ETHERNET port on the panel for Ethernet communication. Use RJ45 crystal head terminals.
- Install the signal monitoring harness. Connect the battery status monitoring signal cable to the DO2 port on the panel. The signal is a normally open dry contact. The normally open dry contact changes to the normally closed dry contact when the system is faulty. Cable terminals use E7510 tubular terminals.

7. Battery Module Installation

Battery Module Safety
****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION.**

- Wear insulated gloves and use insulated tools when performing installation work.
- Battery modules are heavy and require 2 people to lift properly to insert into racking system.
- Place the battery module from bottom to top and from left to right to prevent the center of gravity from tipping too high. Install only the left side of one module. Use a filler panel to protect the right side.
- Use a multimeter in DC voltage mode to measure the positive and negative voltage of the battery module. The value ranges from 54V~69Vdc.

Battery Module Safety
****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION.**

- Use the DC voltage setting of a multimeter to measure the voltage between the positive and negative electrodes of the battery module and the conductive metal body of the cover or the ground point. If the voltage is stable and lower than 5V, the battery module is properly insulated.
- The voltage between the positive and negative electrodes of the battery module ranges from 54V~69Vdc. Cover or insulate the battery module with a protective cover during assembly.
- The cabinet has been secured with a solid foundation. Do not install a battery module on the pallet for commissioning or normal operation
- Each battery module pallet contains eight battery modules. Each battery module cover is pasted with groups (A-Z), corresponding to one module system. It is installed in one cabinet (main cabinet or slave cabinet).
- Battery modules between pallets can be installed in one cabinet regardless of group order. For example, group A can be installed in secondary cabinet 2, Group B in primary cabinet, and Group C in secondary cabinet 1.

Examples for battery module serial numbers:

- SN code: ***** (subject to actual printing)
- Label on battery module pallet: ***** (SN code) -A
- Label outside the battery module: ***** (SN code) -A
- Label battery module: ***** (SN code) -A

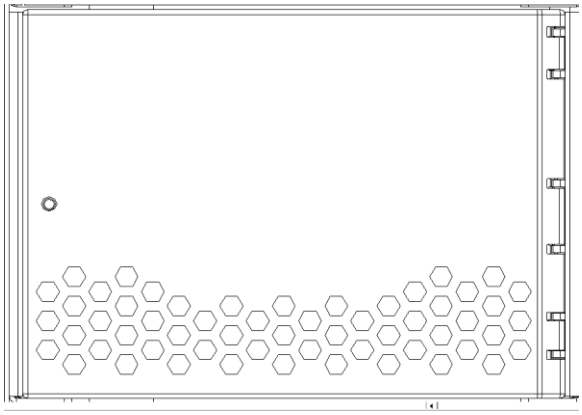
PowerBox 512Vdc Lithium Battery User Manual

7. Battery Module Installation

Setup of Battery Module

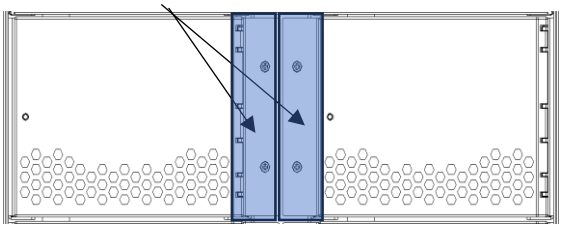
Take the battery module out of the package. Each module will be individually packaged and come 8 per pallet in individual boxes.

Front of Battery Module



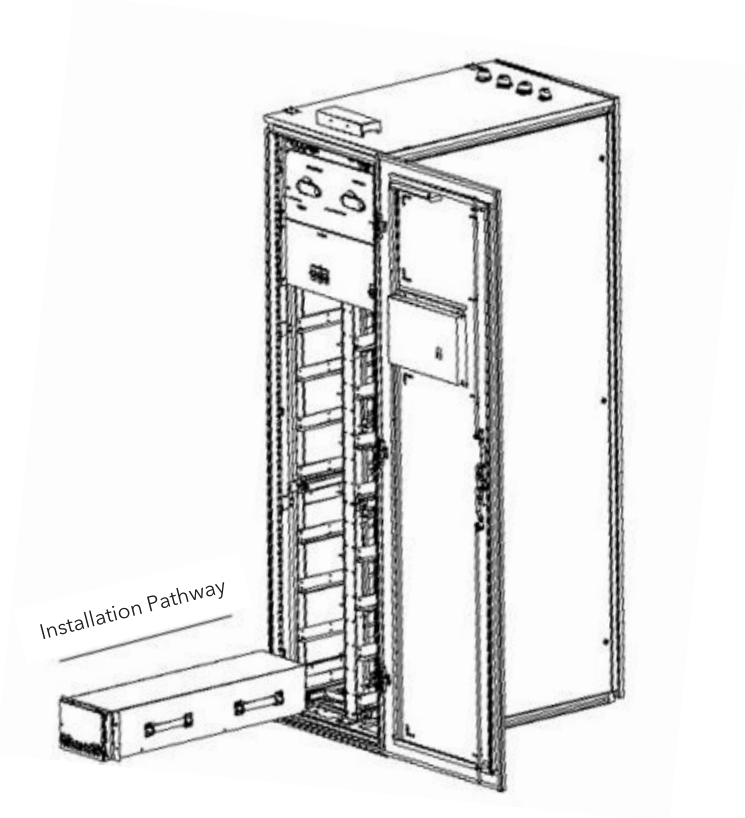
Install the metal handle on the left battery module on the right side of the cabinet. The right metal handle is battery module is installed on the left side of right battery module, as shown in Figure below:

Install Metal Handles



Battery Module Installation

Secure the battery module to the middle column of the cabinet, facing the front. Install battery modules facing upward one by one from the bottom. As shown in Figure below



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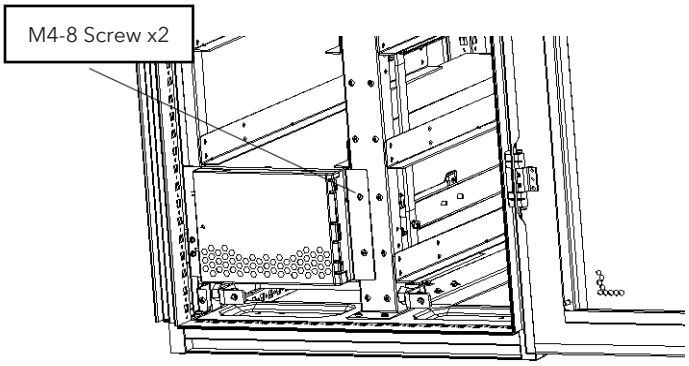
Tel: +886-2-2880-5600 Mail: service@csb-battery.com.tw

PowerBox 512Vdc Lithium Battery User Manual

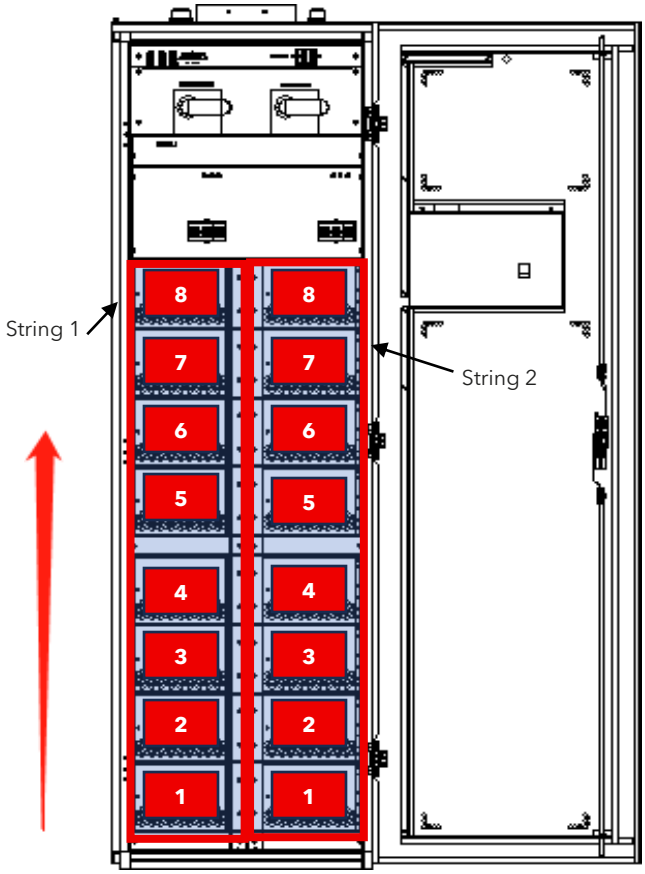
7. Battery Module Installation

Battery Module Installation

Use M4X8 cross pan head combination screw to fix, torque is 2.5N.m as shown in Figure



Install the remaining battery modules from bottom up as shown in figure below.



8. Battery Bussing Installation

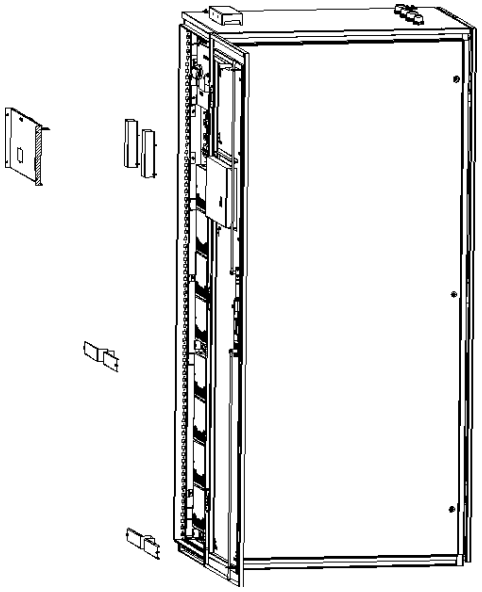
Battery Module Safety

****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION.**

Wear insulated gloves and use insulated tools when performing installation work.

Battery Bussing Preparation

Remove the protective covers from the the main control box and connect the copper bar (5023000030721), as shown in Figure

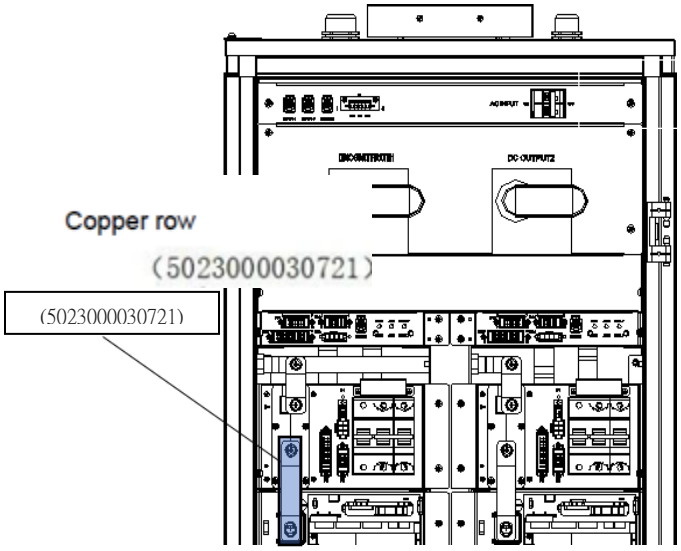


Connect the negative terminal of the main control box to the negative terminal of the battery module using a copper bar 5023000030721. Use the M8*20 screws with a torque of 22N., as shown in Figure.

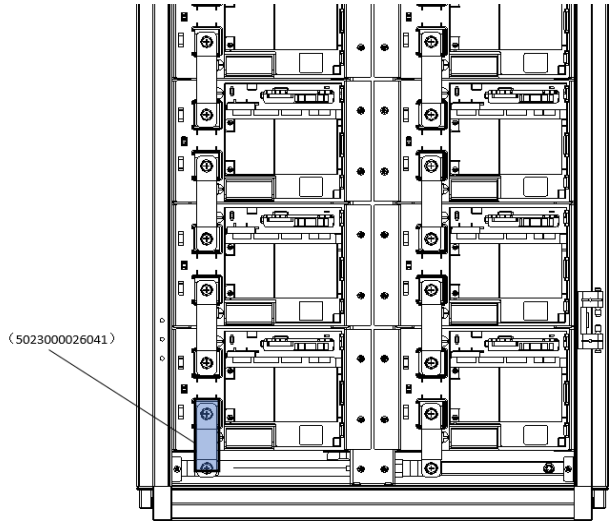
8. Battery Bussing Installation

Battery Bussing Installation

Connect the negative terminal of the main control box to the negative terminal of the battery module using a copper bar (5023000030721). Use the M8*20 screws with a torque of 22N., as shown in Figure.

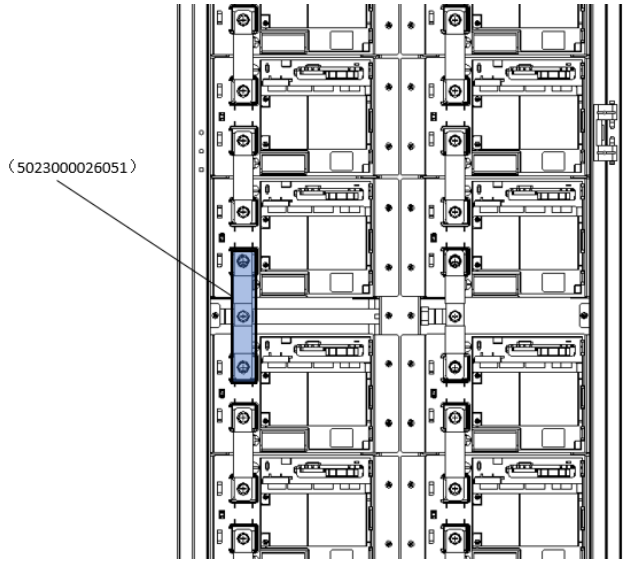


Use the copper bar 5023000026041 to connect the positive terminal of the battery module to the main positive connection bar. Use the M8*20 screws with a torque of 22N.m, as shown in Figure

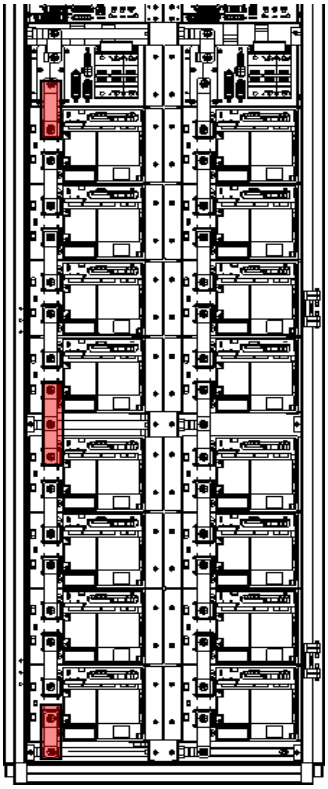


Battery Bussing Installation

Secure the battery module to the middle column of the cabinet, facing the front. Install battery modules facing upward one by one from the bottom. As shown in Figure below



Before proceeding to next bussing step, verify these are only connections made on the modules

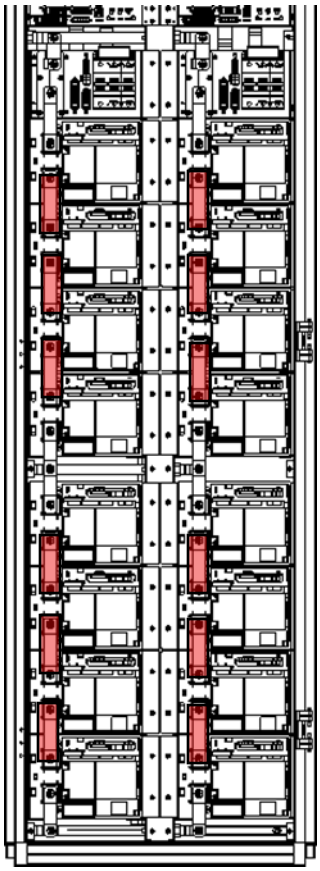


PowerBox 512Vdc Lithium Battery User Manual

8. Battery Bussing Installation

Battery Bussing Installation

Use copper bar (5023000026031) to connect other battery modules from bottom to top and from left to right. Use the M8*20 screws to secure the screw with a torque of 22N.m, as shown in Figure below.

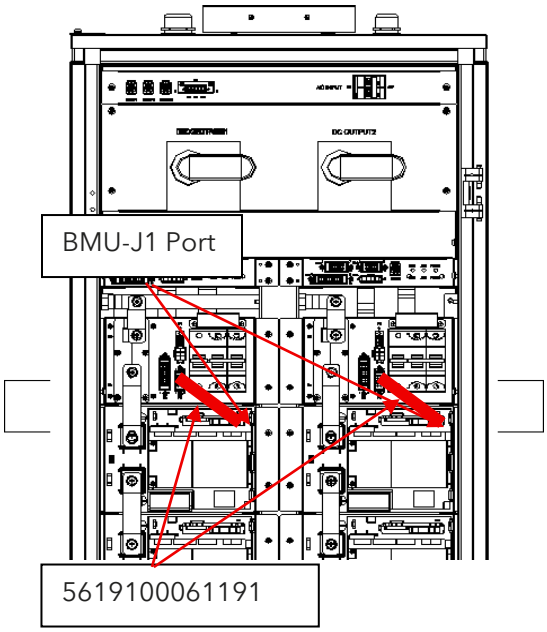


After the battery modules are connected, measure the total voltage of the system to ensure measurement 432V and 552Vdc. Use the DC voltage setting of a multi-meter to measure the voltage between the positive and negative electrodes of the battery module and the conductive metal body or ground point of the housing. If the voltage is stable and lower than 5V, the insulation is good.

9. BMS Cable Installation

Battery BMS Communication Cables

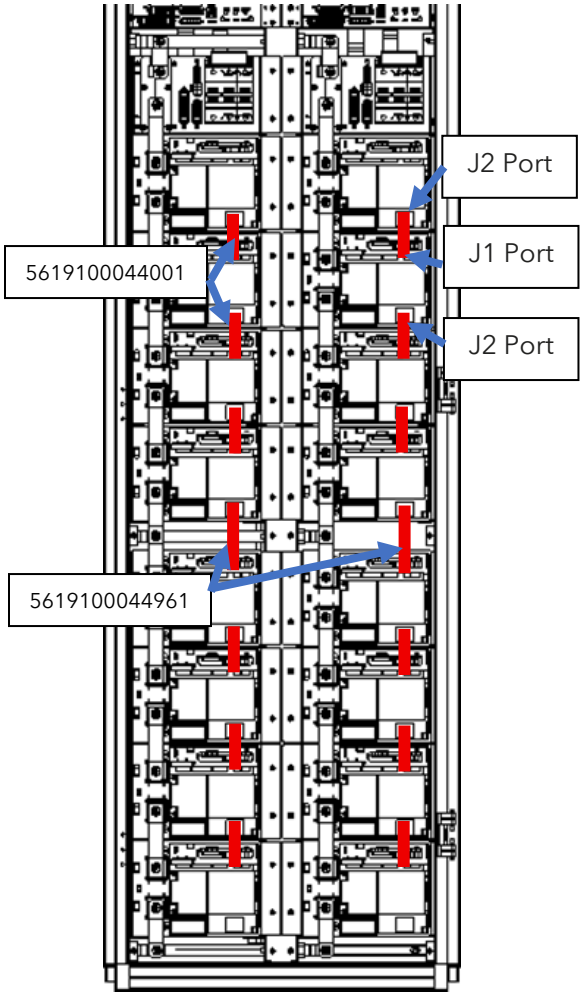
Connect the signal cable harness (5619100061191) delivered with the high voltage box to port BMU-J1 in the battery module, as shown in Figure below



9. BMS Cable Installation

Battery BMS Communication Cables

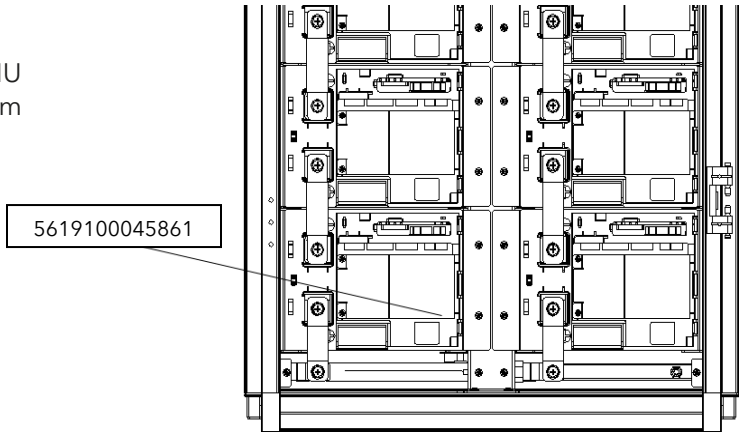
Use the communication power supply harness (5619100044001) to connect the BMU communication power supply ports between battery modules and connect J1 and J2 to the BMU connectors. Connect the cables from top to bottom and from left to right, as shown in Figure below.



Connect the terminal cable harness (5619100044961) port J1 and J2 on the BMU between the battery module#5 and #4, as shown in Figure above.

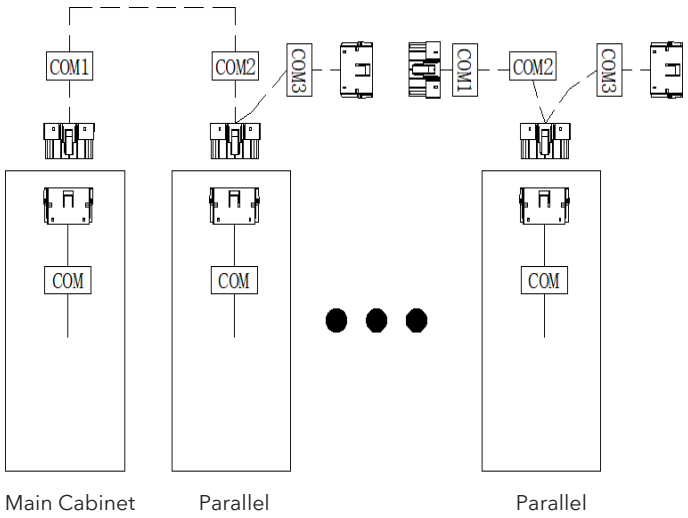
Battery BMS Communication Cables

Connect the terminal cable harness 5619100045861 to port J2 on the BMU in the bottom battery module, as shown in Figure 4-34.



Installing BMS Cables Between Cabinets

The distance between cabinets should not exceed 400mm. Remove the protective cover from the cable hole on the top of each cabinet. Take out the reserved signal cable harnesses between cabinets from the top of cabinet 1 and connect the cable harnesses of the COM1 connector to the COM connector in the host cabinet. Take out the reserved inter-cabinet signal harness from the top of cabinet 2 and connect the COM1 connector end harness to the COM3 connector in cabinet 1. Connect the COM2 connector ends in the cable harnesses between cabinets to the COM ports in the respective connected cabinets.



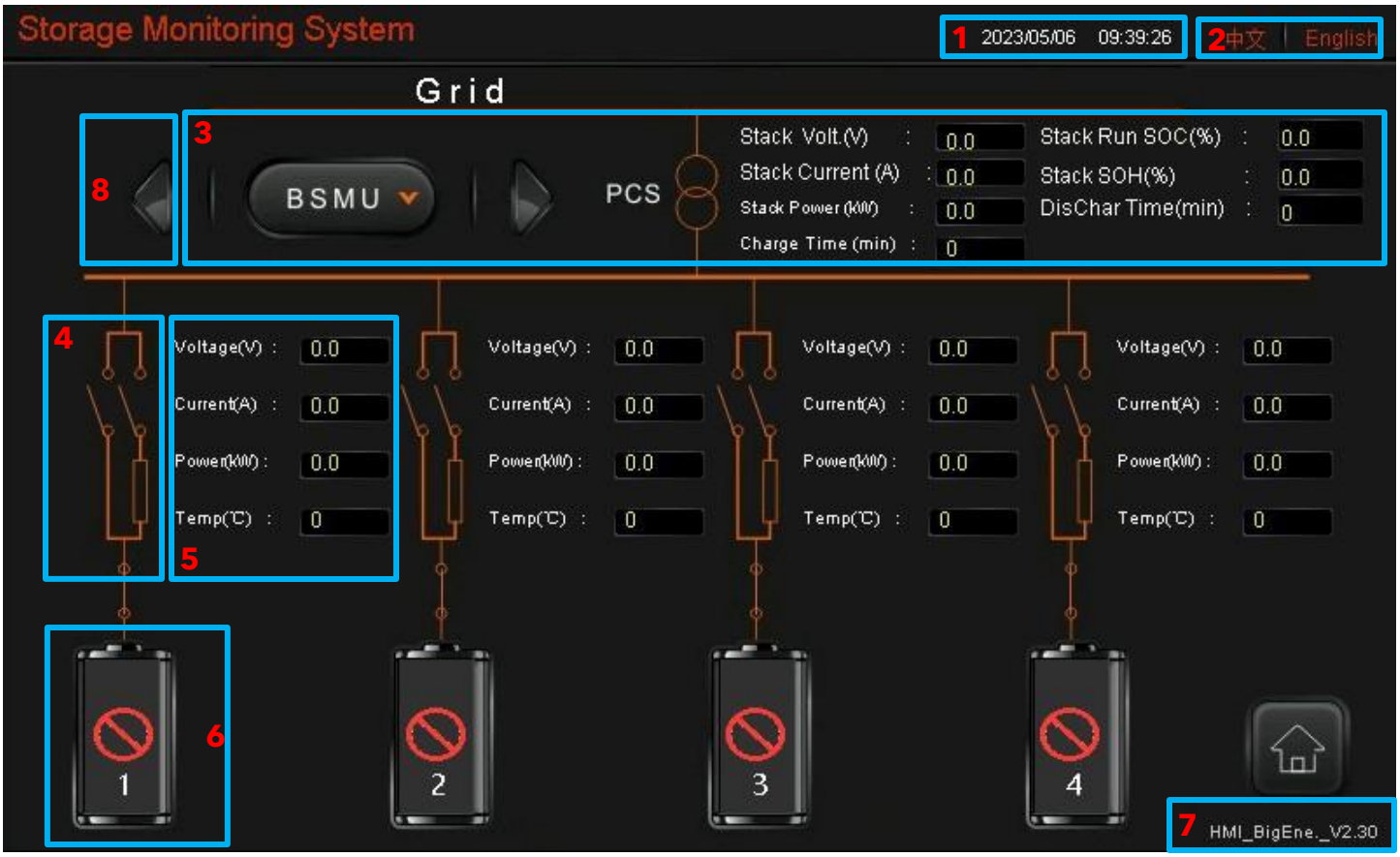
10. Control Software Overview

Introduction

The main cabinet of PowerBox is equipped with an LCD display for easy operation. You can view the current operating status of the system, real-time and historical alarms and faults, and both record and export events. This next section provides detailed instructions on how to program the PowerBox system.

Home Screen

After the HMI is powered on, the system automatically enters the main window, as shown in Figure below:



1 – Time and date	5 – Summary running information of battery string
2 – Language	6 – Battery string details page
3 – Battery system running information	7 – Software version number
4 – Switch status of the battery string	8 – Page turn

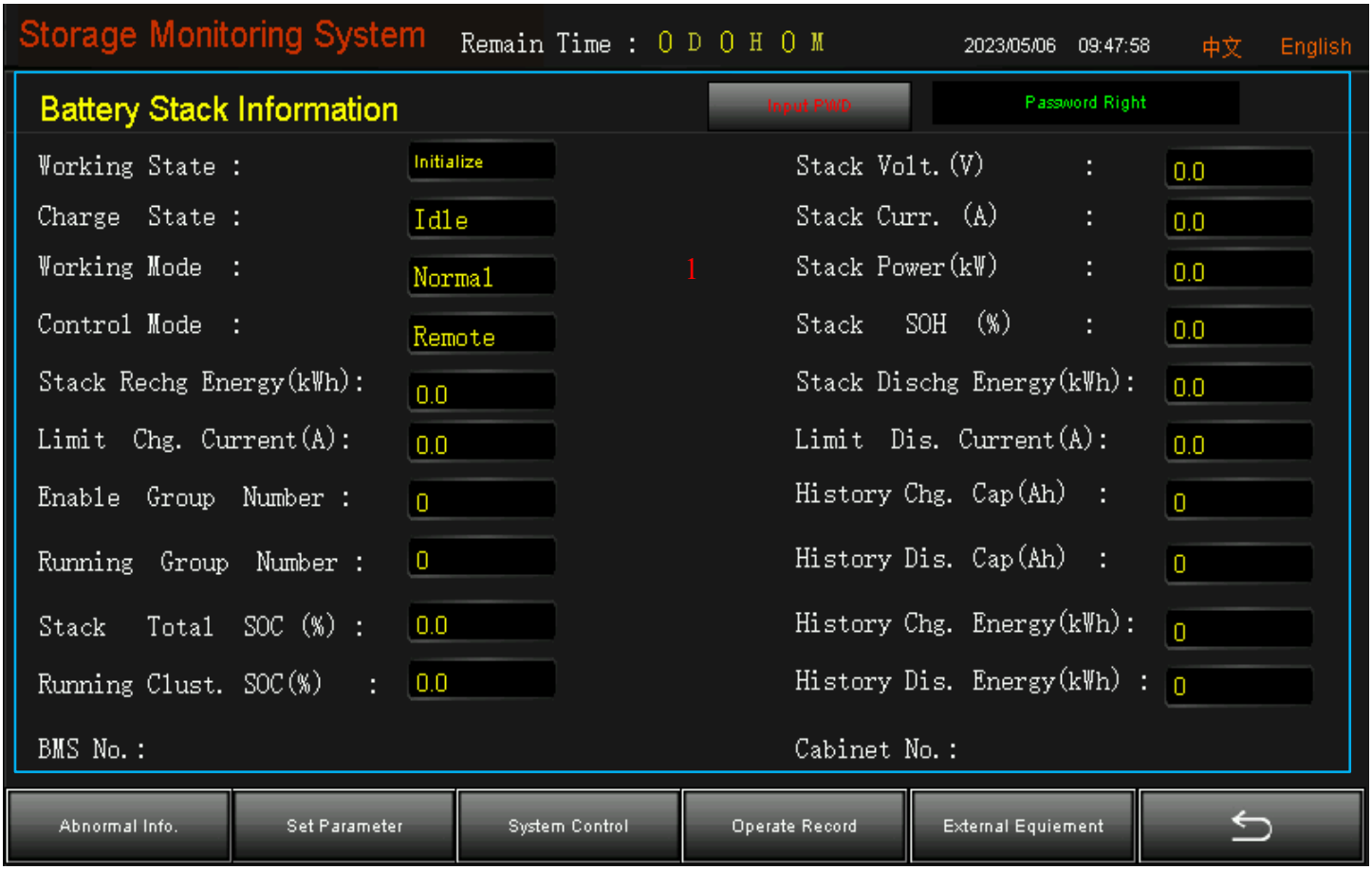
10. Control Software Overview

Interface Details

The main screen displays the total voltage, current, power, temperature, contactor status, and SOC information about the battery system and each battery module. Click the "BSMU" button at the top of the screen where the battery system details page will be displayed. The button next to BSMU is about battery strings that can be switched to the next page. Click the battery button at the lower part of the screen. Detailed information about the battery string is displayed.

Battery String Information

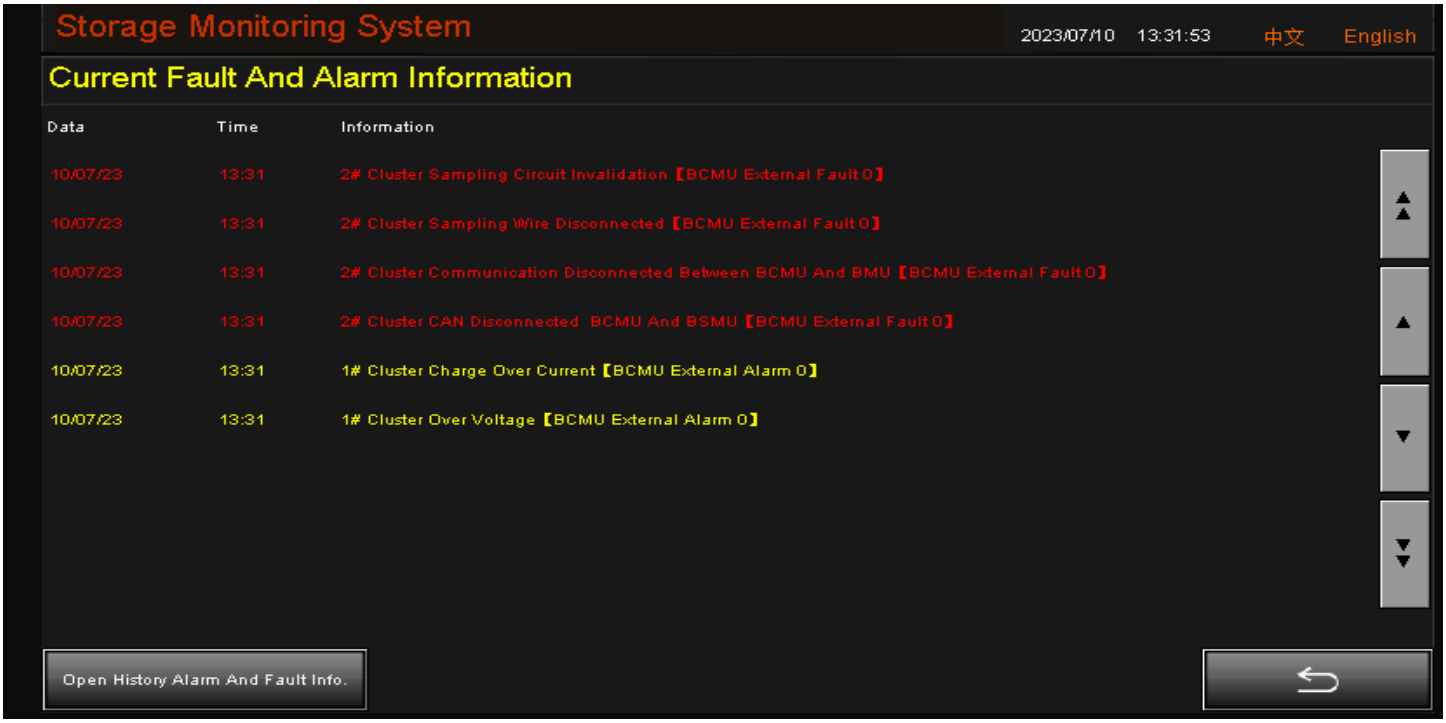
Click the BSMU button to enter the detailed screen of Battery String Info, as shown in Figure below. You can view the current running information of the string and the sub-menus of Fault Alarm Info, Battery System Power Curve, Parameter Settings, System Control, and Operation Record.



10. Control Software Overview

Fault Alarm Information

On the Battery System Info screen, click the Fault Alarm sub-menu. The details screen is displayed, as shown in Figure below. You can view any current battery fault alarm information, view historical fault alarm information, and clear historical HMI fault alarms.

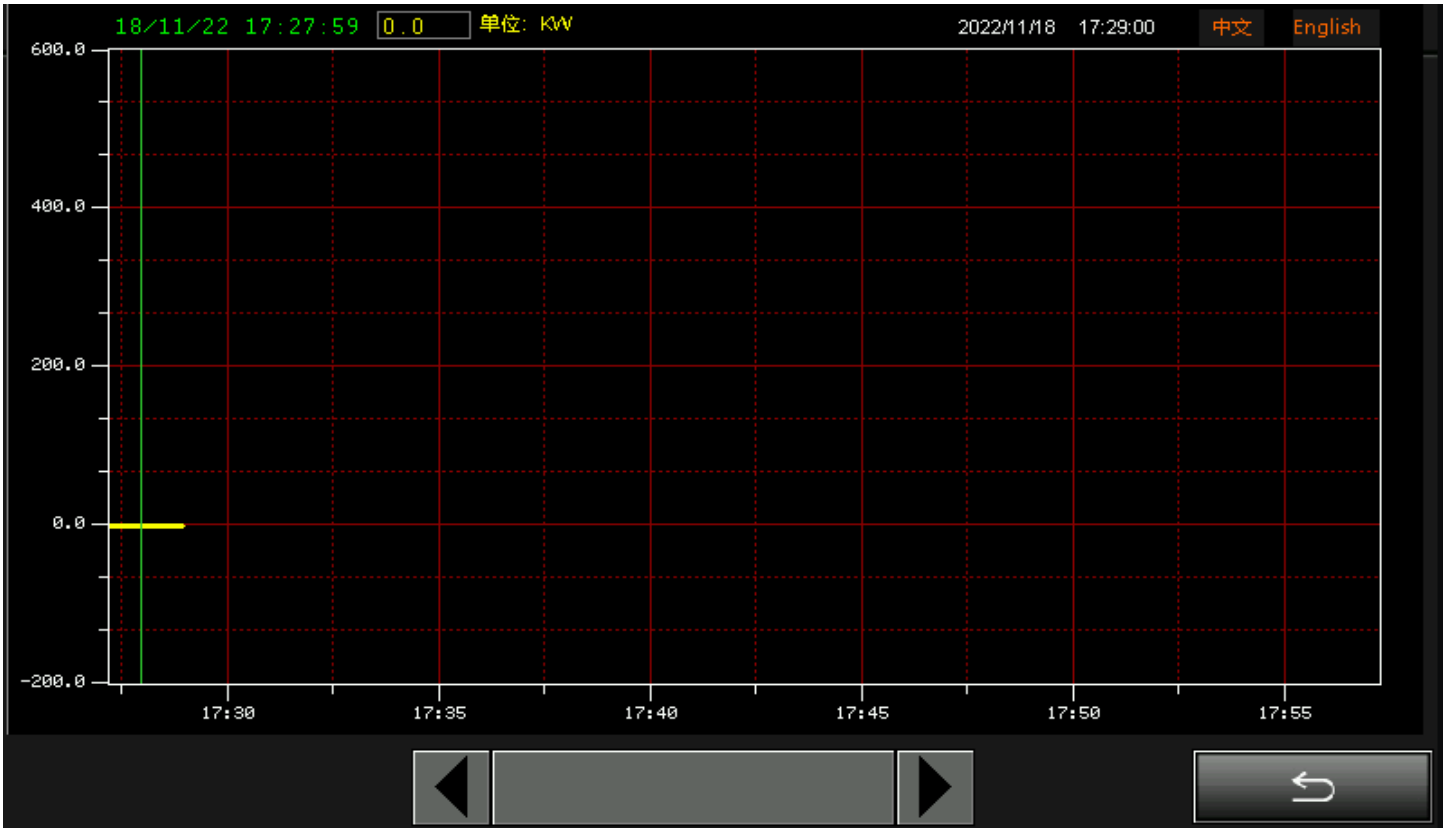


Alarm	Description	Cause
Cell over voltage	Excessive single-cell voltage	Close the charge/discharge contactors.
Pack over voltage	Excessive single-pack voltage	Close the charge contactor.
Cell under voltage	Single-cell voltage too low	Close the charge/discharge contactors.
Pack under voltage	Single-Pack voltage too low	Close the charge contactor.
Charge high temperature	Charging temperature too high	Close the charge/discharge contactors.
Charging low temperature	Charging temperature too low	Close the charge contactor.
Discharge high temperature	Discharging temperature too high	Close the charge/discharge contactors.
Discharge low temperature	Discharging temperature too low	Close the charge/discharge contactors.

10. Control Software Overview

Battery String Power Curve

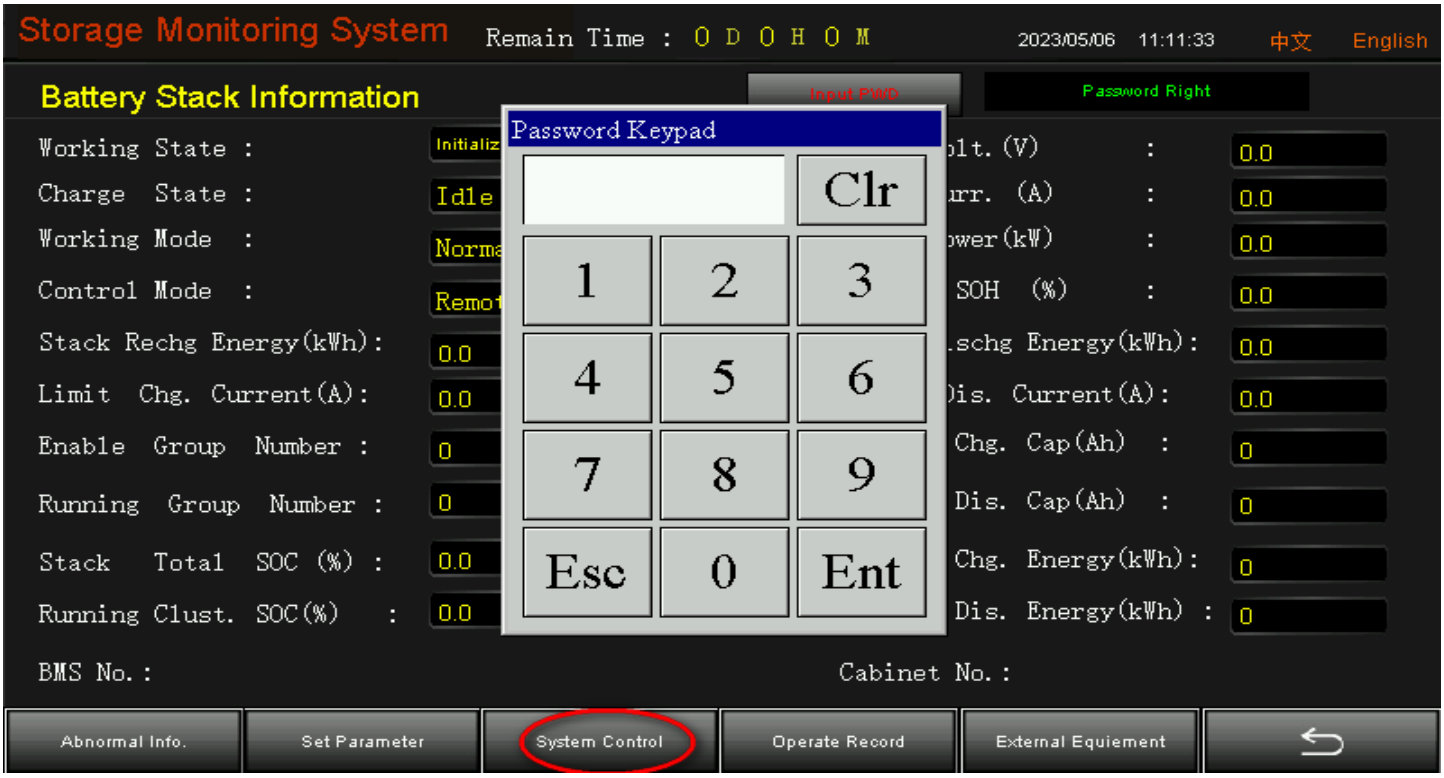
On the Battery Pile Info screen, tap Battery Pile Power Curve to enter the battery pile Power curve screen by default, as shown in Figure below. The battery system power curve screen records the power change of battery string(s) over a period. It is represented by the yellow line on the screen. Tap any part of the yellow line which provides a scroll bar at the lower part of the screen. The battery pile power curve displays the battery string power within 24 hours on the screen. You can click the scroll bar to view the battery string power curves at different intervals.



10. Control Software Overview

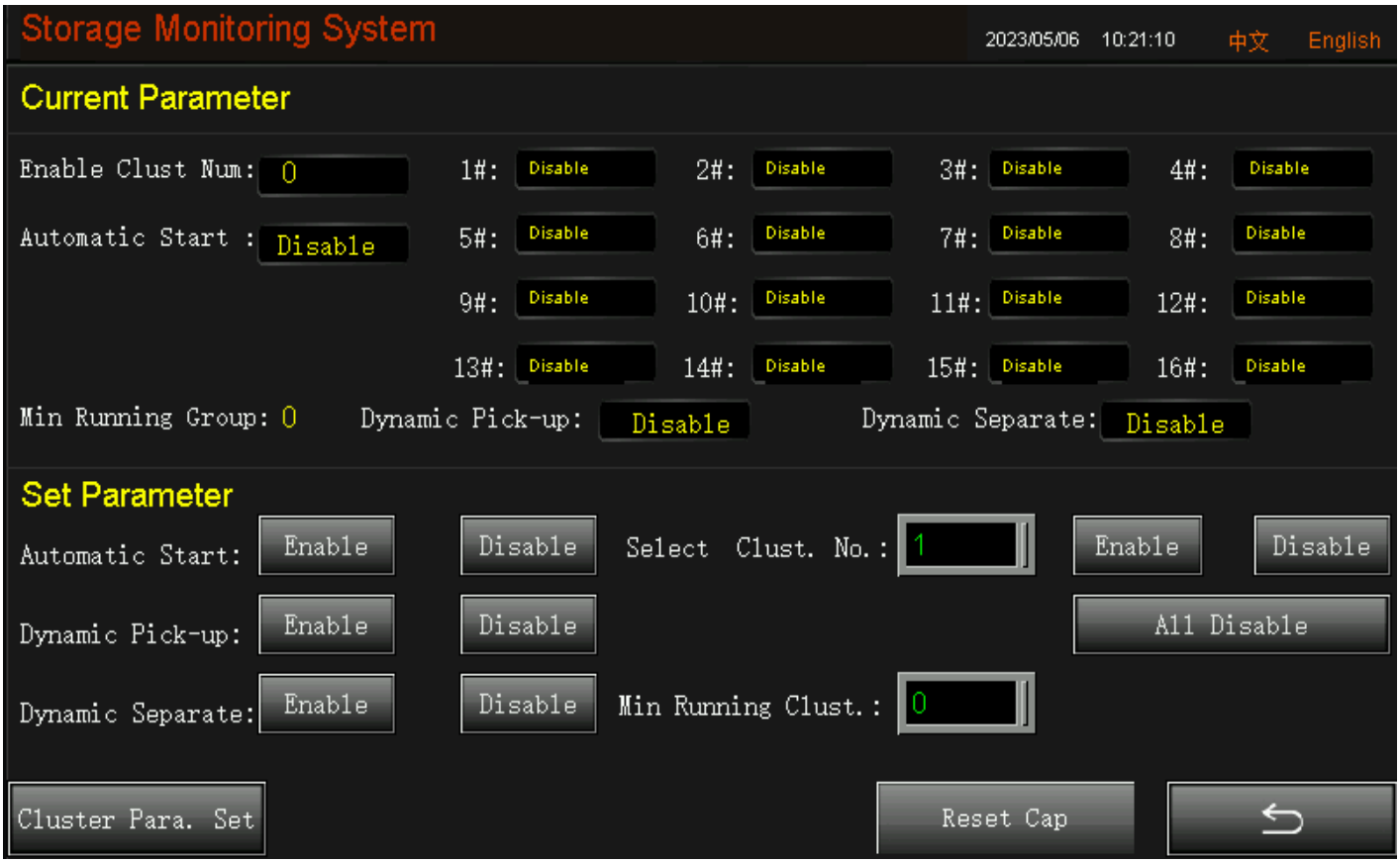
Parameter Settings

On the Battery System Info screen, tap Parameter Settings, as shown in Figure below, and enter the password: 123.



10. Control Software Overview

You can enable System Automatic Startup, Dynamic Grid Connection, and Dynamic Isolation, as shown in Figure below. You can enable or disable the minimum number of running strings and select battery string number based on the system design, actual load, and maintenance. You can also modify the "battery string parameter configuration"; This operation requires professional personnel.



System Auto-Start: When auto-start is enabled, the system will—after power-up and once no faults are detected, the contactors of each battery rack. After all racks have started, the system automatically transitions to the operational state.

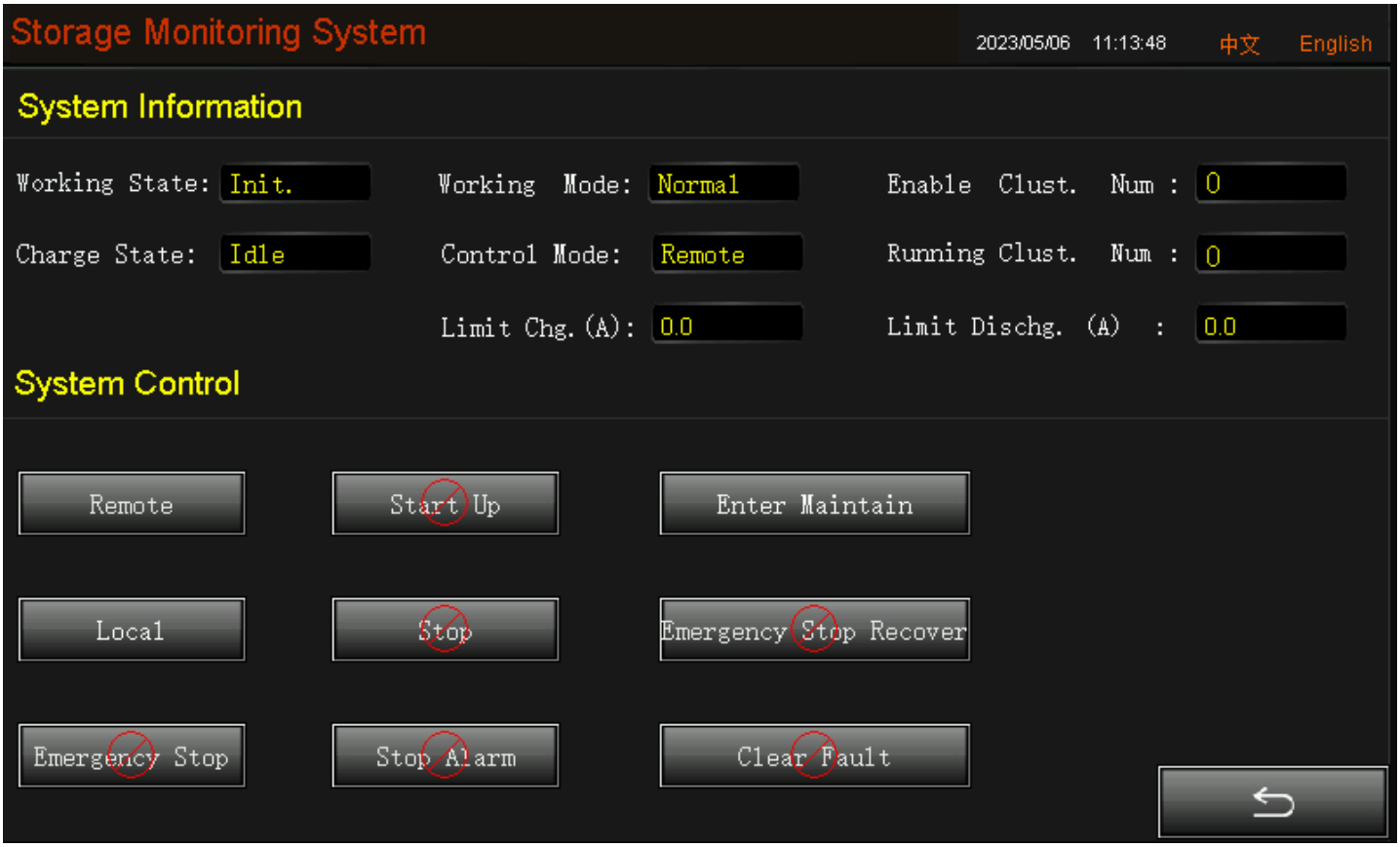
Dynamic Grid-Tie / Islanding: If the auto-grid-tie function is enabled and at least one battery rack meets the grid-connection criteria, the BSMU issues a start-up command to that rack, initiating its grid-connection sequence. Alternatively, the BSMU can directly send contactor-control commands to close both the discharge and charge contactors of the grid-tie-capable rack. Should the discharge contactor fail to close within the preset contactor-close timeout, all contactors for that rack will be opened, its grid-tie flag will be cleared, and the reason for the failed grid connection will be logged.

10. Control Software Overview

The current values of each parameter are displayed at the top of the screen. Buttons and boxes for parameter settings are displayed at the lower part of the interface. You can click the corresponding buttons or enter a value in the input box to set the corresponding parameters. Click the "Battery String Parameter Setting" button at the lower left corner of the interface and enter the correct preset password to enter the screen to set more parameters of the battery string. Click the "Factory Capacity of reactor" button to clear the historical charge and discharge energy to 0. (Since these two operations can only be operated by technicians, the password is not available to common users.) Click the Back button at the lower right corner of the screen to return to the screen showing details about the previous battery system.

System Control

On the Battery System Info screen, tap System Control and enter the general password 123 to enter the battery system control and operation screen. You can start and stop the system, turn off the buzzer alarm, and enter the system maintenance screen, as shown in Figure below.

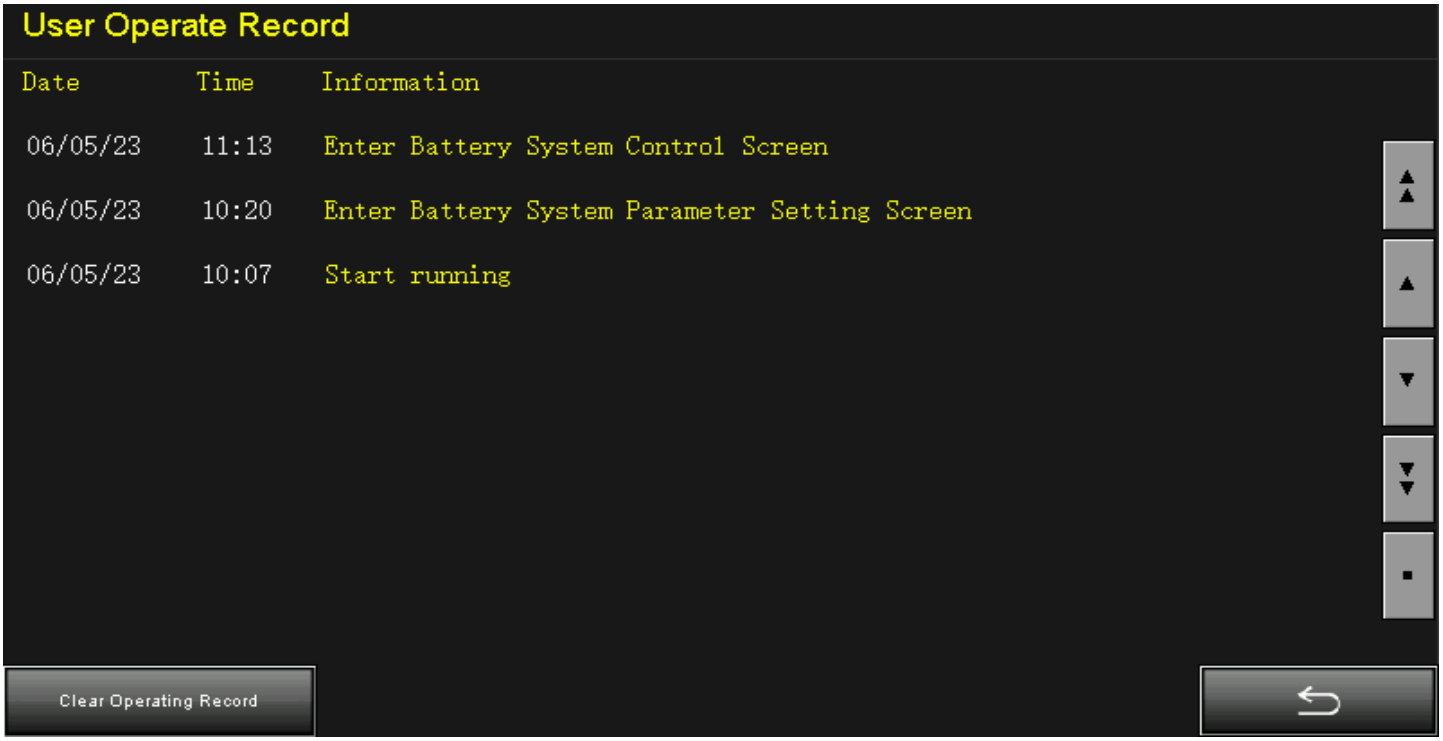


10. Control Software Overview

The current values of system status and mode parameters are displayed in the upper part of the screen. The buttons for system control and mode switch are displayed at the lower part of the screen. You can press the corresponding buttons to perform corresponding operations. (System maintenance can only be performed by technicians, so this password is not available to ordinary users). If the operation permission (control mode) of the BMS is not switched to local mode, the control commands are invalid, and corresponding buttons are displayed as invalid. Click the Back button at the lower right corner of the screen to return to the screen showing details about the previous battery system.

Operations Records

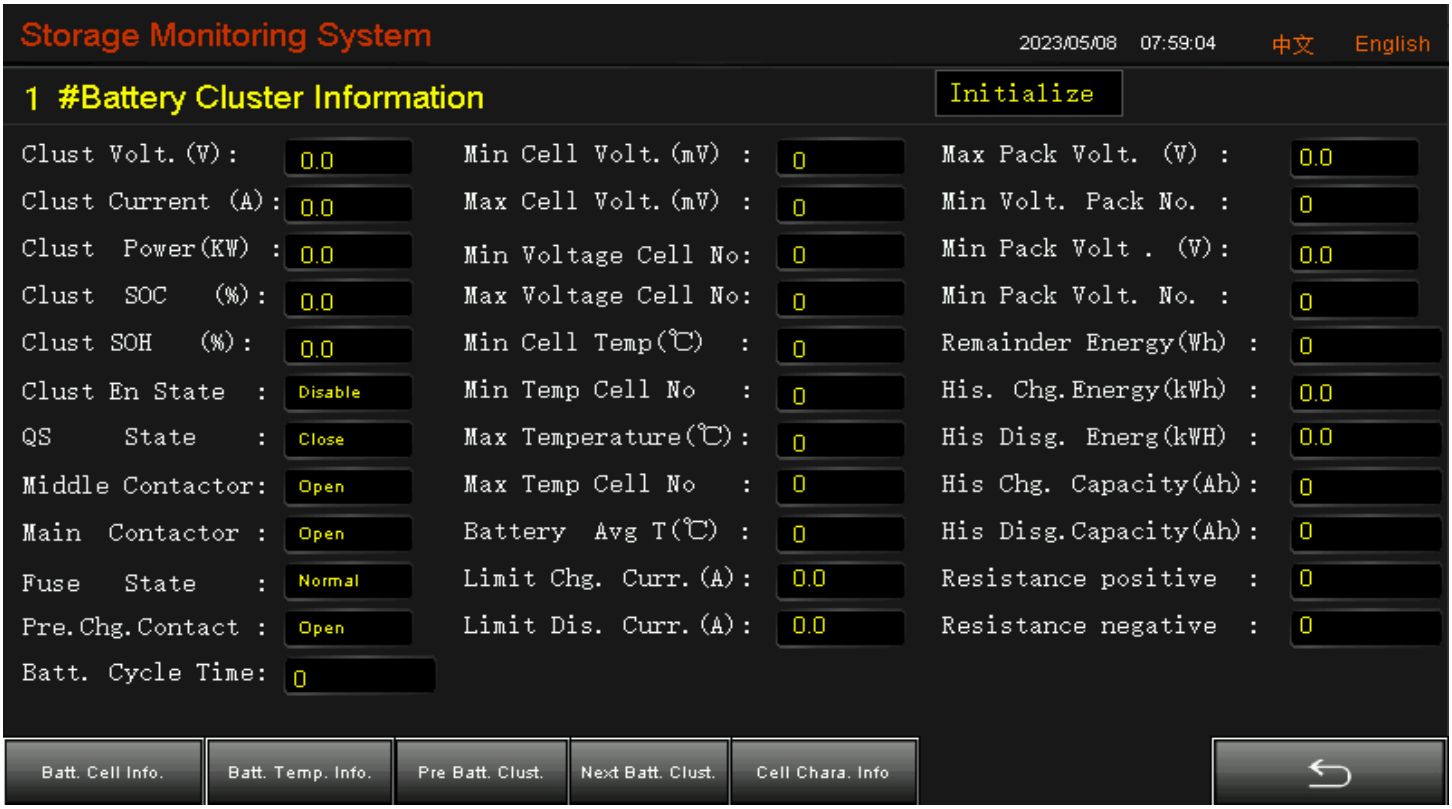
On the Battery System Info screen, click Operation Record, as shown in Figure below. You can view historical system operation records. Operations display system operations performed by users using HMI, including system control, mode switching, and parameter setting. Click the "Clear Operation Record" button at the lower left corner of the interface and enter the correct preset password to clear the operation record. (This operation can only be performed by technicians, so this password is not available to common users.) Click the sliding button on the right to pull up, pull down, or flip the page to view more operation records. Click the Back button at the lower right corner of the screen to return to the battery system information display screen.



10. Control Software Overview

Battery String Information

Click "Battery String Icon" on the home screen. Press the button to go to the detailed information screen shown in Figure below. You can view the running status of the current battery string and switch to the information of the upper and lower groups on the screen.



The battery string information screen displays the total voltage, current, power, temperature, electric energy amount, SOC, Pack maximum and minimum total voltage, and switching status of the battery string. The buttons for cell Info, Battery Temperature Info, Previous Battery String, Next Battery String, Cell Feature Info, BMU Exception Info, and Back are displayed at the bottom of the screen. You can tap each button to display the corresponding information. Tap Battery Cell Info to view the voltage and balance status of each cell in the current battery string as well as the corresponding chart display screen. Tap Battery Temperature Info to view the temperature of each cell in the current battery string. Tap Cell Feature Information to enter the cell feature screen. You can view the top five maximum and minimum values of temperature and voltage of the current battery string and their corresponding battery numbers. Click the "Previous battery string" or "Next battery string" button to switch the corresponding details of the previous battery string or the next battery string. When the communication mode between BMUs is CAN, the BMU Exception button is not displayed. Click the Back button at the lower right corner of the screen to return to the main screen.

11. Startup and Commissioning System

****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION.** CSB PowerBox PB-320 is made of Lithium Iron Phosphate chemistry, hereto referred as Lithium-ion in this user manual. Lithium-ion batteries are potentially dangerous, and proper precautions must be observed in handling and installation. CSB recommends only knowledgeable and trained personnel who can be qualified to work on batteries with proper tools and protective equipment. Keep unauthorized personnel away from the batteries during all operation activities. Any deviation from not following these safety guidelines can result in serious injury or death. Ensure all power connections are made as instructed above before attempting startup and commission of PowerBox system.

UPS Parameter Setpoints

The UPS can interact with the BMS software in any of the following modes below. Ensure proper setpoints are programmed in software prior to the startup of PowerBox system.

Dry Contact Communication Parameters

Category	Set Range	Default
Equalization Voltage	552Vdc – 560Vdc	552Vdc
Equalizing Current	3.5A – 70A	1 String – 35A 2+ String – 70A
Discharge Undervoltage Protection	430Vdc – 432Vdc	432Vdc
Float Charge	Off	Off
Charger Chain	Dry Contact	When the BMS terminal is open, start charging. When closed, stop charging.

RS485 Communication Parameters

Category	Set Range	Default
Main-Parallel Cabinet Relationship	Main, Parallel	Main (UPS)
Baud Rate (BPS)	9600, 19200, 38400	9600
Address	1-250	1
Equalization Voltage	552Vdc – 560Vdc	552Vdc
Equalizing Current	3.5A – 70A (single string)	(3.5A-70A*N ; (N=1~16)
Float Charge	Off	Off
Other	See communication protocols for details	See communication protocols for details

11. Startup and Commissioning System

BMS Monitoring Setpoints

The communication between background monitoring and BMS can be RS485 (Modbus-RTU) or Ethernet (MODBUS TCP). The parameters are as follows:

RS485 Communication

Category	Set Range	Default
Main-Parallel Cabinet Relationship	Main, Parallel	Main (BMS Monitoring)
Baud Rate (BPS)	9600, 19200, 38400	9600
Address	1-250	1 (HMI Programmable)
Other	See communication protocols for details	See communication protocols for details

Ethernet Communication

Category	Set Range	Default
IP Address	(1-254).(1-254).(0-254).(1-254)	192.168.1.91
Stack Subnet Mask Address	(0-255).(0-255).(0-255).(0-255)	255.255.0.0
MAC Address	1-254	100
Local Site	1-100	1
Other	See communication protocols for details	See communication protocols for details

11. Startup and Commissioning System

Powering On the System

Before powering the system, ensure that the battery system, power cables and signal cables between the battery system and the UPS are connected reliably and without short circuit.

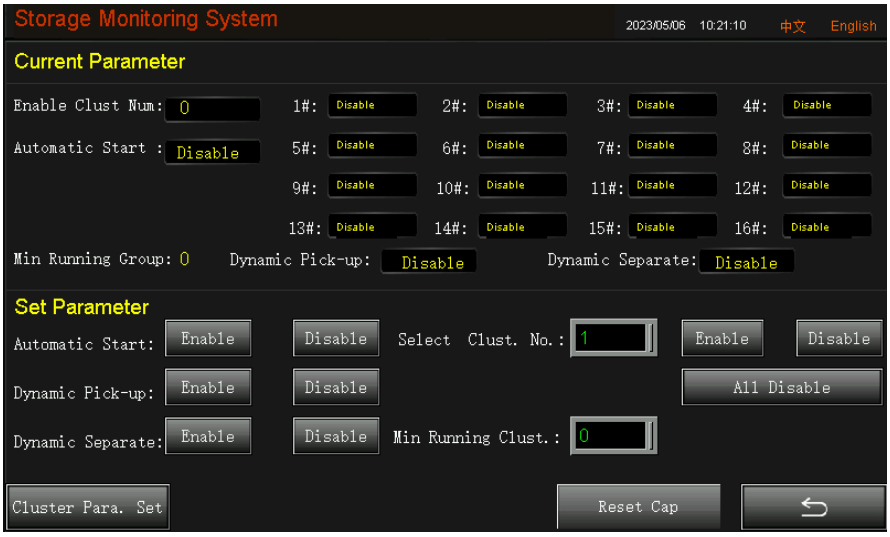
Perform the following steps to power the device：

1. Close the "DC INPUT" circuit breaker on the high-pressure box. In this case, the system is powered on, and the Initialization self-check process begins.
2. Turn on the "AC INPUT" circuit breaker. Close multiple cabinets one by one when combining machines.
3. Manually turn on the "DC OUTPUT" MCCB on the power distribution unit in the cabinet.
4. Click the "BSMU" button on "HMI" to enter the "heap information interface" as Figure below.
5. Click "Parameter Setting" submenu.
6. Click "Parameter Setting" sub-menu, according to the system configuration, check and confirm that the module number of each commissioned battery has been enabled, and the minimum number of operating groups has been set reasonably.
    a. The system self-starts, dynamic grid-connection, and dynamic isolation must all be enabled.
7. Minimum number of running modules setting
    a. Load power ≤ 150kW, set minimum number of operating strings: 1.
    b. 150kW<load power ≤ 300kW, set minimum number of operating modules: 2.
    c. 300kW<load power≤450kW, set the minimum number of operating modules: 3.
8. System is now POWERED ON

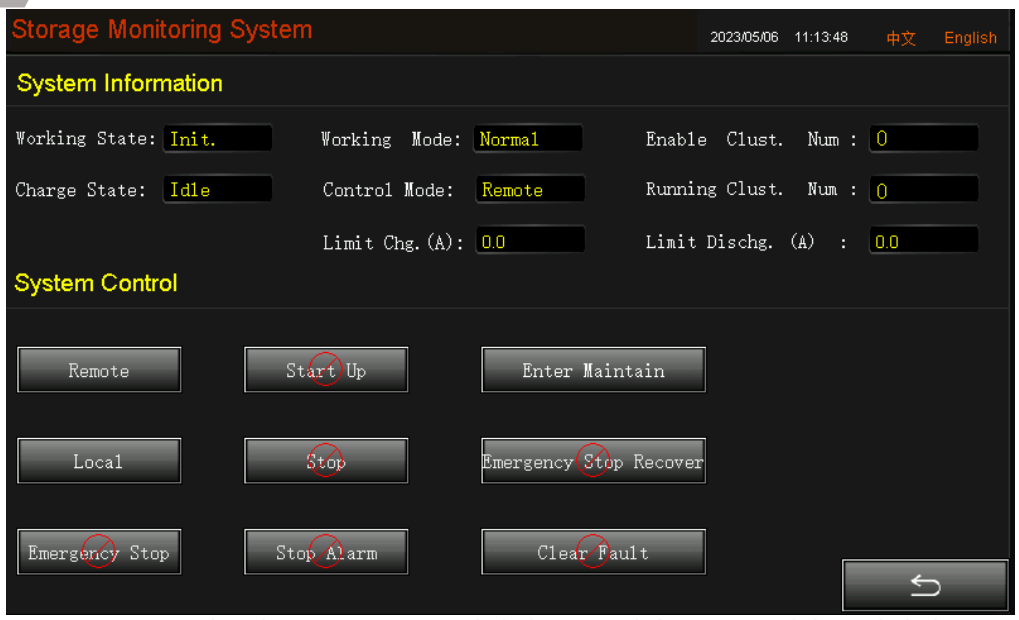
System Power Down

The power-down procedure is as follows:

1. Click the "BSMU" button on "HMI" to enter the "Module information interface" as in Figure below.
    a.



2. Click "Parameter Setting" submenu. Click "Parameter Settings" submenu, set "Automatic Start" to "Disable".
3. Click the "BSMU" button on the "HMI" to enter the "Module information interface" as shown in Figure below,



4. Click the "System Control" submenu to enter, click the "Local" button, and then click the "Stop" button, currently the system disconnects the contactor and enters the shutdown state.
5. Click on the "System Control" submenu, click on the "Local" button, and then click on the "Stop" button, currently the system disconnects the contactor and enters the shutdown state.
6. System is now POWERED OFF

Emergency Shutdown

When the system is charging, discharging or static state, if an emergency occurs, press the "EPO" button on the panel of the main cabinet, (Picture of EPO and location). At this time, the system will enter the shutdown state and disconnect the "DC OUTPUT" switch in each cabinet to cut off the connection between the main circuit of the battery system and the external circuit. To restore, first reset the "EPO" button on the panel, and then disconnect and reset the "DC OUTPUT" switches of each group before closing them.

12. Maintenance

Module Maintenance

In the event of an internal product failure requiring single-module repair, the following principles should be considered:

- When repairing the faulty battery clusters individually, it is necessary to ensure that the maintenance safety clearance, operating space, and emergency measures are complete before proceeding, otherwise, the whole system should be ordered and then repaired.
- The number of operating clusters remaining after fault cluster isolation is less than the minimum number of operating clusters, then the entire system needs to be powered down. Refer to "System Power Down" for power down procedure.
- The number of operating clusters remaining after isolation of the number of faulty clusters is still greater than the minimum number of operating clusters, at this time, only the faulty battery clusters can be individually powered down for maintenance, but the system has a short power-down process. The operation steps are as follows

Replacing Faulty Modules – Hot-Swapping

1. Click the "BSMU" button on the "HMI" to enter the "heap information interface"; click the "Parameter setting" submenu, set "System Self-start" to "Disable". Click "Parameter Settings" submenu, set "System Self-start" to "Disable".

2. Click the "BSMU" button on the "HMI" to enter the "heap information interface", click the "system control" submenu to enter, click the "local" button, then click the "stop" button, currently the system disconnects the contactor and enters the shutdown state; currently the connection with the UPS is disconnected.

3. Click on the "System Control" submenu, click on the "Local" button, and then click on the "Stop" button, currently, the system disconnects the contactor and enters the shutdown state; currently, it is disconnected from the UPS.

4. Click the "BSMU" button on the "HMI" to enter the "heap information interface"; click the "Parameter setting" sub-menu, set the "Select battery cluster number" to the corresponding fault cluster number, and set it to "Disable". Click the "Parameter Setting" sub-menu, set "Select Battery Cluster Number" to the corresponding fault cluster number and set it to "Disable". At this time, you can see that the status of the cluster is "Disabled".

5. Disconnect the "DC OUTPUT" switch corresponding to the faulty battery cluster, then disconnect the "DC INPUT" switch of the high voltage box and the "AC INPUT" switch of the distribution unit. then disconnect the "DC INPUT" switch of the high voltage box and the "AC INPUT" switch of the power distribution unit. At this point, the faulty battery module is disconnected from the other battery modules.

6. Click the "BSMU" button on the "HMI" to enter the "heap information interface"; click the "Parameter Settings" submenu. Click "Parameter Setting" submenu, set "System Self-start" to "Enable". Currently, other non-faulty modules start to run.

12. Maintenance

****ATTENTION** CAREFULLY READ THIS DOCUMENT SECTION**. CSB PowerBox PB-320 is made of Lithium Iron Phosphate chemistry, hereto referred as Lithium-ion in this user manual. Lithium-ion batteries are potentially dangerous, and proper precautions must be observed in handling and installation. CSB recommends only knowledgeable and trained personnel who can be qualified to work on batteries with proper tools and protective equipment. Keep unauthorized personnel away from the batteries during all operation activities. Any deviation from not following these safety guidelines can result in serious injury or death.

Frequency	Work Type	Requirements
Daily	Cabinet Status	Whether the cabinet operates normally and whether the indicator lights display normally.
Weekly	Operating Status	The main control box panel green indicator should be long light, HMI display interface without alarm and fault information, cabinet panel buzzer without sound and light alarm.
Monthly	Voltage	Modules and strings require maintenance when the minimum and maximum voltage difference of cell exceeds 400mV during standstill.
	Temperature	Maintenance is required for modules and strings with a minimum and maximum sampling temperature difference of more than 6°C during standstill.
	Parallel Cabinets	Isolated modules when running multiple modules in parallel must be investigated and maintained.
Quarterly	Exterior Cleanliness	Use cotton cloth to clean the appearance of the battery module, high voltage box and other modules. When cleaning, it is strictly prohibited to touch the electrically charged connections to prevent electric shock.
	Check Connections	Check the bolts at each terminal and retighten them if they are loose.
	Shallow Discharge Test	Shallow charge/discharge test is conducted once every quarter, and the data and analysis of the test process are recorded. Discharge conditions: under full state, discharge at 70A until the SOC is 80% or the minimum voltage of a single unit reaches 3.2V; after that, resume the system to continue operation.
Yearly	Capacity Test	Charge and discharge at least once a year to update SOC, SOH and verify battery capacity. Discharge conditions: under full state, discharge with 70A current until SOC is 0% or the minimum voltage of a single unit reaches 2.5V when the cut-off; after that, restore the system to continue to operate. When checking the capacity, the system will be discharged to protect and stop the power supply, users need to provide their own power supply or disconnect the battery system from the UPS to check the capacity separately

13. Troubleshooting

Fault	Fault Happening	Reason	Solution
N# Battery cluster internal communication CAN disconnection with BMU (Battery cluster external fault 0)	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Battery module communication cable disconnection	Check for missing wires or loose connections, re-plug or tighten
N# Cluster BMU data not ready (Cluster external fault 1)	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Disconnection of the communication cable between the battery module and the main control box	Check for missing wires or loose connections, re-plug or tighten
N# Battery cluster external Communication CAN disconnection with BSMU (Battery cluster external fault 0)	HMI's BSMU wireframe bright red	BCMU to BSMU Communication line disconnection	Check for missing wires or loose connections, re-plug or tighten
N# Battery Cluster External Failure	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	MCCB not closed or return check disconnected	Close the MCCB to confirm that the auxiliary contact is closed
N# Battery Cluster Charge Overcurrent Protection	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Charging current exceeds the set value	Check the parameter setting values and reduce the charging current
N# Battery Cluster Charging Overvoltage Protection	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Protective voltage setting exceeded during charging	Check the parameter setting values and automatically recover after stopping charging and resting.
N# cell cluster discharge overcurrent protection	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Discharge current exceeds set value	Check parameter setting values to reduce discharge current
N# Battery Cluster Discharge Undervoltage Protection	HMI's battery cluster wireframe lights red; N# cell cluster main control box lit red	Protection voltage setting exceeded during discharge	Check the parameter setting values, recharging can restore the
N# cell cluster fault isolation	HMI's N# battery cluster wireframe lights red; N# cell cluster main control box lit red	Check the cause of the fault	Handle according to the cause of the malfunction or contact the manufacturer to analyze

14. Warranty

These warranty terms and conditions apply to the PowerBox PB-320 521Vdc Lithium-Ion Battery System from CSB Energy Technology Co., Ltd. (hereinafter referred to as "CSB") through its authorized means. CSB makes the following warranties for the buyer:

Warranty Period
The product warranty period is 1 year from the date of delivery by CSB, based on the delivery note date or bill of lading date.

Capacity Performance Warranty
CSB guarantees that the product will maintain eighty percent (80%) of its available power from the date of delivery for 10 years, subject to the following usage conditions:

- Operating environment temperature: 0~40℃
- Storage environment: -20~60℃
- Storage duration: 45%SOC≤6 months
- Charge and discharge current: 3.5~70A
- Depth of discharge: 5%~95%
- Cycle requirements: 1C/4C 70%DOD 25℃1 years≤10 cycle

Replacement or Repair
In the case of problems during the warranty period, engineers from both parties need to jointly confirm and analyze the causes, and no unilateral judgment is allowed. For any product covered by this warranty letter and confirmed by CSB authorized service partner to have defects or non-compliance, CSB will decide at its own discretion whether to replace or repair the defective or non-compliant product. Any repair or replacement shall not be regarded as an extension or re-calculation of the warranty period. CSB will be responsible for the repair costs arising from product non-compliance or defects. If product replacement is involved, the relevant costs will also be borne by CSB. Upon completion of the product replacement, the ownership of the replaced battery or product will be transferred to CSB, Unless otherwise agreed between CSB and the authorized service partner, the end - user shall, within 4 weeks from the date of product replacement, send the replaced battery or product, in its original packaging or similar packaging, to the location designated by CSB authorized service partner. If CSB has stopped producing the product in question when the relevant warranty claim is confirmed, and if it is technically feasible and reasonable, CSB shall decide at its own discretion to replace it with a different model (with dimensions, color, shape, and/or power agreed upon by both parties). The replaced battery, components, or products may not be brand - new, but their quality and specifications shall meet the product specifications.

Warranty Exclusions
The following items are not covered by the compensation scope:

- The product has exceeded the above- specified warranty period.
- The end-user has caused damage or defects to the product due to improper use, incorrect operation, or abuse, and such usage does not conform to the relevant provisions in the user manual.
- Damage caused during product transportation; incorrect product installation; use beyond the specified temperature range; improper usage methods.
- The product has unauthorized wiring or is used in conjunction with faulty or incompatible equipment.

- The product has been modified without the permission of CSB, resulting in a change in its functions.
- Any installation changes are made to the product that does not follow the installation guide.
- The product is damaged due to maintenance or other services provided by unauthorized personnel.
- The end-user cannot provide the correct product serial number, or the product serial number is blurred and difficult to identify, or the serial number has been modified without CSB permission.
- The product is affected by external factors, including abnormal physical stress (such as accidental damage) or electrical stress (such as power outages, surges, inrush currents, lightning strikes).
- The product is damaged due to external forces, force majeure factors (including but not limited to war, civil war, strikes, riots, government intervention, terrorism, unrest, labor or material shortages, and other events beyond CSB's control, as well as unforeseeable, inevitable, and insurmountable natural disasters), or third - party reasons.
- The product is damaged due to the intentional or deliberate actions of the end-user.
- The end-user fails to report the product failure to CSB's authorized service partner within 2 weeks after the failure occurs.

Inapplicable Warranty Claims
If the warranty claim reported by the end - user is verified to be unfounded, the end - user shall bear the costs incurred by CSB or its authorized service partner due to such inapplicable warranty claims.

Warranty Limitations
Unless otherwise expressly provided in this warranty letter, to the maximum extent permitted by law, the contents of this warranty letter and the corresponding remedies are exclusive and will replace all other warranties and remedies, whether oral or written, express or implied. To the extent permitted by law, CSB expressly disclaims any statutory or implied warranty obligations, including but not limited to warranties of merchantability, fitness for a particular purpose, and warranties regarding hidden or latent defects. If CSB is unable to waive certain implied warranties due to legal requirements or must comply with specific warranties stipulated by law, then the scope of such warranties shall be strictly limited to the scope clearly defined by law and shall only apply when legally required. No dealer, agent, employee of CSB, or CSB's authorized service partner has the right to modify, extend, or add additional terms to this quality guarantee without permission. If any provision of this warranty letter is determined to be illegal or unenforceable, the invalidity of such provisions shall not affect the legality and enforceability of the remaining provisions, and the remaining provisions shall remain in force and be enforced.

Unless otherwise provided in this warranty letter, to the maximum extent permitted by applicable law, CSB shall not be liable for any direct, indirect, special, incidental, or consequential losses arising from the purchase or use of the product and its system, including but not limited to loss of use, loss of income, actual or expected loss of profit (including loss of contract profit), loss of use of funds, expected savings loss, business loss, loss of opportunity, loss of goodwill, loss of reputation, personal injury or damage, or any indirect or consequential losses or damages caused by any reason (including any costs arising from equipment and property replacement, production restoration, etc.). Under no circumstances shall CSB's liability for any reason exceed the purchase price paid by the end - user to CSB for the relevant product.

After the Warranty Period
For products that have exceeded the warranty period, if the end - user submits a written service request to CSB's authorized service partner, CSB agrees to provide certain after - sales services to the end - user upon receipt of the request. All costs and expenses incurred in this process, including but not limited to material costs, component costs,

and labor costs, shall be borne by the end - user. When the end - user sends a written notice requesting out-of-warranty services, it is necessary to describe the defect situation of the product in detail so that CSB's authorized service partner can accurately determine whether the defect can be repaired. It should be clear that CSB is not required to assume any legal liability for out - of - warranty services under any circumstances, and the content of this warranty does not imply that CSB has made a commitment to providing such out - of - warranty services.

Dispute Resolution

In case of any disputes regarding warranty claims, both parties shall, with mutual consent, entrust an international testing agency, such as TÜV SUD/SGS, etc., to provide third - party verification and opinions. Unless otherwise agreed, all costs and expenses shall be borne by the party requesting such verification procedures.

PowerBox 512Vdc
Lithium Battery User Manual

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