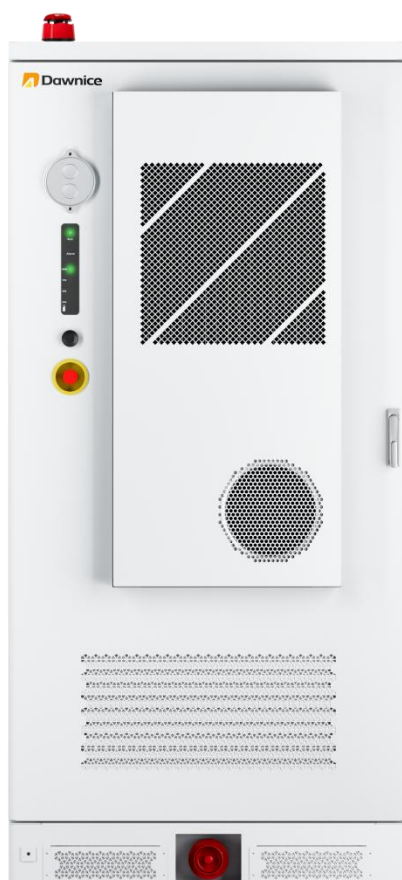




User Manual

BS09-265-D

DC-side Energy Storage System

Contents

All Rights Reserved	1
1. Safety Precautions	2
1.1 Safety precautions	2
1.2 Personnel requirements	2
1.3 Electrical safety	3
1.4 Environmental safety	4
1.5 Mechanical safety	5
1.6 Operation and maintenance	6
1.7 Battery safety	7
1.8 Product disposal	8
2. Product Introduction	10
2.1 Energy storage system introduction	10
2.2 Product function	11
2.3 Product features	11
2.4 Dimension and layout	12
2.4.1 Product dimension	12
2.4.2 Product layout	13
2.5 Product components introduction	14
2.5.1 Battery pack	14
2.5.2 High-voltage cluster control box	15
2.5.3 PDU indicator light	15
2.5.4 Industrial temperature control air conditioner	17
2.5.5 Status indicator lights and emergency stop button	18
2.6 Working principle	20
2.6.1 Single-machine topology structure	20
2.6.2 Typical application scenarios	21
2.7 CAN analyzer connection	21
2.7.1 CAN box connection	21
2.7.2 Host computer operation	22
3. Transportation and Storage	23
3.1 Transportation	23
3.1.1 Handling requirements	23
3.1.2 Transportation requirements	25
3.2 Storage requirements	26
3.2.1 Energy storage system storage (excluding battery pack)	26
3.2.2 Battery pack storage	27
3.2.3 Storage environment requirements	28
4. Installation Site Requirements	29
4.1 Location requirements	29
4.2 Foundation requirements	33
4.3 Forklift requirements	34
4.4 Lifting requirements	34
5. Mechanical Installation	37
5.1 Unpacking	37
5.1.1 Unpacking	37
5.1.2 Accessories check	38
5.1.3 Product inspection	40

5.2 Installation environment	40
5.3 Install the foundation	41
5.4 Infrastructure requirements	44
5.5 Transportation and lifting	45
5.5.1 Forklift transportation	45
5.5.2 Hoisting	47
6. Cable Installation	48
6.1 Electrical connection overview	48
6.2 Preparation before connection	49
6.3 Cabinet cable connection	51
6.3.1 Grounding wire connection	51
6.3.2 Battery cabinet cable connection	52
6.4 Auxiliary power supply connection	55
6.5 PCS cable installation	57
7. System Power On	58
7.1 Inspection before powering on	58
7.2 System power-on	59
7.2.1 Power on procedures	59
7.2.2 AC-side power on	60
7.2.3 DC-side power on	60
7.3 System power off	62
7.3.1 Issue a stop work command	62
7.3.2 DC side power off	62
7.3.3 AC side power off	63
8. Fire Protection System	63
8.1 Fire protection layout	64
8.2 Working principle of fire protection equipment	64
8.3 Fire extinguishing mechanism	65
8.4 Thermal aerosol fire extinguishing equipment	67
8.5 Temperature sensor	67
8.6 Smoke sensor	68
8.7 Audible and visual alarm device	68
8.8 Gas detector	69
8.9 Water fire protection system	70
9. System Maintenance	71
9.1 Maintenance Instructions	71
9.2 Maintenance precautions	71
9.3 Quarterly maintenance	72
9.4 Semi-annual maintenance	73
9.5 Annual maintenance	73
10. Troubleshooting	74
11. Battery Recycling	75
11.1 Cathode material recycling process and steps	75
11.2 Anode material recycling	76
11.3 Diaphragm recycling	76
11.4 List of recycled equipment	76
12. Appendix	76

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Disclaimer

Our company shall not be liable for any personal injury, property damage, product damage, or consequential damages arising from or caused by any of the following circumstances:

- * Equipment damage caused by force majeure events such as earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, and voltage fluctuations;

- * Failure to use the product in accordance with the instructions in this manual;

- * The installation, operation, and storage environment does not comply with relevant international, national, or regional standards;

- * Unqualified personnel shall not be allowed to install, use, repair, dismantle, or otherwise operate the equipment;
- * Using unauthorized spare parts;
- * Unauthorized modification or technical changes to the product or software;
- * You made a mistake in shipping the goods yourself or through a third party;
- * The materials and tools you provided yourself do not meet international, national, or regional standards;
- * Damage caused by your own or a third party's negligence, intentional misconduct, fault, or improper operation.

1. Safety Precautions

1.1 Safety precautions

Read all safety instructions carefully before performing any work and follow them when handling batteries.

Incorrect operation may result in:

- Injury or death of the operator or third party;
- Damage to system hardware.

Skills of qualified personnel:

- Training in electrical system installation and commissioning and hazard handling;
- Understand this manual and other related documents;
- Know your local regulations and directives.

1.2 Personnel requirements

The lifting, loading, transportation, installation, wiring, operation, and maintenance of energy storage systems must be performed by qualified electrical technicians or other professionals. These qualified technicians should meet the following requirements:

- Operators should be thoroughly familiar with the structure and operating principles of the entire energy storage system;
- Operators should be thoroughly familiar with this Manual;
- Operators should be thoroughly familiar with the relevant standards of the country/region where the project is located;
- Operators should be able to respond quickly to hazards or emergencies that occur during construction and installation.

1.3 Electrical safety



- Never touch terminals or conductors connected to the power grid, as this could cause electric shock; all circuit connectors must be disconnected during maintenance;
- Both batteries and the power grid can generate voltage; you must use a standard voltmeter to ensure there is no voltage before touching them;
- Working on live wires is strictly prohibited; doing so could result in fire or personal injury.



- The product contains a fatal voltage!
- There is a fatal high voltage between the positive and negative electrodes of the energy storage battery pack;
- Damaged equipment or system malfunctions can cause electric shock and fire;
- When maintaining the equipment, ensure that the connection between the energy storage converter and the energy storage battery pack is completely disconnected;
- Pay attention to and follow the warning labels on the product;
- Comply with all safety precautions listed in this manual and other relevant

documents;

- Comply with the requirements and precautions for the use and protection of lithium batteries;

- You can only operate the equipment after confirming that it is in a safe condition.

 Warning

- All installation, wiring, operation, and maintenance must comply with the relevant laws and regulations of the equipment installation location and the project site;

- This product must be used in accordance with the instructions in this manual; otherwise, it may result in personal injury or equipment damage.

 Notice

- Avoid unnecessary contact with the circuit board;
- Comply with electrostatic discharge (ESD) protection guidelines, such as wearing anti-static wrist straps.

 Instruction

- Set up warning signs or safety warning tape near the operating area;
- After maintenance or repair operations are completed, be sure to remove the cabinet key and keep it safe.

1.4 Environmental safety

 Danger

- Do not place the equipment in flammable, explosive, or dusty environments, as this may cause fire or explosion hazards.

 Danger

- Do not place flammable or explosive materials around the battery pack;
- Do not block or occupy escape routes with clutter or in any other manner.

 Notice

- Do not use the product in environments exceeding the specified temperature range;
- Do not use the product in environments exceeding the specified humidity levels;
- Do not use the product at altitudes exceeding the specified limits.

1.5 Mechanical safety

 Danger

- When working at heights, safety helmets and other safety equipment must be worn and secured to sturdy structural members to prevent falls;
- Before installation, ensure the equipment is securely fixed to prevent it from tipping over and injuring people or damaging the equipment.

 Danger

- When using a forklift, ensure the forks are in the center position before lifting to prevent tipping;
- Before moving, secure the equipment to the forklift with ropes. During movement, assign a dedicated person to supervise;
- Lifting personnel must complete and pass relevant training before being allowed to perform the work;
- Place warning signs and barriers to isolate the lifting area;
- The lifting conditions must meet the operational requirements;
- Do not allow personnel to walk underneath during lifting operations;
- During lifting operations, ensure the angle of the lifting cables is less than 90°.

 Warning

- Prepare for load-bearing before moving heavy objects;
- When multiple people are involved in moving, distribute the load evenly to ensure

balanced weight distribution;

- Wear protective gloves, safety shoes, and other safety gear when moving heavy objects;
- When working at heights, wooden ladders or insulated ladders should be used; straight ladders are prohibited;
- When using a ladder, it must be placed on a stable surface, and someone must hold the ladder while working.



- Scratches that occur during transportation and installation must be repaired promptly, and scratched areas must not be exposed for extended periods;
- Unauthorized welding, cutting, or other operations on the equipment are prohibited;
- Use the correct basis and master the correct way to use the tools.

1.6 Operation and maintenance



- The equipment contains high voltage, accidental contact could result in a fatal electric shock hazard;
- When performing live measurements, proper protective measures should be taken (such as wearing insulating gloves and insulating shoes);
- High-voltage work should be carried out by two people to ensure personal safety.



- Users must not perform battery maintenance without prior instruction. Do not perform any maintenance other than those described in this manual, as this may damage the battery;
- Disassembling or repairing the battery may cause it to catch fire. Replacing internal

parts must be performed by a qualified professional;

- Do not spray paint on the internal or external parts of the product;
- Do not use cleaning agents or products to clean this product or expose it to harsh chemicals.



When performing electrical measurements, connections, and trial runs on equipment:

- Select high-quality measuring equipment whose range and operating conditions meet the requirements of the site;
- Ensure that the measuring equipment is connected and used correctly and in accordance with regulations to avoid dangers such as electric arcs.

1.7 Battery safety

Before installing or using the battery, please read the user manual carefully and follow all instructions or warnings in the document. Otherwise, it may result in electric shock, serious injury or death, or damage the battery and render it unusable.

The battery needs to be charged within 48 hours after being fully discharged, otherwise it will cause the battery capacity to degrade or be irreversibly damaged; if the battery needs to be stored for a long time, it should be charged at least once every 6 months.

- Do not store batteries with flammable or explosive materials;
- Do not connect the battery directly to the solar cable;
- Do not put any foreign objects inside the battery compartment;
- Do not use our batteries with other batteries, including but not limited to batteries of other brands or capacities;
- Handle or process with care to prevent battery damage, dropping, or leakage.

Please refer to this manual for battery use and maintenance.

1.8 Product disposal



- When a product needs to be disposed of, it should not be treated as regular waste.

Some parts can be recycled, while others may cause environmental pollution;

- Our company has priority in recycling end-of-life batteries;
- For used batteries that are not recycled by our company please contact your local authorized professional recycling organization or our company for disposal.

Note: This manual may not cover all possible situations during operation, maintenance, and repair. If you encounter circumstances not explained in the manual, please follow the relevant local regulations and standards and contact our company promptly.

About The Manual

This manual provides information on the transportation and storage, mechanical installation, electrical connections, start-up and shutdown operations, troubleshooting, and maintenance of battery energy storage systems. Before transporting, storing, installing, operating, using, or/and maintaining the equipment, please read this manual first, strictly follow its contents, and adhere to all safety precautions indicated on the equipment and in this manual. In this manual, "equipment" refers to the products, software, components, spare parts, and/or services related to this manual; "our company" refers to the manufacturer (producer), seller, or service provider of the equipment; and "you" refers to the entity responsible for transporting, storing, installing, operating, using, and/or maintaining the equipment.

This document applies to the following product models of our company:

BS09-265-D

※ Unless otherwise specified, in this manual, the terms "system" and "energy storage system" refer to this particular product model.

How To Use This Manual

Please read this manual carefully before using the product and keep it in an easily accessible place. To provide the best customer experience, the content of this manual may be updated and revised, therefore some errors or slight discrepancies with actual conditions may exist. We will not notify you of any changes in information. Please obtain the latest manual from your sales channels.

Symbol explanation is to ensure user safety and property security while using this product, and to ensure optimal and effective product use, this manual provides users with the following safety information highlighted by the symbols below.

The following symbols may appear in this manual to highlight information; their meanings are as follows:

	This indicates a dangerous situation. Failure to take action could result in a high-risk situation such as death or serious injury.
	This indicates a potential for damage or injury. Failure to take precautions could result in a medium-level risk, such as serious personal injury or damage.
	This indicates a potential for damage or injury. Failure to take precautions may result in minor or moderate injury or loss.
	This indicates a potential for equipment damage or property loss. Failure to take precautions may result in equipment damage, data loss, performance degradation, or other unforeseen consequences.

This product is designed as an integrated system and must be operated by trained and qualified personnel, including but not limited to:

- * Technical Support Engineer
- * Installation Engineer
- * Commissioning Engineer
- * Electrical Engineer

* Maintenance Engineer

Operators should be familiar with the characteristics and safety requirements of lithium batteries. If you are unsure whether you possess the necessary skills to complete this integration, please do not use this product.

2. Product Introduction

2.1 Energy storage system introduction

The energy storage system involves the process of storing energy in a medium or device and then releasing it when needed. The energy storage system includes input and output devices of energy and materials, along with energy conversion and storage devices. Energy storage technologies can be classified into several categories, including physical energy storage, electrochemical energy storage, and electromagnetic energy storage.

The electrochemical energy storage system is a system that uses electrochemical batteries as the storage carrier and employs power conversion systems (PCS) to store and release electrical energy in a cyclic manner. The essence of an electrochemical energy storage system is to convert electrical energy into chemical energy, which is then stored and later released through the mechanism of chemical battery, ultimately converting back into electrical energy to be fed into the power grid. Compared with other energy storage technology routes, the electrochemical energy storage system is characterized by higher energy density, moderate response speed, and wide range of applications, and is easier to mass-produce, install, and operate and maintain, thus having excellent potential for large-scale promotion.

Electrochemical energy storage includes forms such as lithium-ion, sodium-ion, and liquid flow. Among these, lithium-ion technology is the most mature and is currently the widely recognized route in the market.

In an energy storage system, storage battery serves as a critical device for energy storage and plays a key role in adapting to various usage scenarios.

2.2 Product function

This system is the DC side of the energy storage system. It can control the PCS to perform charging or discharging operations through commands from the control system. The energy input and output of the storage system are determined by the PCS you use, with a maximum charging and discharging current of 157 A/0.5C.

- Battery charging: the Energy Storage Converter (hereinafter referred to as PCS) is connected to the high-voltage cluster control box. Under the control system's scheduling, the PCS manages battery charging, storing excess energy in the battery.
- Battery discharge: when the grid is insufficient to supply power to the load, the system needs to use the control system to manage the battery to provide power to the load, with the stored energy in the battery being output to the load through the PCS.

2.3 Product features

This product is a storage DC-side system with an outdoor cabinet design. The system uses lithium iron phosphate battery cells, which are highly energy-dense, cost-effective, and safe, connected in a specific series-parallel configuration. The energy storage system includes a power distribution system, battery management system, thermal management system, and fire suppression system. It features safety and reliability, as well as rapid deployment. When paired with an energy management system and intelligent energy storage converters, it can achieve effective performance across a wide range of applications and scenarios.

- Comprehensive, multi-level battery warning and protection strategies, ensuring high safety;

- Equipped with comprehensive communication and monitoring functions, ensuring continuous and stable operation for a long time;
- A single stack can support up to 10 clusters in parallel (requires a suitable EMS);
- Equipped with automatic fire alarm and automatic fire extinguishing system inside the cabinet;
- Equipped with an intelligent temperature control system inside the cabinet, minimizing the impact of external environmental conditions on the internal equipment and making the system suitable for a wide range of applications.

2.4 Dimension and layout

2.4.1 Product dimension

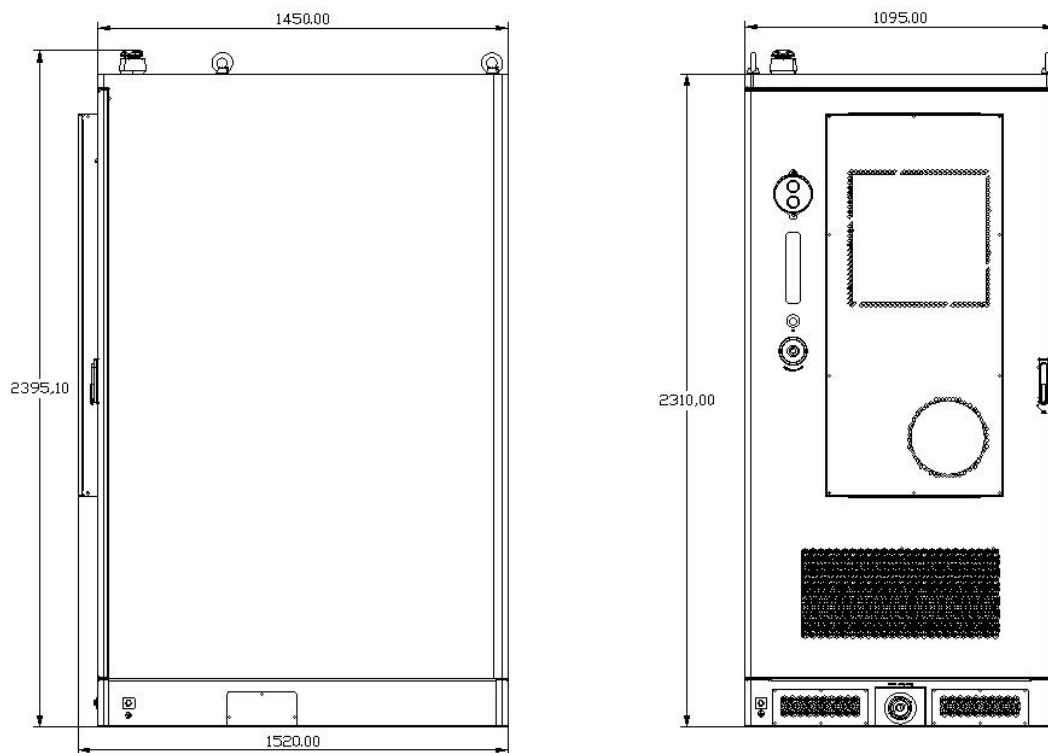


Figure 2.4.1 Product Dimension

2.4.2 Product layout

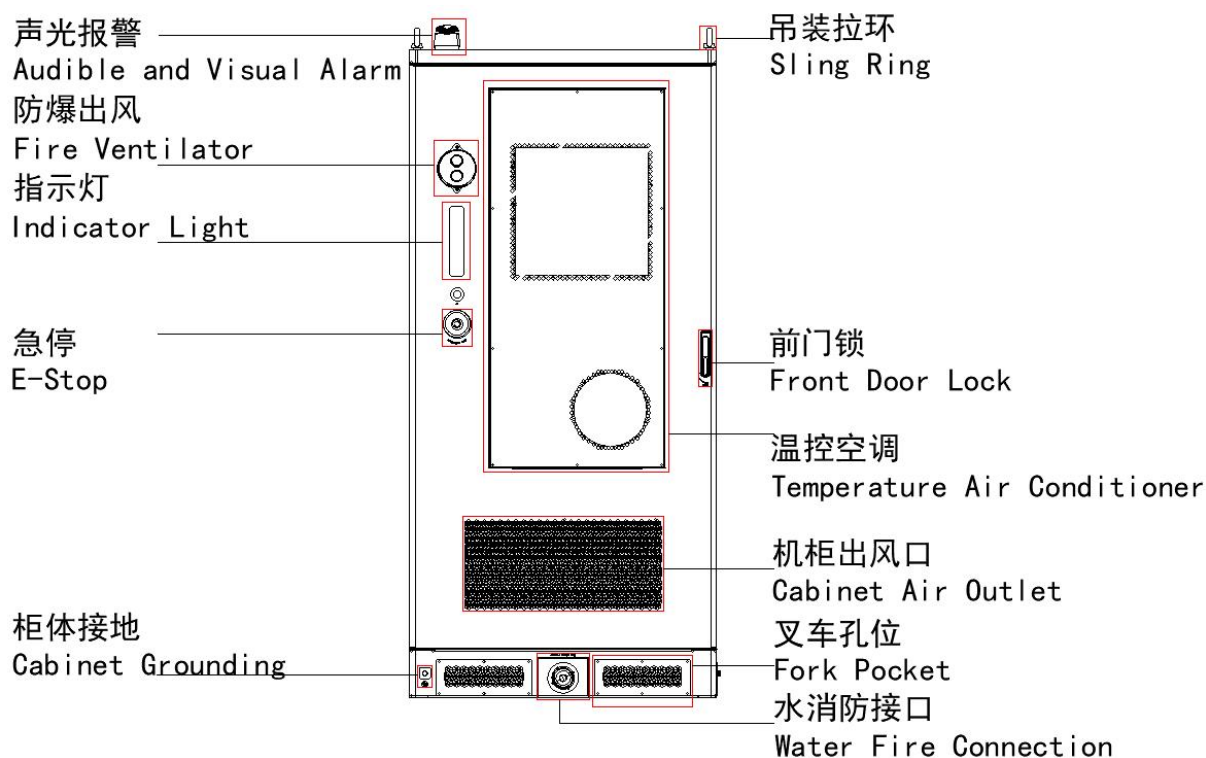


Figure 2.4.2 Product Layout - External

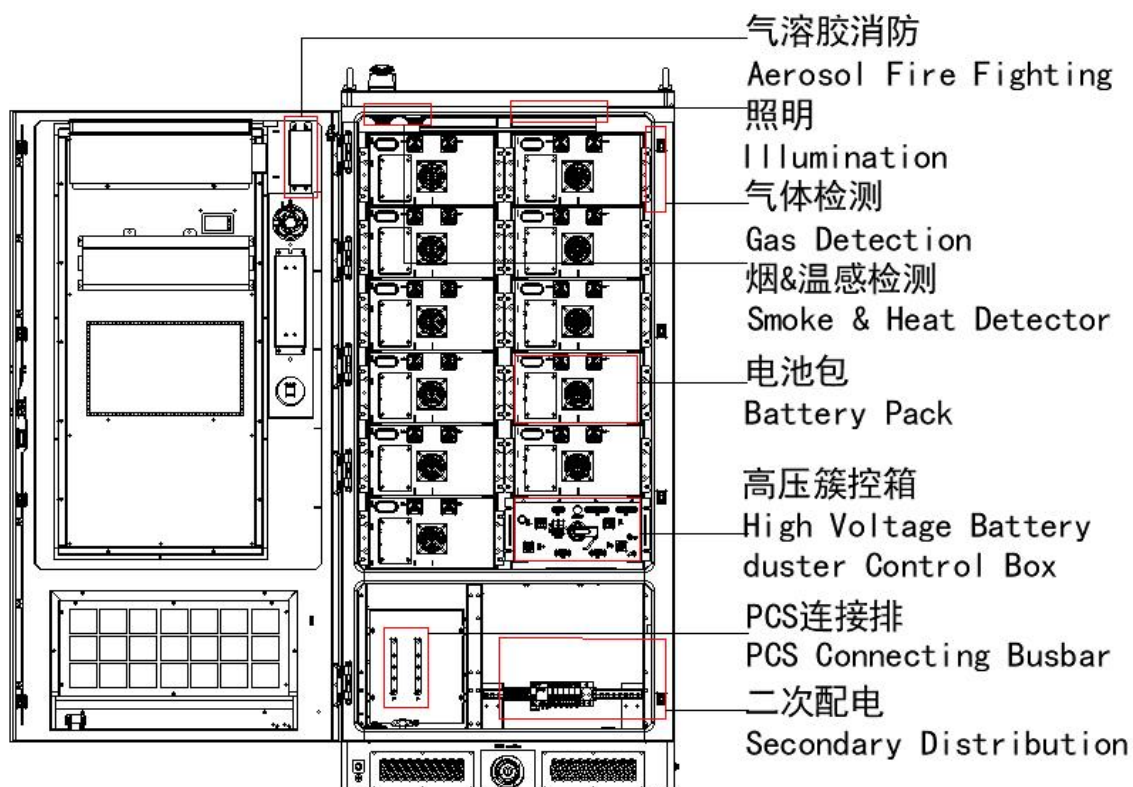


Figure 2.4.2 Product Layout - Internal

2.5 Product components introduction

2.5.1 Battery pack



Figure 2.5.1 Battery Pack Appearance Drawing

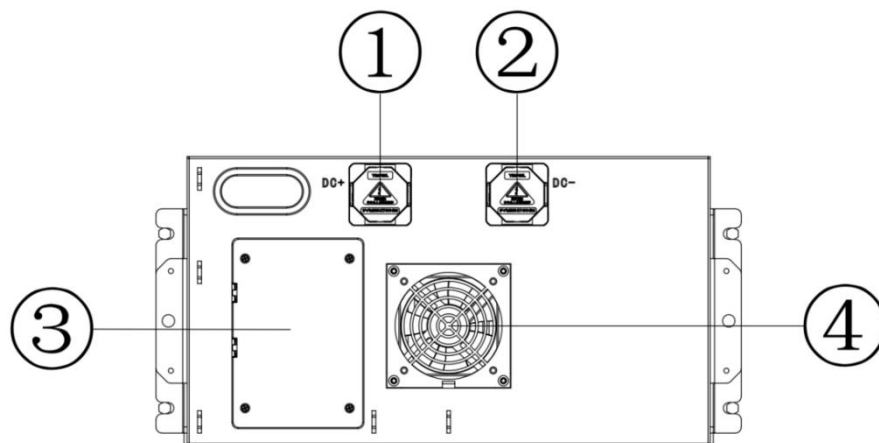


Figure 2.5.1 Battery Pack Panel Introduction

Table 2.5.1 Battery Pack Panel Introduction

No.	Item
1	Positive Connector
2	Negative Connector
3	BMU
4	Fan

Battery box fan control strategy:

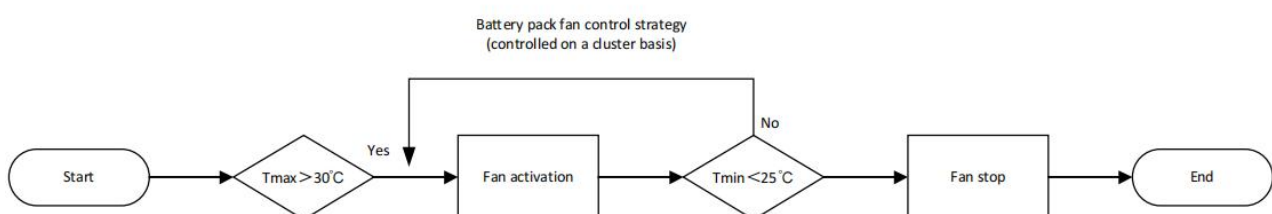


Figure 2.5.1 Battery Pack Fan Control Logic

2.5.2 High-voltage cluster control box



Figure 2.5.2 PDU Appearance Drawing

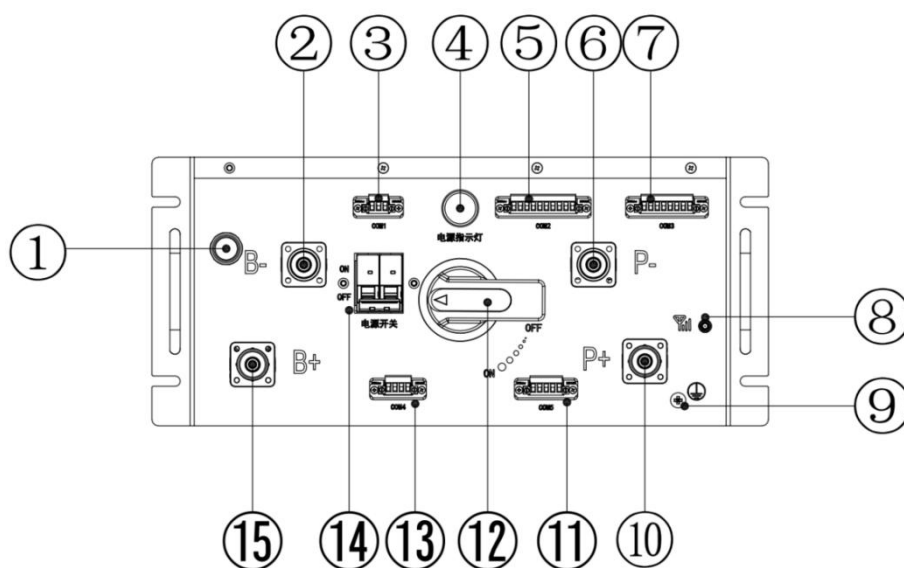


Figure 2.5.2 PDU Panel Introduction

Table 2.5.2 PDU Panel Introduction

No.	Item	No.	Item
1	Wake-up Switch	9	Grounding Point
2	Battery Cluster Main Negative Connector	10	PCS Main Positive Connector
3	COM1	11	COM5
4	Power Indicator Light	12	Circuit Breaker Manual Operator
5	COM2	13	COM4
6	PCS Main Negative Connector	14	Power Switch
7	COM3	15	Battery Cluster Main Positive Connector
8	Antenna Interface		

2.5.3 PDU indicator light

The PDU indicator light is a dual-color indicator. A solid green light indicates normal system operation, while a red light indicates an alarm from the PDU.

The following are level 2 alarm faults: the rack alarm red light is on, and the PDU alarm indicator red light is on.

Table 2.5.3 Level 2 Fault Information

1	System Failure	11	Overcurrent Discharge Fault
2	Emergency Stop Triggered	12	Overcurrent Charging Fault
3	Low Total Battery Voltage Fault	13	Intranet Communication Failure
4	High Total Battery Voltage Fault	14	Precharge Failure
5	Low Cell Voltage Fault	15	Relay Fault
6	High Cell Voltage Fault	16	Insulation Test Fault
7	Differential Pressure Fault	17	Abnormal Temperature Reading Inside Cabinet
8	Individual High Temperature Failure	18	Abnormal Smoke Detection Inside Cabinet
9	Individual Low Temperature Failure	19	Fire Sprinkler
10	Temperature Difference Fault		

Communication port definition:

Table 2.5.3 Communication Port Definitions

No.	I/O	COM port	Definition	Explanation
1	I	COM1 (3P)	AC220V-N	External input 220V power supply neutral wire
2	/		AC220V-PE	External input 220V power ground wire
3	I		AC220V-L	External input 220V power live wire
1	I/O	COM2 (10P)	CAN1R	Termination resistor
2	I/O		CAN1H	Isolate CAN, communicate with PCS interface or connect to external devices
3	I/O		CAN1L	
4	I/O		CAN1G	
5	I/O		RS485-A1	Isolated 485, communicating with I/O modules, interface or connecting to external devices
6	I/O		RS485-B1	
7	I/O		RS485-G1	
8	I/O		RS485-A0	Non-isolated 485, communication interface with display screen or connection to external devices
9	I/O		RS485-B0	
10	I/O		RS485-G0	
1	O	COM3 (8P)	GND	Switch quantity detection short circuit effective
2	O		SWITCH_IN	
3	/		SW2_IN	Dry contact 2 (0.1A)
4	I/O		SW2_OUT	
5	I/O		SW1_IN	Dry contact 1 (0.1A)
6	/		SW1_OUT	
7	O		24V+_OUT	Output 24V+ (rated 75W)
8	O		24V-_OUT	Output 24V - (rated 75W)

1	I/O	COM4 (4P)	DEBUG_CANH	Debugging CANH on the host computer
2	I/O		DEBUG_CANL	Debugging CANL on the host computer
3	I		24V+_IN	External DC input 24V+
4	I		24V-_IN	External DC input 24V -
1	I/O	COM5 (5P)	SPI-H	BMU intranet daisy chain communication H
2	I/O		SPI-L	BMU intranet daisy chain communication L
3	/		/	/
4	O		FAN+	Fan power supply AC output 24V+
5	O		FAN-	Fan power supply AC output 24V -

2.5.4 Industrial temperature control air conditioner

The industrial air conditioning for energy storage is an industrial air conditioning unit specifically designed for energy storage system. It features an integrated structure and high airflow design, providing a safe, reliable, and energy-efficient precision temperature control solution. The air conditioner offers both cooling and heating functions to meet various environmental application needs.

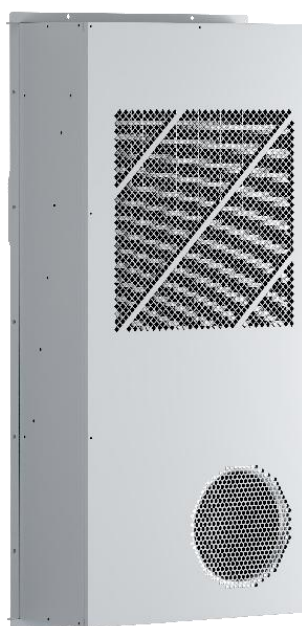


Figure 2.5.4 Air Conditioner

Air conditioning control strategy:

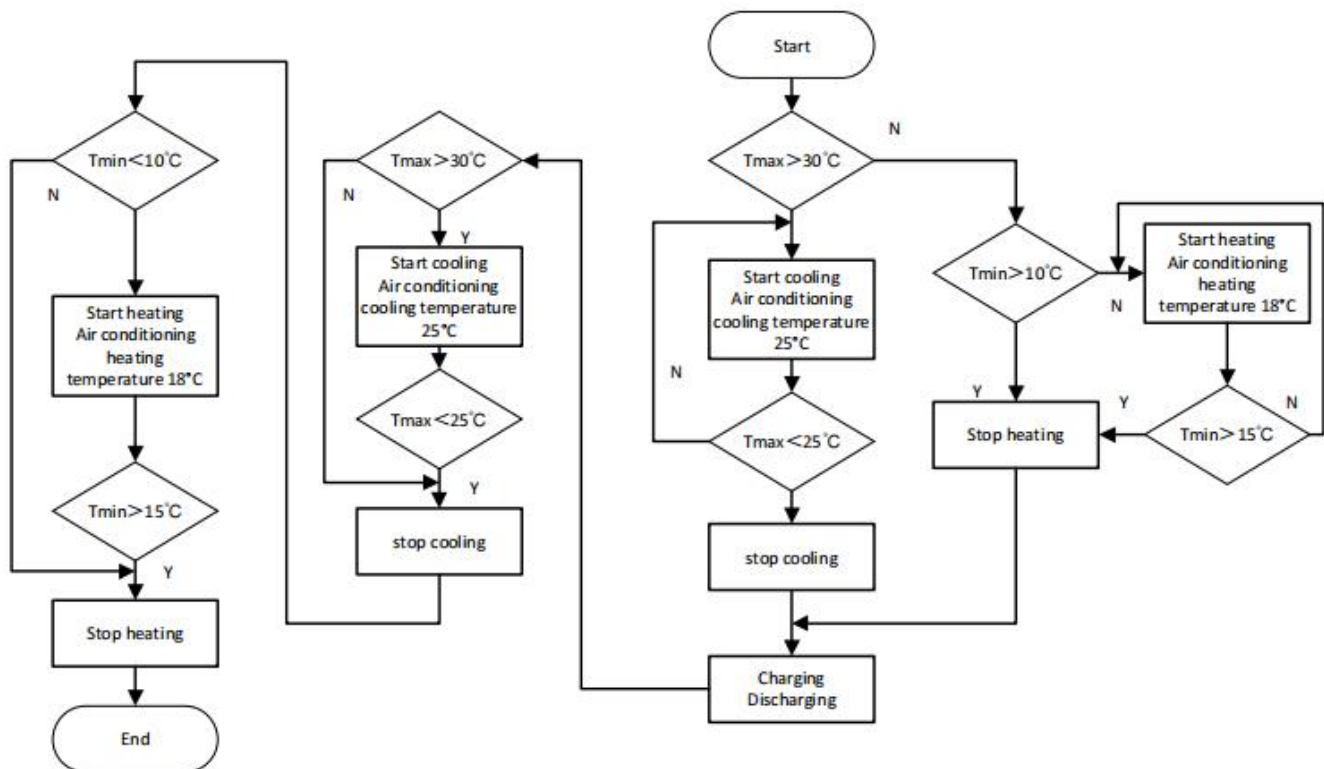


Figure 2.5.4 Industrial Air Conditioning Control Logic Flow

2.5.5 Status indicator lights and emergency stop button

The energy storage system is equipped with two status indicator lights and four power indicator lights to display the operating status of the equipment.

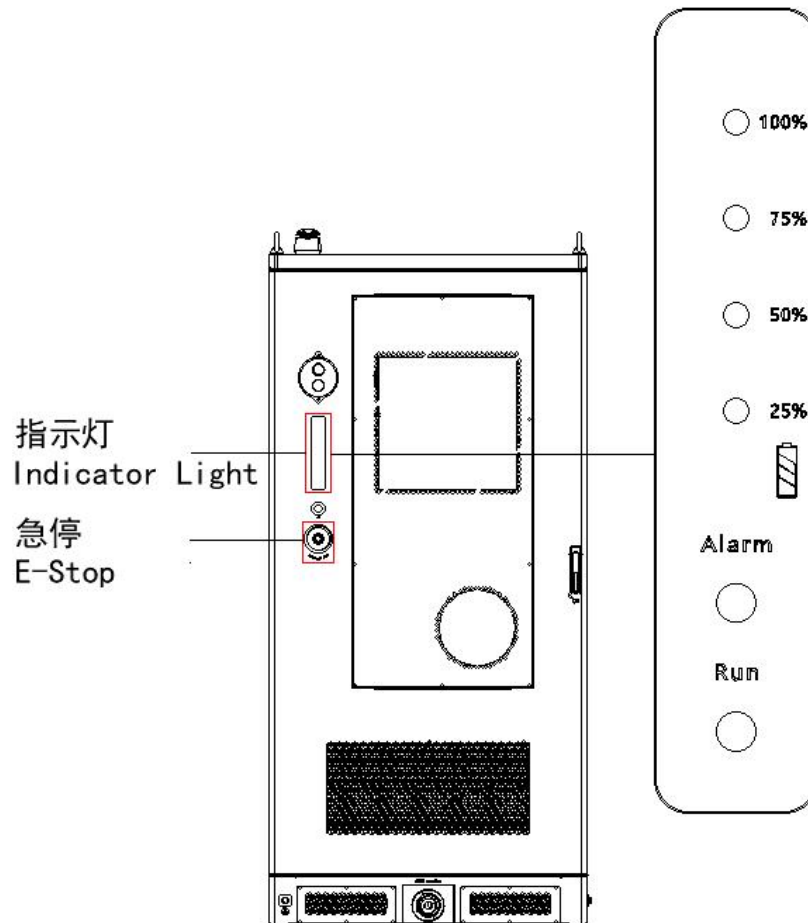


Figure 2.5.5 Indicator Panel Introduction

Table 2.5.5 Indicator Panel Description

State	Description	Description
●	The operation light is on	The system is running normally
●	Warning lights come on	The system has fault information
●	Power indicator light	100% SOC: 4 power indicators light up 75%~99% SOC: 3 power indicators light up 50%~74% SOC: 2 power indicators light up 25%~49% SOC: 1 power indicator light light up

Emergency power off (EPO)

In an emergency, pressing the emergency stop switch will immediately halt the system.

2.6 Working principle

2.6.1 Single-machine topology structure

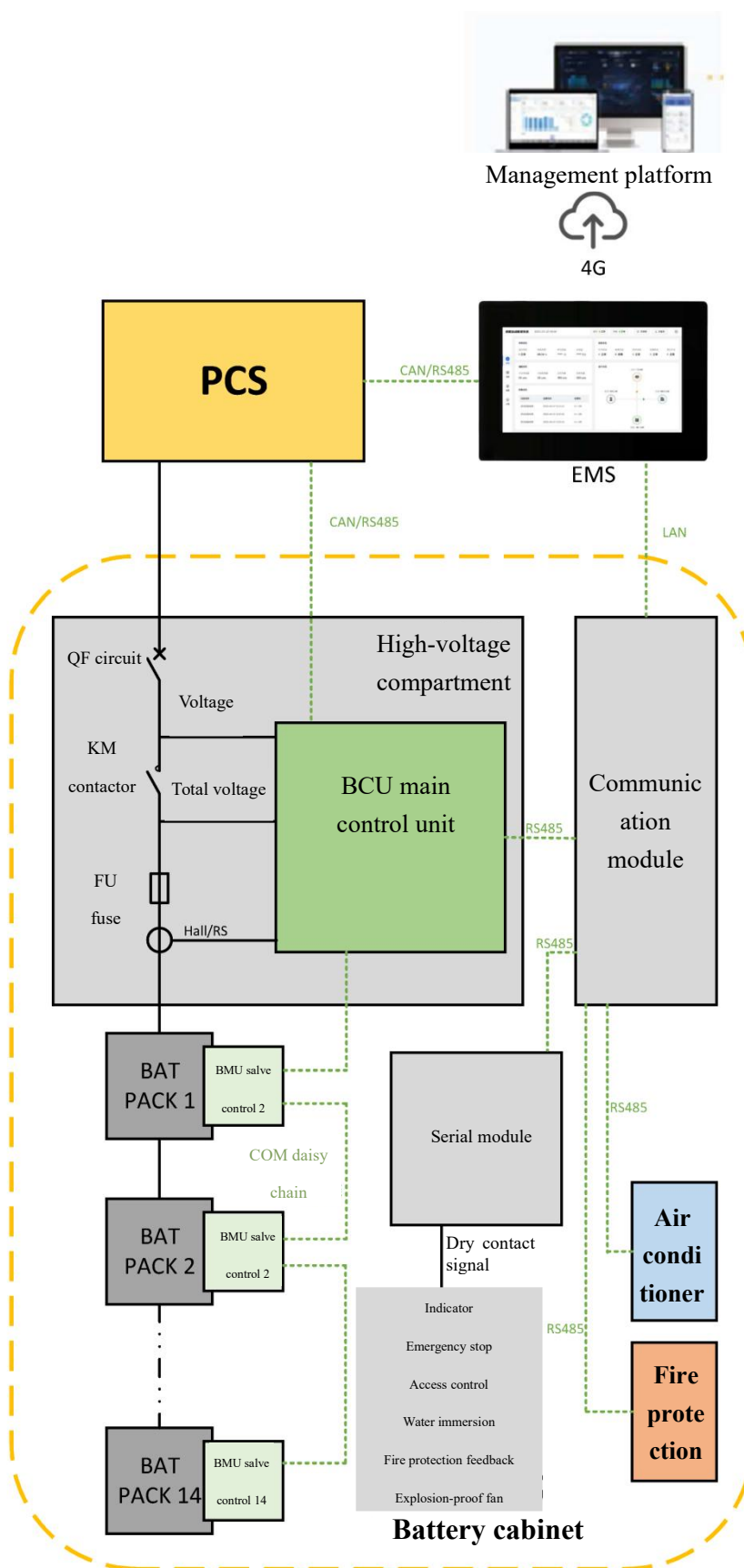


Figure 2.6.1 Battery Cabinet Topology

2.6.2 Typical application scenarios

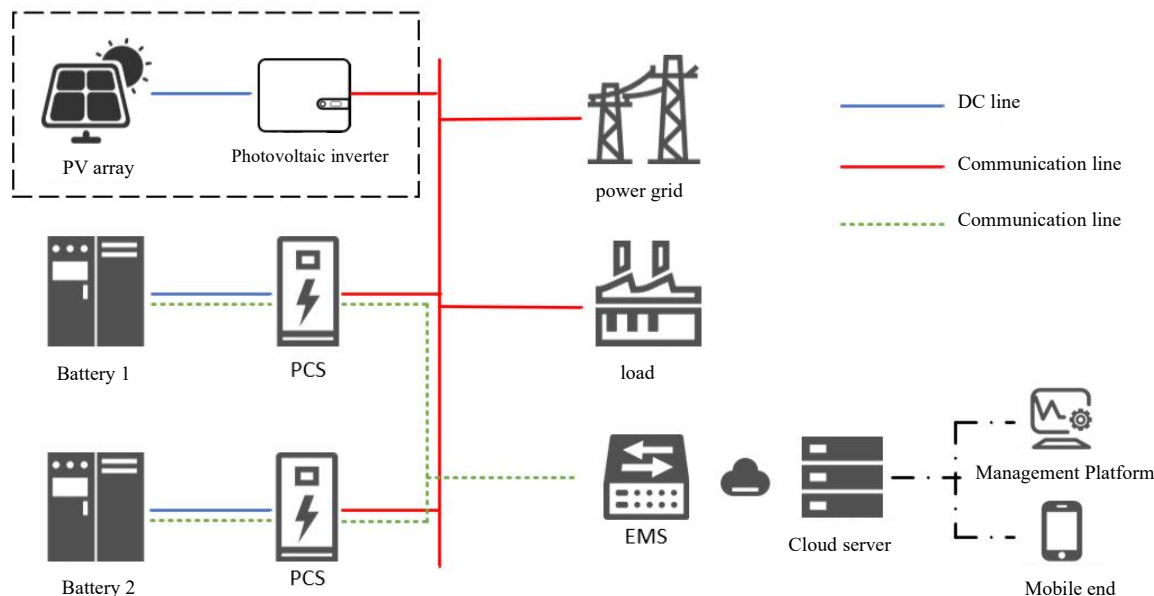


Figure 2.6.2 Typical Application Scenarios

※ This product is only for use on the DC side of the system (i.e., the battery part in the typical application scenario shown in the figure). A complete energy storage system requires the use of optional equipment such as PCS and EMS.

2.7 CAN analyzer connection

2.7.1 CAN box connection

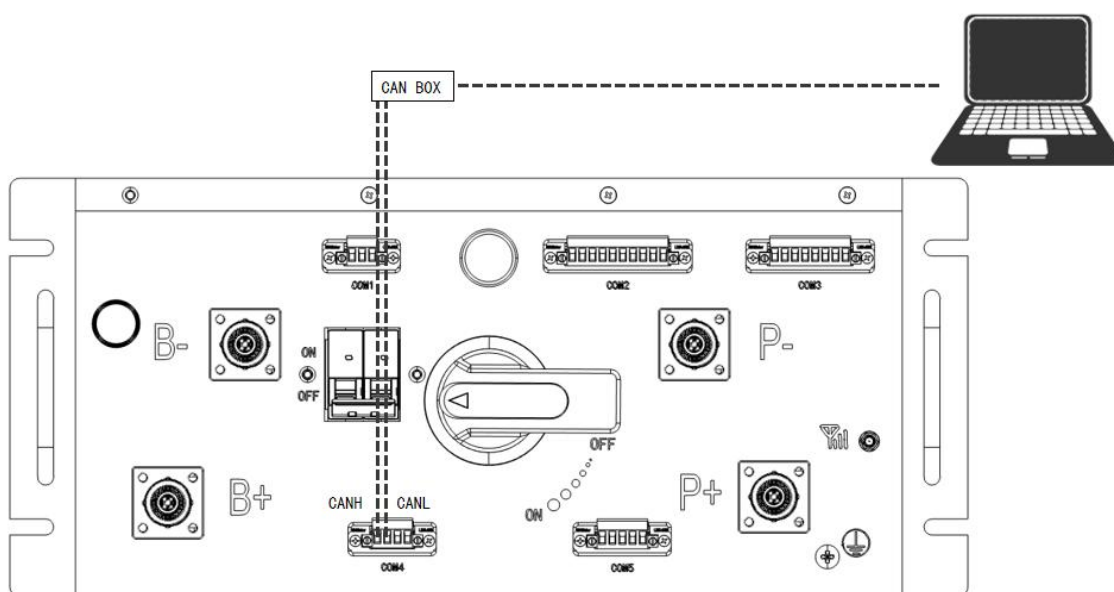


Figure 2.7.1 CAN BOX Connection

Connect the CANH and CANL interfaces of the CAN box to the CANH and CANL interfaces of the COM4 of the high-voltage box, respectively, and connect the other end to the USB port of the computer.

2.7.2 Host computer operation

After opening the host computer, the following interface will appear:

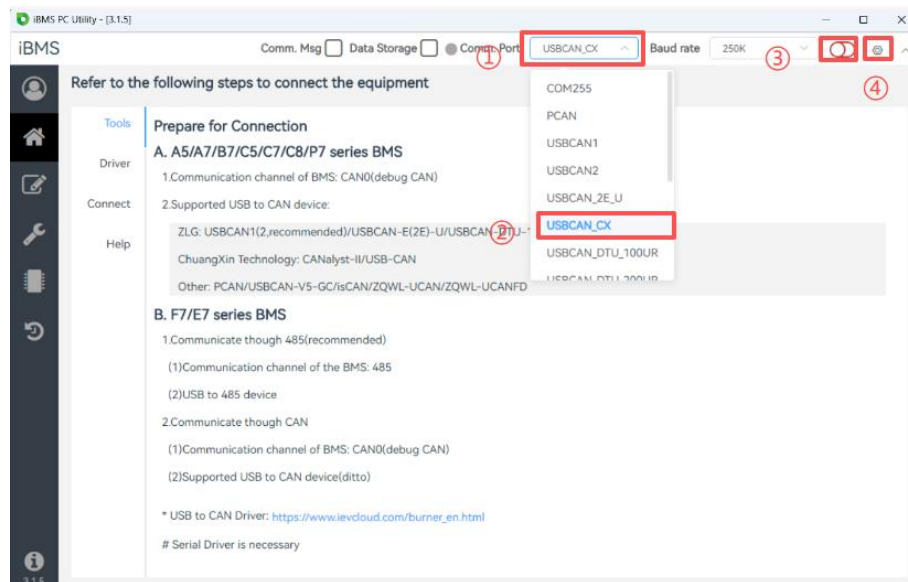


Figure 2.7.2 Host Computer Login

Click ① Communication Port Selection ② USBCAN_CX, click ③ Open Host Computer, and click ④ to enter the port and language modification interface.

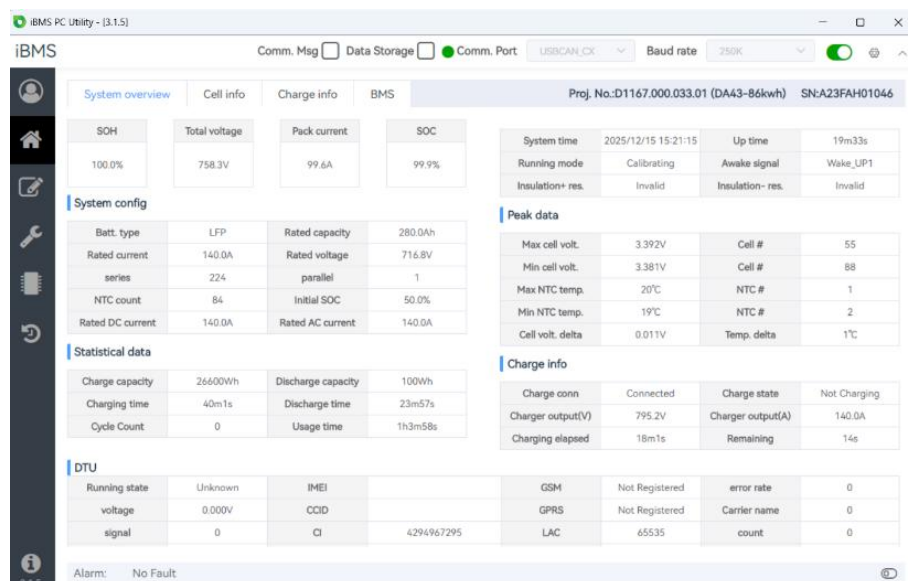


Figure 2.7.2 Battery Information Interface

Using a host computer allows you to view the current battery status information, individual battery cell voltage and temperature information, and battery fault information,

which is more conducive to data monitoring and fault diagnosis.

Note: The CAN analyzer is an optional product.

3. Transportation and Storage

3.1 Transportation

3.1.1 Handling requirements



During the moving process, comprehensive safety measures must be implemented. When moving items, handle them gently, avoid dragging or throwing them on rough surfaces.

- When moving heavy objects, be prepared to bear the weight to avoid being crushed or twisted by the heavy objects;
- When two or more people are moving heavy objects together, one person should give instructions, and they should lift or lower the equipment simultaneously in a coordinated manner;
- When handling equipment by hand, wear protective gloves and safety shoes to prevent injury;
- When lifting equipment by hand, first approach the object, squat down, and use the strength of your straight legs (do not use your back) to slowly and steadily lift the object. Never suddenly lift or twist your torso;
- When moving or lifting the equipment, hold the equipment handle or support the bottom edge of the equipment, and do not hold the handles of the modules installed inside the equipment;
- Do not lift heavy objects above waist height quickly. First, place the heavy object on a workbench or other suitable surface at waist height, adjust the position of your

hands, and then lift it;

- When moving heavy objects, force must be applied evenly and steadily; the movement speed should be uniform and low; and positioning should be smooth and slow to avoid any impacts or drops that could scratch the equipment surface or damage its components and cables;
- When moving heavy objects, be especially careful around workbenches, ramps, stairs, and other slippery areas. When moving heavy objects over thresholds, ensure the threshold is wide enough for the equipment to pass through to prevent injury or abrasions to fingers;
- When moving heavy objects, move your feet instead of twisting your waist. When lifting and passing heavy objects simultaneously, point your feet in the direction you want to move them first, and then lift them;
- When using a forklift to move the equipment, the forklift must be positioned in the middle to prevent tipping. Before moving, secure the equipment to the forklift with ropes; during movement, it must be supervised by a designated person;
- The tilt angle should meet the requirements: with packaging, the tilt angle $\alpha \leq 15^\circ$; after removing the packaging, the tilt angle $\alpha \leq 10^\circ$.

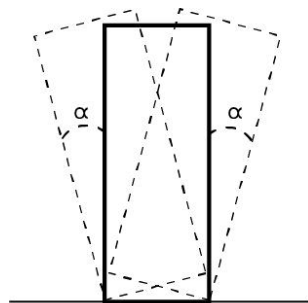


Figure 3.1.1 Inclination Angle

- During handling and transportation, the air conditioner must be kept upright; it is forbidden to lay it flat or upside down.

3.1.2 Transportation requirements

- Rough handling during loading and unloading is prohibited, as it may cause battery short circuits, damage (such as leakage or rupture), fire, or explosion;
- During moving, ensure that the battery is transported according to its specified orientation. Do not invert, tilt, drop, expose to mechanical impacts, or subject to rain, snow, or immersion in water;
- Batteries must be transported separately. For cabinets equipped with batteries, transportation with the batteries installed is prohibited. If the cabinet needs to be transported or moved, the batteries must be removed first;
- The battery is certified according to UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and is classified as a Class 9 hazardous material;
- The transport service provider must have qualifications for handling hazardous materials. The use of open-top vehicles is strictly prohibited;
- The battery can be shipped directly to the site, provided it meets the transportation requirements for vehicles, ships, and other modes of transport;
- The international regulations for the transport of hazardous materials should be complied with, and the regulatory requirements of the origin country, transit countries, and destination country authorities should be met;
- Sea transport or well-maintained highways should be used for shipping; rail and air transport are not supported. During transport, minimize bumps and tilting as much as possible;
- For sea transport, adhere to the requirements of the International Maritime Dangerous Goods Code;

- Before transport, the battery packaging must be checked for completeness and integrity. Ensure there are no signs of odor, leakage, smoke, or fire; otherwise, transport is prohibited;
- The transport packaging must be sturdy. Handle with care during loading, unloading, and transit, and implement moisture protection measures.

3.2 Storage requirements



Due to the characteristics of lithium batteries, storage must adhere to specific battery storage requirements. Failure to do so may result in permanent damage or performance degradation.

- Battery packs should not be stored for extended periods. Long-term storage of lithium batteries can lead to capacity loss, with an irreversible capacity loss of 3% to 10% typically occurring after 12 months at recommended storage temperatures;
- The battery should be stored in a clean, dry place, and should be protected from dust and moisture. Avoid exposure to rain or standing water;
- The environment must be free from corrosive or flammable gases;
- The battery should not be stored tilted or inverted;
- For equipment other than battery packs that has been stored for two years or more, it must be inspected and tested by a professional before use.

3.2.1 Energy storage system storage (excluding battery pack)

- Avoid removing the packing during long-term storage;
- Avoid stacking storage;
- Store (long-term or temporary) on a flat surface;
- Close the cabinet door tightly;

- Storage environment temperature: -40°C – $+60^{\circ}\text{C}$, relative humidity: 5% RH – 90% RH.

3.2.2 Battery pack storage

- Batteries should be stored indoors, away from direct sunlight and rain, in a dry and well-ventilated area. The surroundings should be clean, free from excessive infrared or other radiation, organic solvents, corrosive gases, and conductive metallic dust. Keep them away from heat and ignition sources;
- If a battery shows signs of fault (such as carbonization, leakage, swelling, or water ingress), it must be promptly transferred to a hazardous materials storage area, kept at least 3 m away from flammable materials, and disposed of as soon as possible;
- When storing batteries, place them according to the packaging labels. Do not store them upside down, on their side, or tilted. Ensure stacking complies with the requirements specified on the outer packaging;
- Batteries should be stored separately from other equipment and should be avoided stacking too high. Ensure that the site is equipped with appropriate fire safety measures, such as fire sand and extinguishers;
- After discharging, batteries may experience static power consumption of internal modules and self-discharge, which could lead to damage from over-discharge. Avoid storing batteries in a low-charge state and promptly recharge them. If a battery experiences permanent fault due to lack of recharging beyond the recommended period, our company will not provide warranty services. Scenarios triggering low-charge storage include but are not limited to:
 - Battery power cables or signal lines are not connected;
 - The battery cannot enter charging mode due to a system fault after

discharging in an energy storage system;

- The battery cannot enter charging mode due to improper configuration of the energy storage system;

- The battery cannot enter charging mode due to prolonged loss of AC power;

- The battery cannot enter charging mode due to the control system, PCS (Power Conversion System), or main circuit components not being properly closed or engaged.

3.2.3 Storage environment requirements

- Environmental temperature: $-30^{\circ}\text{C} \sim +50^{\circ}\text{C}$ (excluding battery pack);
- Environmental temperature: $0\sim 30^{\circ}\text{C}$ (battery pack); It is recommended to store the battery pack in a constant temperature environment of 25°C . Long term storage may affect the performance and service life of the battery;
- Relative humidity: 5% RH~90% RH (recommended around 45% RH) ;
- Dry, ventilated, and clean;
- Avoid contact with corrosive organic solvents, gases, and other substances;
- Avoid direct sunlight;
- The distance from the heat source should not be less than two meters;
- When storing, it is necessary to disconnect from the external connection. If there is an indicator on the battery pack panel, the indicator should be in the off state;
- Report any overdue storage promptly;
- When shipping batteries, follow the first-in, first-out principle;
- Move batteries gently during transport, and avoid damaging them.

4. Installation Site Requirements

4.1 Location requirements

- This system is only applicable to outdoor scenes;
- The installation environment horizontal surface should be elevated above the area historical highest water level and at least 300 mm above the ground. The installation site must not be in a low-lying area;
- The installation site and a 3-meter surrounding area of the energy storage system or energy storage station should be free of vegetation and flammable plants to prevent fires caused by wildfires during high summer temperatures;
- The safety distance between the energy storage system and buildings should comply with local fire safety regulations or standards;
- The safety distance between energy storage systems and Class A production buildings must be $\geq 12\text{m}$; with Class B production buildings, $\geq 10\text{m}$; with Class C, D, and E production buildings meeting fire resistance ratings I or II, $\geq 10\text{m}$; with Class III fire resistance production buildings, $\geq 12\text{m}$; and with residential buildings, $\geq 12\text{m}$. If the exterior walls of adjacent buildings are non-combustible and there are no doors, windows, or exposed combustible eaves, the fire separation distance can be reduced by 25% from the aforementioned safety distances;
- If the specified safety distances cannot be met, a fire wall must be installed between the battery equipment room, energy storage room, or energy storage installation area and Class C, D, and E buildings. The fire wall should have a fire resistance rating of at least 3 hours and extend 1 m beyond the outer contours of the energy storage system in terms of length and height. Additionally, the fire wall design should consider space requirements for equipment transportation, installation, and maintenance;

- The energy storage system or energy storage station must be situated in an environment free from explosion or fire risk;
- The site should have convenient transportation access and reliable fire suppression system equipment.

Description 1

- During the installation, commissioning, and operation phases of the energy storage system, the fire safety principle should be prioritized. At least two gas fire extinguishers, such as those using halon, perfluorohexane, or carbon dioxide, should be placed near each unit;
- Please reserve a water fire extinguishing system interface for the energy storage system site;
- Ensure the site meets the immediate space requirements and provides additional space for future expansion based on the full life cycle needs;
- Choose a place with good ventilation;
- The energy storage system should not be installed in areas prone to salt damage or pollution, as it will suffer from corrosion. It is suitable for use in the following or better environments:

- The energy storage system is suitable for outdoor environments more than 2,000 m from the coast. It is not recommended for use within 500 m–2,000 m of the coast (if needed, confirm with the distributor or our engineers). The system should not be used within 500 m of the coast;

- 1,500 m–3,000 m away from heavy pollution sources such as smelters, coal mines, and thermal power plants;

- 1,000 m–2,000 m away from moderate pollution sources such as chemical,

rubber, and electroplating;

■ 500 m–1,000 m away from light pollution sources such as food, leather, heating boilers, slaughterhouses, centralized garbage dumps, and sewage treatment plants.

Description 2

If the safety distance at the selected site does not meet relevant national standards, it is advisable to choose a new location. The site should avoid scenarios not recommended by industry standards and regulations, including but not limited to the following areas, regions, and locations:

- Areas with strong vibration, intense noise sources, and significant electromagnetic interference;
- Places with dust, oil smoke, harmful gases, or corrosive gases;
- Places where corrosive, flammable, or explosive materials are produced or stored;
- Places with existing underground facilities;
- Areas with poor geological conditions, such as rubber soil, soft soil layers, or surfaces prone to water accumulation and subsidence;
- Areas beneath water reservoirs, water landscapes, or water intake rooms.

Description 3

- If placement in a potentially water-accumulating area is unavoidable, install barriers, drainage facilities, or elevate the ground;
- Cable trenches should not be used as drainage channels, and all openings for cable routing (such as holes where cables pass through partition walls or floors) should be fire-resistant sealed;
- Earthquake faults and earthquake zones with a seismic intensity higher than nine

degrees;

- Areas prone to direct hazards such as mudslides, landslides, quicksand, or sinkholes;
- Within the boundaries of mining subsidence (displacement) zones;
- Historical and cultural heritage protection areas within the blasting hazard zone;
- Areas that may be flooded after a dam or dike breach;
- Important water supply source sanitary protection zone;
- Crowded places, high-rise buildings, and underground structures;
- Intersections of arterial street and heavily trafficked areas.

Site selection requirements for flood control and drainage:

- The site design elevation for large-scale electrochemical energy storage systems (power $\geq 100\text{MW}$) should be higher than the flood level at a frequency of 1% or the historical highest water level;
- For medium and small-sized electrochemical energy storage systems (power $< 100\text{MW}$), the site design elevation should be higher than the flood level at a frequency of 2% or the historical highest water level;
- If the site design elevation cannot meet the above requirements, choose an alternative site or implement various flood and drainage measures based on different conditions;
- For energy storage stations along rivers, lakes, or coastal areas affected by wind and waves, flood protection facilities should be designed to accommodate a 2% wave height plus an additional 0.5 m for safety;
- When there is significant runoff entering or crossing the site perimeter, it is advisable to install ditches or drainage (cut-off) channels to manage surface water

drainage systematically.

Fence against illegal entry:

It is recommended to use solid walls or fences for isolation and protection around the energy storage area. The fence should have a lockable gate, and its height should be greater than 2.2 m. Firewalls may replace part or all of the fencing, depending on the design considerations.

4.2 Foundation requirements

Foundation design requirements:

- The energy storage system must be installed on a concrete or other non-combustible surface. Ensure that the installation plane is level, stable, and even, with sufficient load-bearing capacity. Installation on surfaces with depressions or inclines is prohibited;
- The equipment foundation should be designed based on a load-bearing capacity of 2,750 kg per unit. If the foundation load-bearing capacity is insufficient, it must be reassessed;
- The bottom of the equipment foundation pit must be thoroughly compacted and levelled;
- After excavation of the equipment foundation, avoid water exposure and disturbance. If water exposure occurs, continue excavation and replace the disturbed material;
- The horizontal deviation between the equipment foundation and the equipment contact surface must not exceed 3 mm;
- The foundation must be higher than the local historical highest water level and at least 300 mm above the ground;

- Construct drainage facilities based on local geology and municipal drainage requirements to prevent water accumulation at the equipment foundation. The equipment foundation must meet the drainage requirements for the area's historical maximum rainfall, and the discharged water should be treated in accordance with local laws and regulations;
- When constructing the equipment foundation, consider the routing of energy storage system cables by reserving trenches or entry holes;
- The reserved holes in the equipment foundation and the entry holes at the bottom of the equipment should be properly sealed;
- Users must verify the foundation design parameters of the energy storage system based on the project's installation environment, geology, and seismic requirements.

4.3 Forklift requirements

- Do not move the energy storage system after the battery pack harness has been installed;
- If using a forklift for cabinet installation, the forklift load capacity must be ≥ 3 t;
- If using a forklift for battery pack installation and maintenance, the forklift load capacity must be ≥ 1 t;
- Recommended fork length: 1,300 mm–1,500 mm, width: 80 mm–160 mm, and thickness: 25 mm–80 mm;
- Forklift lifting height requirement: when the foundation height is ≤ 0.3 m, the lifting height should be ≥ 2 m; when the foundation height is greater than 0.3 m, the lifting height increases accordingly.

4.4 Lifting requirements

Personnel involved in lifting operations must receive relevant training and be certified

as competent before they can perform the tasks.

- The lifting area must be marked with temporary warning signs or fenced off for isolation;
- The foundation for lifting operations must meet the load-bearing requirements for the crane;
- Before lifting, ensure that the crane and lifting ropes meet the load-bearing requirements;
- Before lifting, ensure that the lifting tools are securely fixed to fixed structures or walls that meet the load-bearing standards;
- During lifting operations, do not walk under the crane boom or the lifted load;
- During lifting operations, do not drag wire ropes or lifting equipment, and avoid using hard objects for impact;
- During lifting, ensure that the angle between the two cables does not exceed 90°;
- When installing or dismantling lifting equipment, avoid dragging it across the cabinet to prevent scratches;
- Do not perform lifting or moving operations after the battery pack has been installed in the energy storage system.

Lifting precautions:

Before lifting:

- Crane lifting capacity ≥ 3 t, working radius ≥ 2 m. If the on-site working conditions do not meet requirements, consult a professional for assessment;
- Personnel involved in lifting operations must receive relevant training and be certified as competent before they can perform the tasks;

- Lifting tools must be inspected and complete before use;
- Ensure that lifting tools are securely fixed to load-bearing structures or walls;
- When using outdoors, it is recommended to perform lifting operations in clear, calm weather conditions;
- Confirm that the crane and steel cables meet the requirements before proceeding with the lift;
- The doors of the equipment have all been closed and locked;
- Ensure the safe and reliable connection of steel cables;
- It is recommended to use a left-to-right or right-to-left lifting sequence to ensure a smooth lifting operation.

During lifting:

- Unauthorized personnel must not enter the lifting area, and no one should stand under the crane boom;
- Ensure the crane is positioned correctly and avoid long-distance lifting;
- Maintain stability, ensuring that the diagonal tilt of the cabinet does not exceed 5°;
- Ensure that the angle between the two cables does not exceed 90°;
- Lift and place the equipment gently. Lower the cabinet slowly and steadily to avoid impacting the internal components;
- When the cabinet contacts the base, wait until the load on the base is evenly distributed before removing the lifting cables;
- Do not drag wire ropes or lifting equipment, and avoid equipment collisions;

- Only proceed with lifting subsequent cabinets after the initial cabinet has been securely fixed.

5. Mechanical Installation

5.1 Unpacking

5.1.1 Unpacking

Depending on the type of wooden crate, there are two ways to open it:



Figure 5.1.1 Schematic diagram of wooden box fixing buckle operation

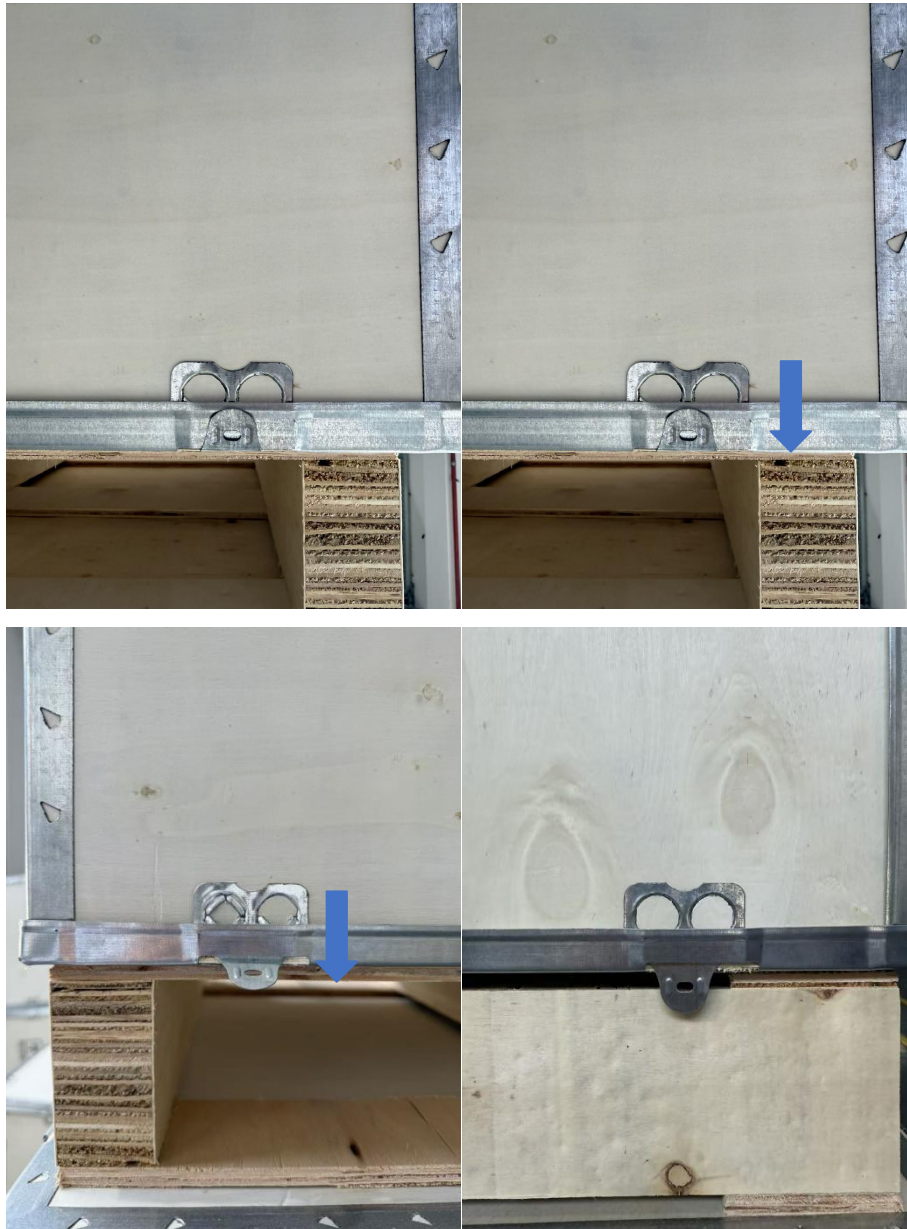


Figure 5.1.1 Schematic diagram of wooden box fixing buckle operation

5.1.2 Accessories check

Before installing the product, please carefully check the following accessories:

Figure 5.1.2 Parts List

No.	Accessories	Appearance	Explanation	Quantity
1	Battery		Provide power	1

2	Cluster Control Box/Battery Positive Power Line		50 square meters red (620mm) power line	1
3	Cluster Control Box/Battery Negative Power Line		50 sq mm black (400 mm) power cable	1
4	Battery Pack Jumper Wire		50 square meters red (450mm) power line	1
5	Battery Pack Power Line		50 square meters red (275mm) power line	9
6	Cluster Control Box/Copper Busbar Positive and Negative Power Lines		50 sq mm red (1100 mm) & black (1100 mm) power lines	1 each
7	Power Line Between High Voltage Box/PCS		50 sq m red (6m) & black (6m) power lines	1 each
8	Auxiliary Power Supply / Air Conditioner External Wiring		Mains power to auxiliary power/air conditioner power supply line	2
9	Communication Line		RJ45 to CANH/L (6m) Category 6 network cable	1
10	Diverter Power Line (optional)		25 sq mm red (1.5m) & black (1.5m) power cable	2 each
11	Busbar (Optional)		4-channel M8 terminal busbar 300A 48V Red/Black	1 each

12	User Manual	 User Manual BS09-265-D DC-side Energy Storage System	Product Manual	1
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5.1.3 Product inspection

Inspect the internal products and equipment for damage. If any problems or questions are found, please contact the seller.

5.2 Installation environment

- The installation environment should be kept dry and well ventilated, and the installation location should be away from toxic, harmful, flammable and explosive gases and corrosive environments;
- The installation location should be away from residential areas to avoid noise impact;
- The installation ground should be kept flat and firm without tilting or sinking;
- The system is suitable for outdoor installation only;
- The installation environment level should be higher than the highest historical water level in the area and at least 300mm above the horizontal ground. The installation location cannot be in a low-lying area;
- During construction, sufficient space should be reserved for laying and routing AC and DC cables;
- There should be no vegetation or flammable plants within 3m of the installation site of the energy storage system or energy storage power station to prevent wildfires caused by high temperatures in summer from causing fires in the energy storage system;
- After all cables are installed, they should be sealed with fireproof sealing materials to prevent small animals or insects from entering the equipment.

5.3 Install the foundation

The foundation drawings are for reference only and should not be used as final construction drawings. Users must verify the design parameters of the energy storage system foundation based on the installation environment, foundation bearing capacity, geological conditions, and seismic requirements of the project site.

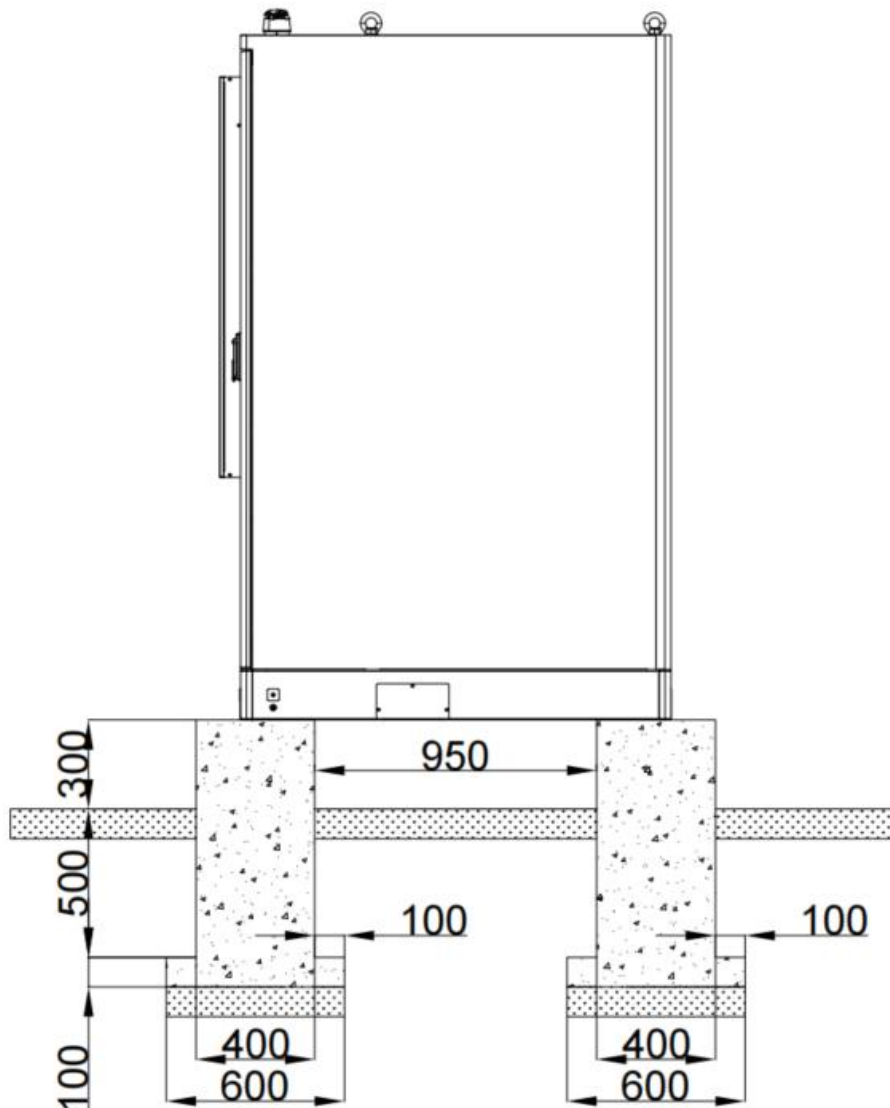


Figure 5.3 Schematic diagram of foundation installation

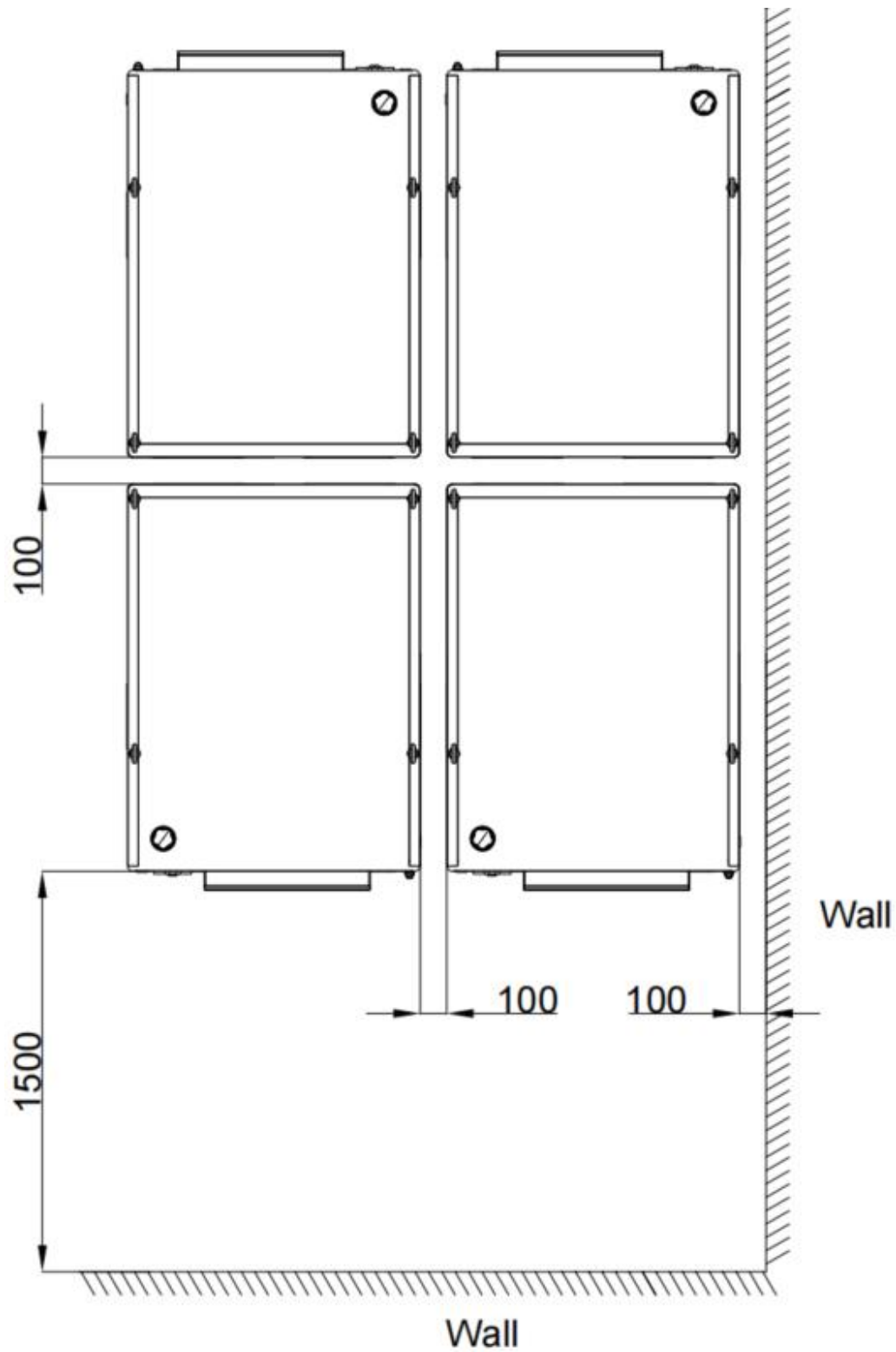


Figure 5.3 Foundation Installation

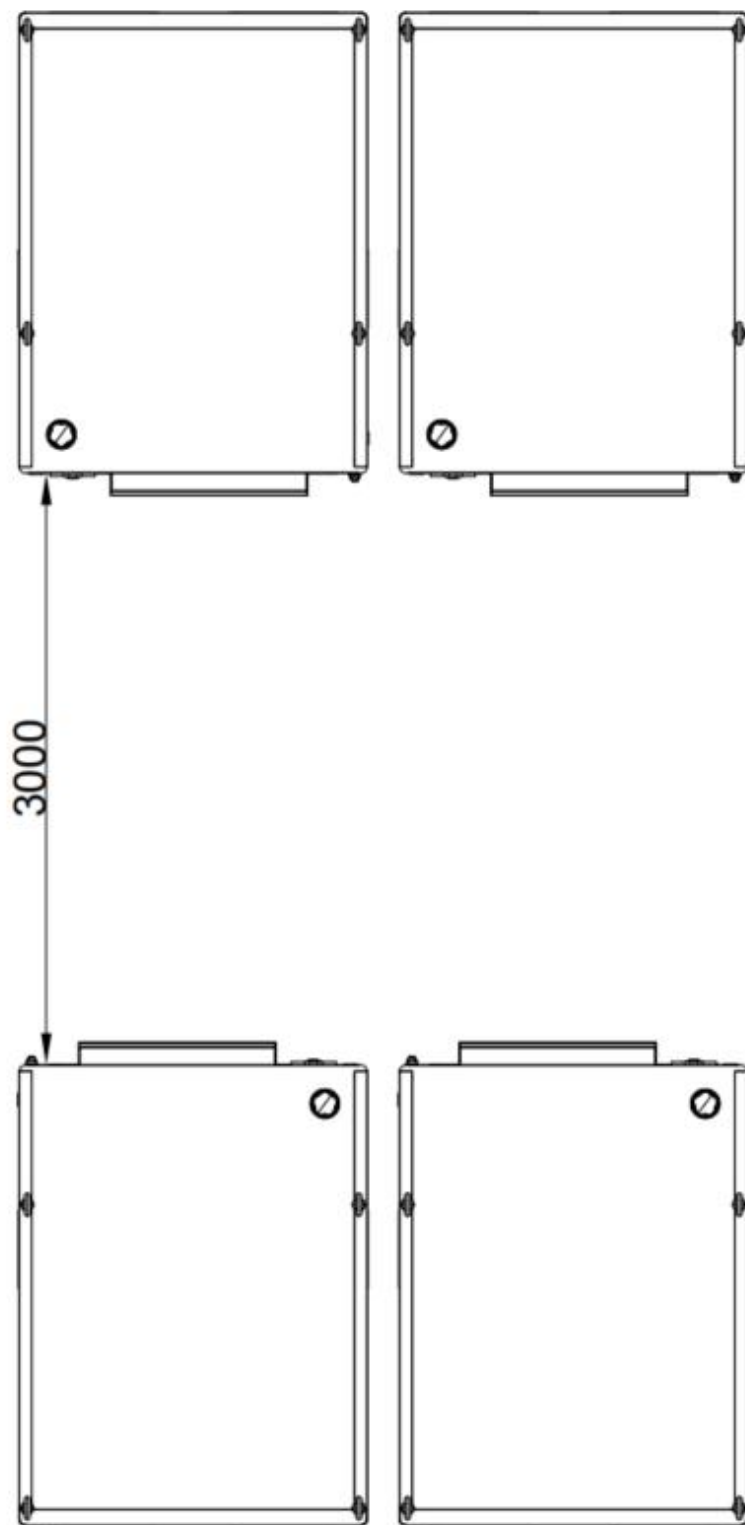


Figure 5.3 Foundation Installation

5.4 Infrastructure requirements

Improper foundation construction will cause a large number of problems during installation and maintenance and affect the stable operation of the system. Therefore, when constructing the installation base, it is necessary to ensure that the foundation meets the necessary requirements for mechanical support, cable layout, and maintenance of the system.

The following necessary requirements must be met when constructing the installation foundation for the energy storage system:

- 1、 Install the cabinet on concrete or other non-combustible construction materials;
- 2、 The foundation should be flat, level, and solid, and have sufficient bearing capacity and will not tilt or sink in the future;
- 3、 The default construction method is C30 grade concrete with a construction height of 300mm;
- 4、 The reinforcement in the foundation shall be HRB400 grade 3 threaded steel bars with a diameter of 12mm and a laying spacing of 150mm. The steel bars shall be derusted and then treated with anti-corrosion;
- 5、 The foundation pit must not be soaked in water after excavation, and drainage facilities should be built on the foundation, and the drainage performance should meet the drainage requirements of the local maximum historical rainfall;
- 6、 Foundation surface level error $\leq 3\text{mm}$;
- 7、 The bearing capacity of the foundation is configured according to the total weight of the equipment placed on the foundation.

Cable trench requirements:

- 1、 The cable trench should have enough space to meet the bending radius of the

cable;

- 2、 To prevent unauthorized access and damage to the line, the cable trench should be treated with dust and rodent prevention;
- 3、 To prevent cable aging, short circuit, etc., the cable trench should be waterproof and moisture-proof;
- 4、 Cable trenches should not be used as drainage channels, and openings for cable routing (such as holes where cables pass through partition walls and floor slabs) should be fire-blocked.



When designing and constructing the foundation, the design requirements such as the environment of the project location, foundation bearing capacity, address adjustment, natural disasters, etc. should be considered.

5.5 Transportation and lifting

5.5.1 Forklift transportation

If the site is flat, you can use a forklift to move the device. There is a special forklift handling socket at the bottom of the device.

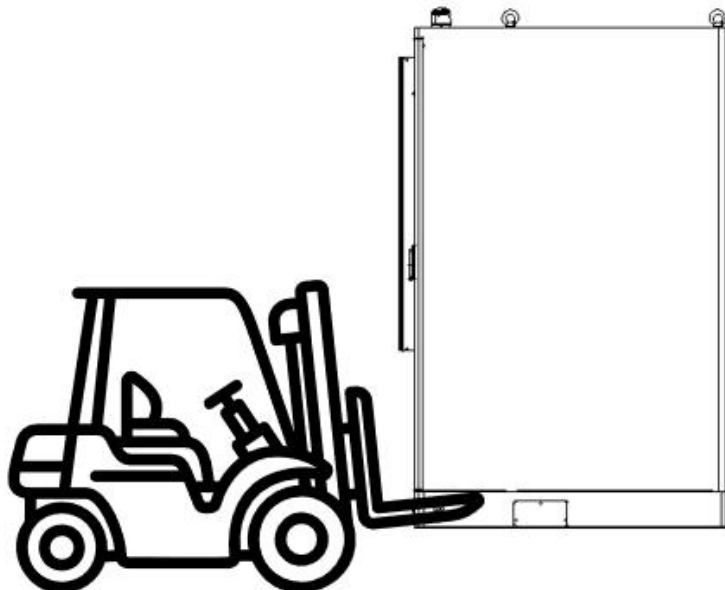


Figure 5.5.1 Schematic diagram of cartridge transportation



- The forklift should have sufficient carrying capacity;
- The forklift's pins should meet the lifting requirements of the equipment;
- When lifting, pay attention to the center of gravity of the equipment and lift slowly;
- It is prohibited to stand on the forklift or use the forklift to lift people;
- Avoid sharp turns when transporting equipment;
- When moving the equipment, the speed should be kept below 5 km/h;

Note: Forklifts are only permitted to be operated from the front and rear. Lifting from the side may cause the forklift to tip over due to a shift in the center of gravity, resulting in personal injury and equipment damage.

5.5.2 Hoisting

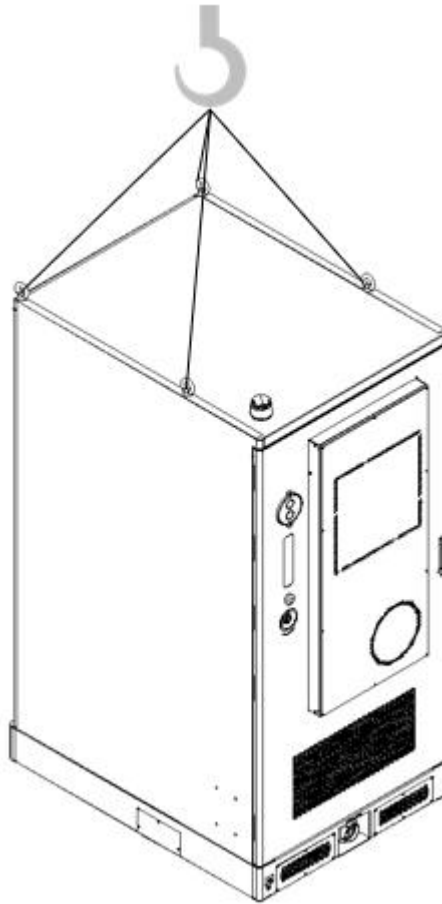


Figure 5.5.2 Schematic diagram of hoisting

 Notice

- When hoisting, you should use lifting equipment with sufficient load-bearing capacity;
- The entire lifting process requires professional guidance;
- When lifting, ensure that the lifting rope is firm;
- During lifting, personnel are prohibited from standing within 1000mm of the lifting area;
- Only vertical lifting is allowed;
- The equipment is not allowed to be dragged on the ground or other flat surfaces during hoisting;
- During hoisting operations, ensure that the angle between each two cables is no

greater than 90° .

Note: During hoisting operations, the angle between any two cables must not exceed 90° ; otherwise, hoisting accidents may occur, resulting in personal injury and equipment damage.

6. Cable Installation



- Beware of high voltage electric shock;
- Do not touch live parts without protection;
- Before installation, confirm that there is no voltage on any components on the AC and DC sides.



- Moisture and dust can damage electrical equipment or affect its operation and performance. Do not perform electrical installations in environments with absolute humidity $\geq 90\%$ or dusty conditions;
- Before connecting the cable, please check and confirm that the cable polarity is correct;
- All cables need to have sufficient bending space.

6.1 Electrical connection overview



- All connections must be made strictly according to requirements and drawings;
- All connections must be made with the equipment completely powered off;
- Only qualified electrical engineers and relevant personnel may make electrical connections, and must comply with the requirements in "1. Safety Precautions" of this manual;

- Our company is not liable for personal injury or property damage caused by neglecting these safety instructions;

6.2 Preparation before connection

Prepare tools

- The illustrated tools are for reference only; please refer to the actual products;
- Due to varying site conditions, this tool list does not exhaustively list all tools that may be needed. On-site installers and users are requested to prepare any tools not listed based on the actual situation.

Installation tools

Table 6.2 Installation Tools

No.	Accessories	Appearance	Explanation
1	Hammer		Unboxing
2	Utility Knife		Unboxing
3	Screwdriver		Fixed battery assembly
4	Handheld Electric Drill		Fixed battery assembly
5	Insulated Torque Wrench		Install cables and busbars
6	Insulated Torque Wrench		Install cables and busbars
7	Multimeter		Measure battery voltage

Protective tools

Table 6.2 Protective Equipment

No.	Accessories	Appearance	Explanation
1	Insulating Gloves		Prevent electric shock
2	Safety Shoes		Prevent injury from falling objects
3	Helmet		Protect head
4	Reflective Vest		Improve visibility
5	Dust Mask		Prevent dust
6	Goggles		Protect your eyes

Door opening method



Figure 6.2 Schematic diagram of door opening method

- 1、 Rotate the keyhole cover counterclockwise to expose the key hole;
- 2、 Insert the key;

- 3、 Rotate the key clockwise to pop out the handle;
- 4、 Rotate the handle counterclockwise and pull it out to open the cabinet door.

6.3 Cabinet cable connection



Before installing cables, all electrical switches must be turned off; otherwise, electric shock may occur, endangering the lives of installers.

6.3.1 Grounding wire connection

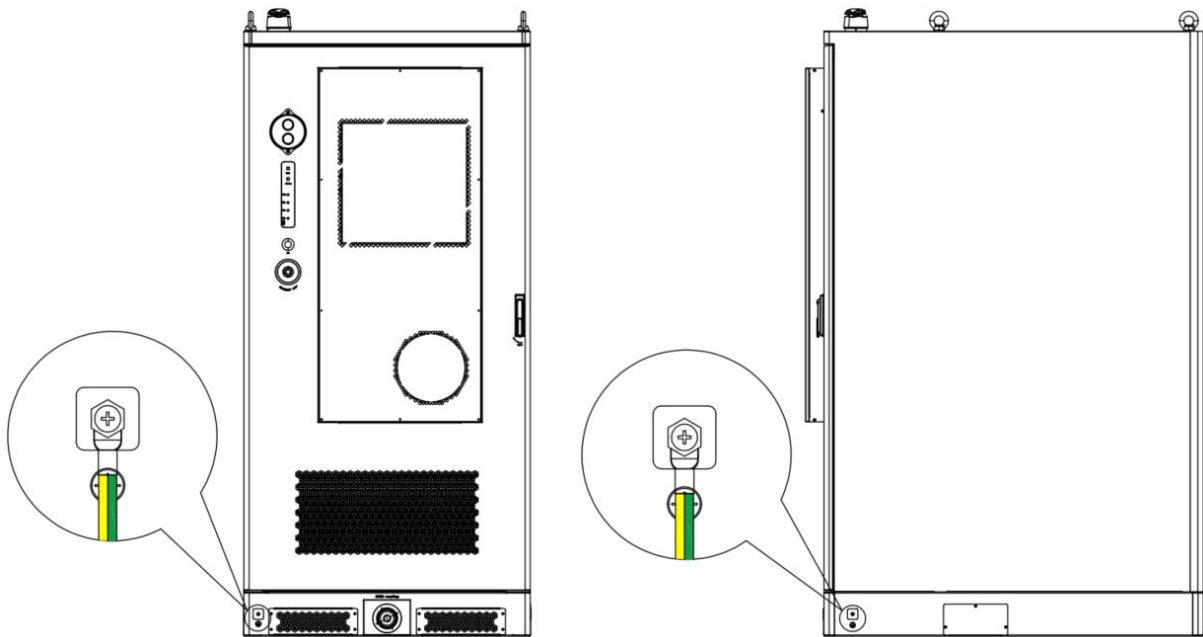


Figure 6.3.1 Grounding Wire Diagram

6.3.2 Battery cabinet cable connection

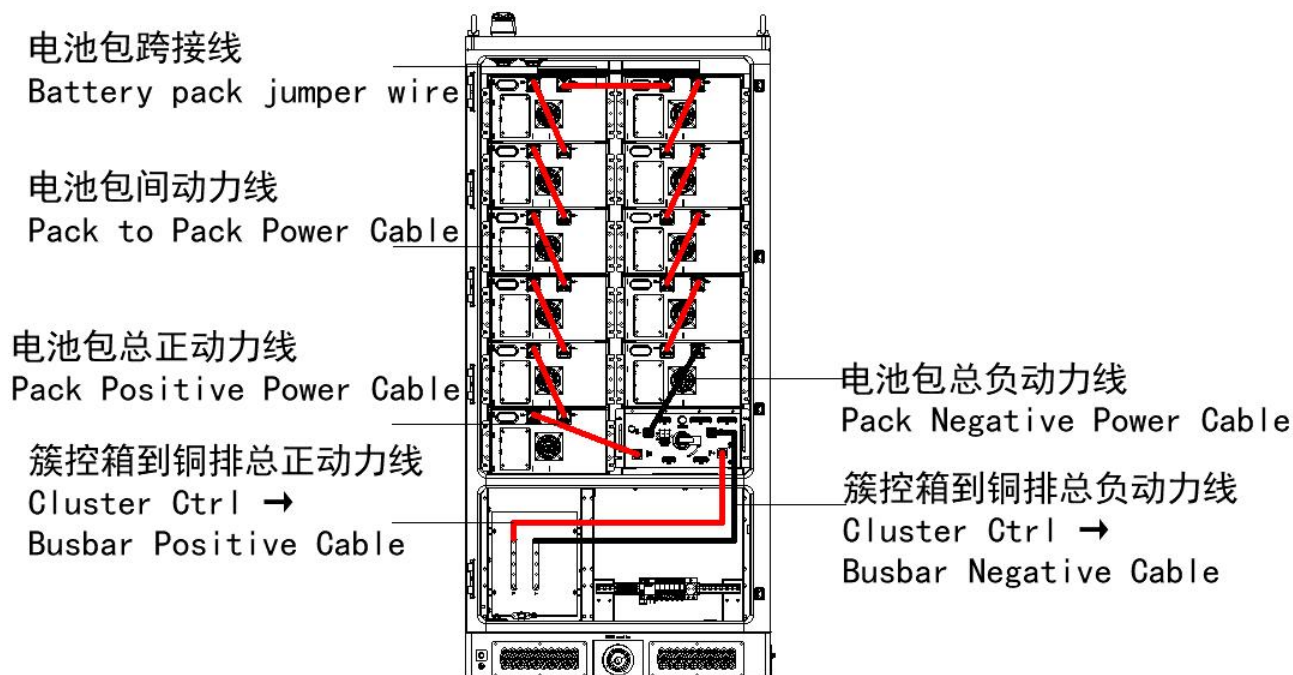


Figure 6.3.2 Cabinet Internal Cable Diagram

➤ Step 1: Check that the high-voltage cluster control box circuit breaker is in the "OFF" state.

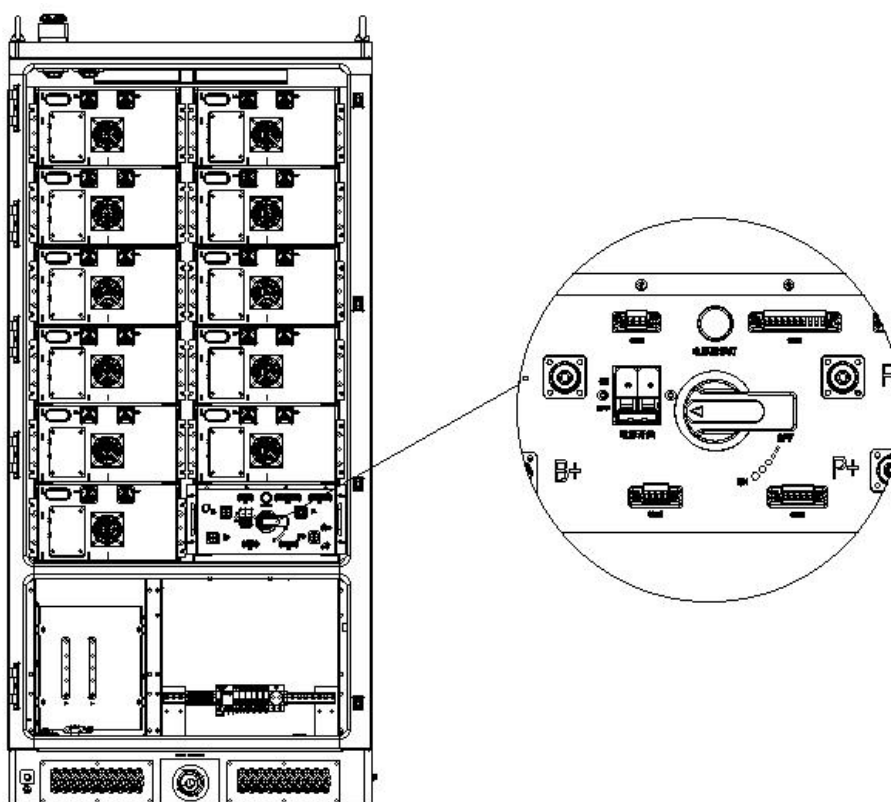


Figure 6.3.2 Schematic diagram of circuit breaker inspection

➤ Step 2: Remove the protective cover.

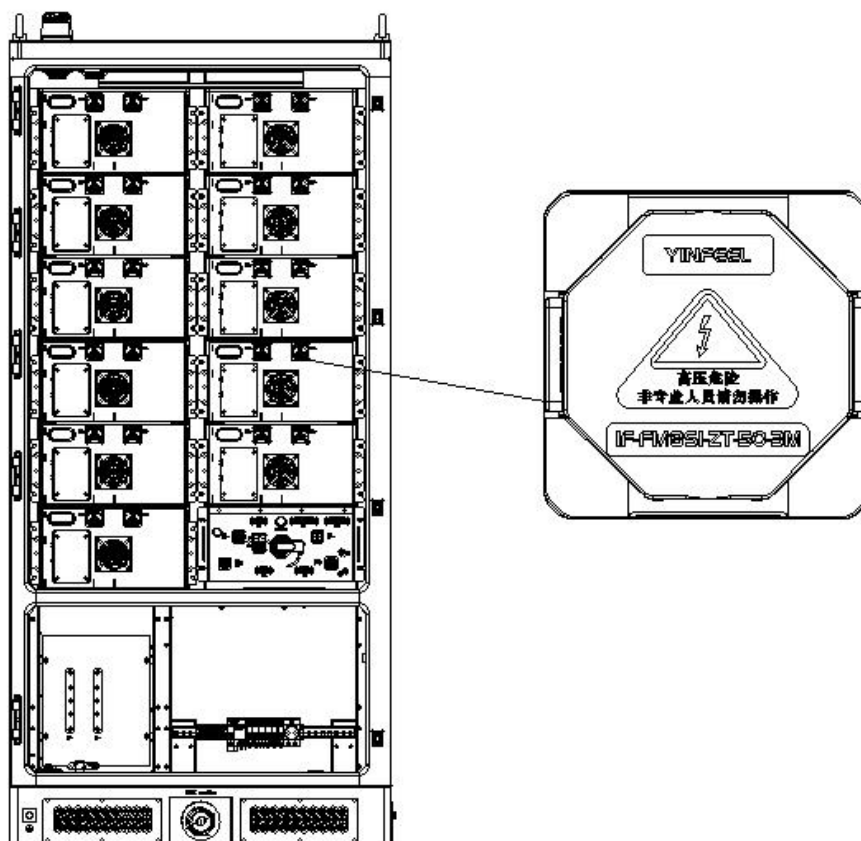


Figure 6.3.2 Diagram of Removing the Protective Cover

➤ Step 3: Install battery pack jumper wire.

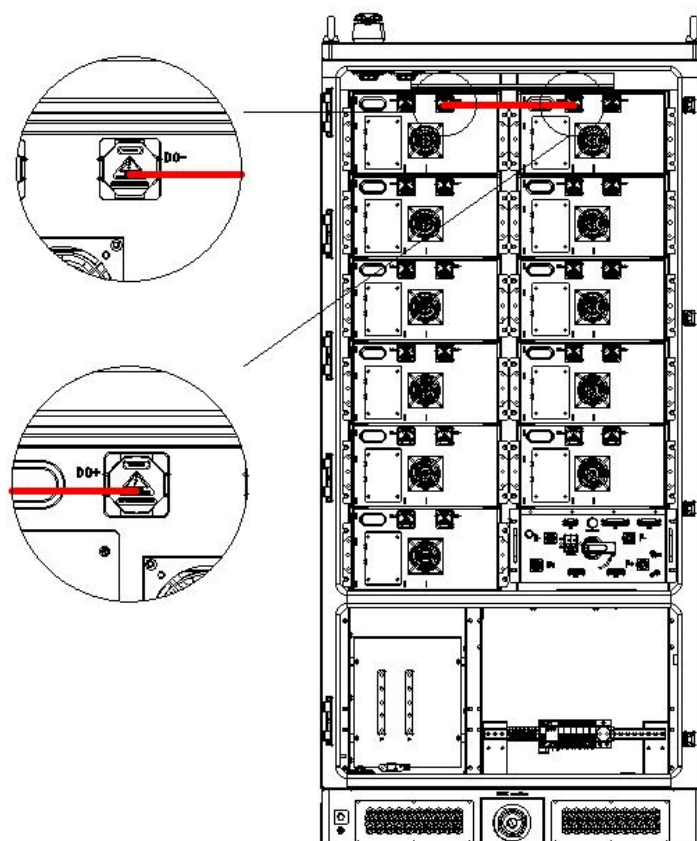


Figure 6.3.2 Installation diagram of jumper wire

- Step 4: Install cables between battery packs.

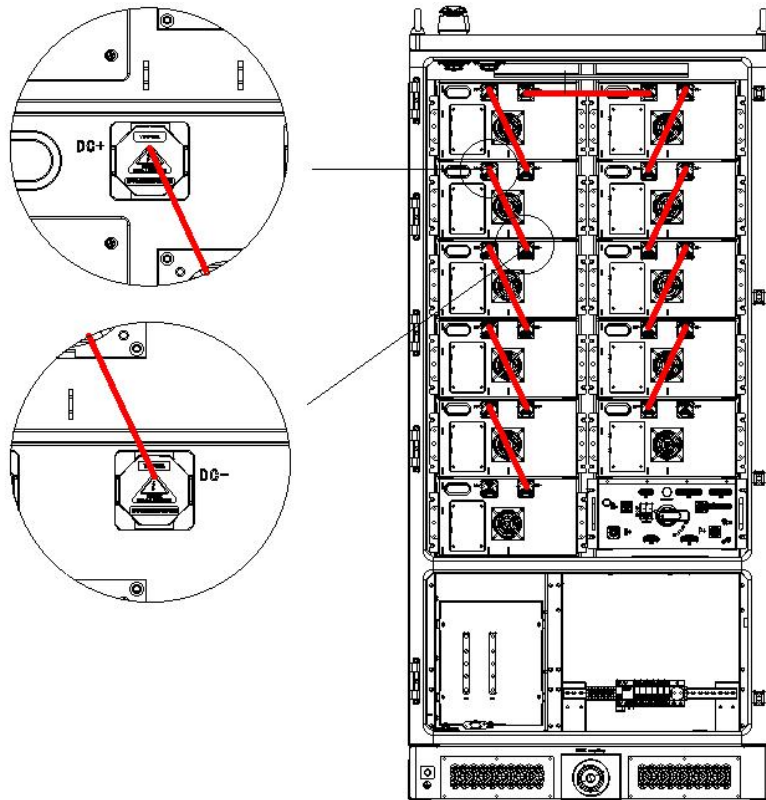


Figure 6.3.2 Installation diagram of jumper wire

- Step 5: When installing the battery pack's main positive/negative wires, install terminal A first, then terminal B.

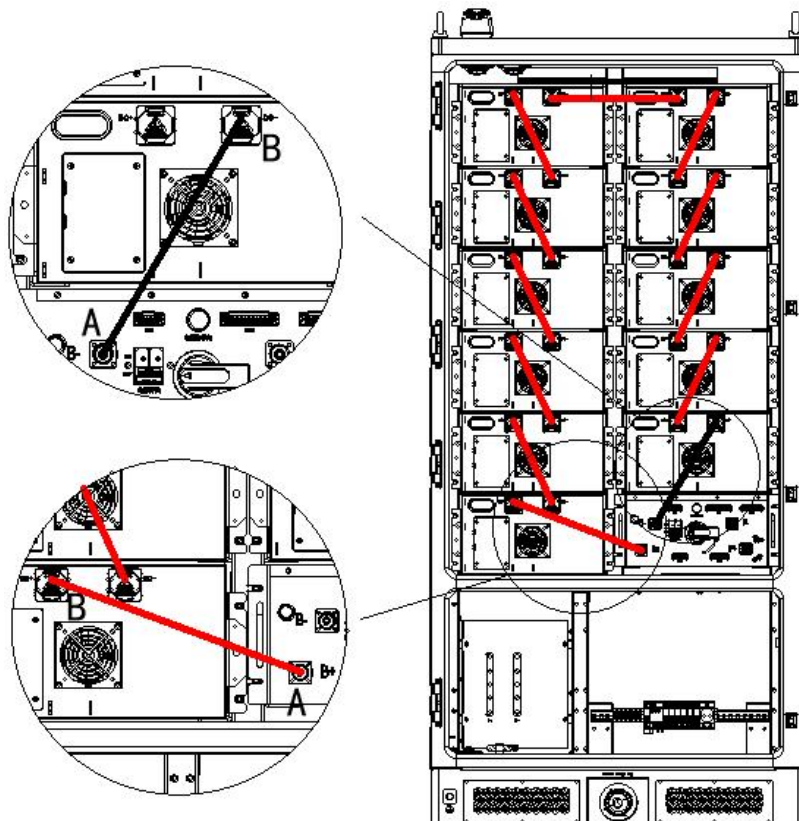


Figure 6.3.2 Battery pack positive and negative terminal wiring diagram

- Step 6: Connect the cluster control box to the main positive/negative copper busbar.

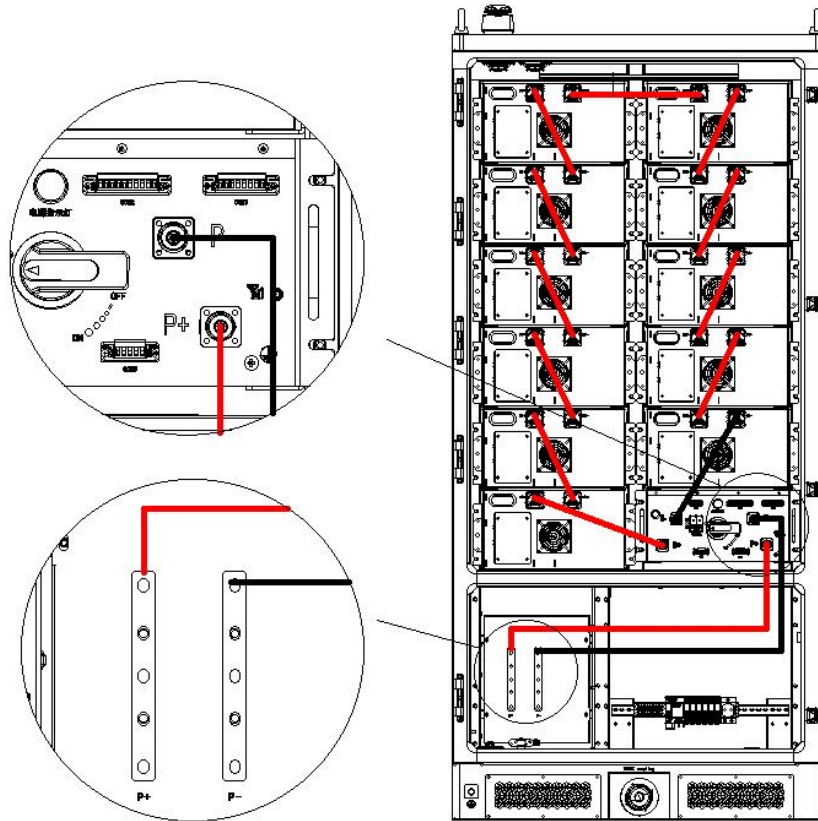


Figure 6.3.2 Wiring diagram from cluster control box to copper busbar positive and negative terminals

6.4 Auxiliary power supply connection

The auxiliary power supply is used to power equipment within the system (such as air conditioners). To ensure the stable operation of the battery system when off-grid, the auxiliary power supply should be connected to the load side of the inverter or the grid side (different inverters have different functions, and it should be ensured that the auxiliary power supply will not experience power outages during project operation).

Accessory auxiliary power cable storage location:

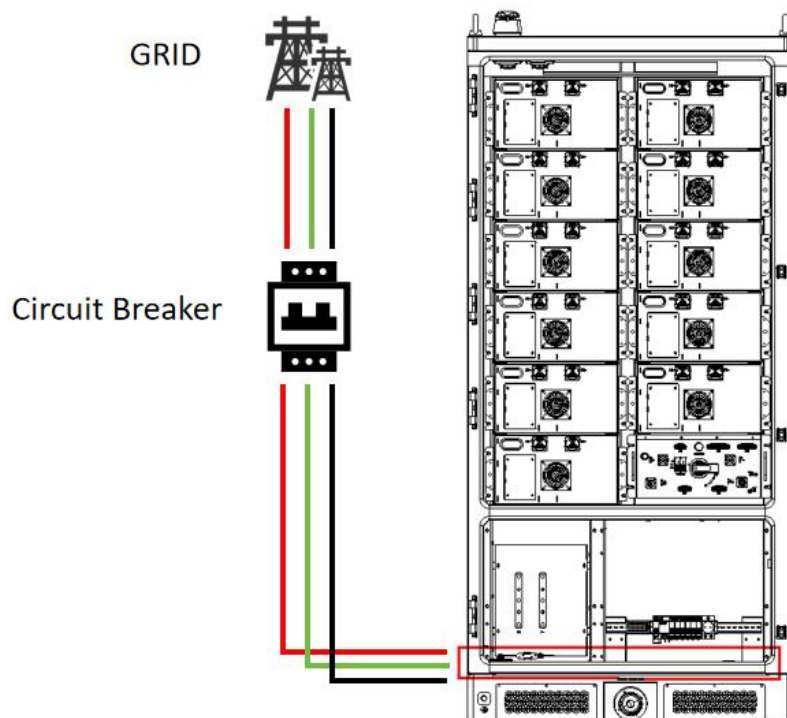


Figure 6.4 Schematic diagram of auxiliary power supply connection

Outlet location:

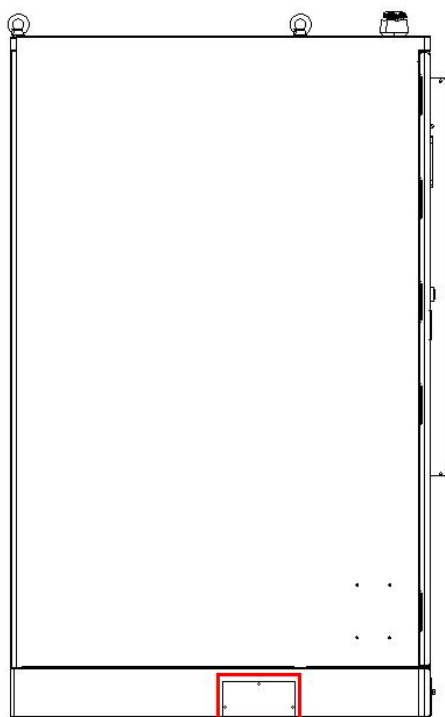


Figure 6.4 Outlet location diagram

6.5 PCS cable installation

- Step 1: Check that the high-voltage cluster control box circuit breaker is in the "OFF" state.

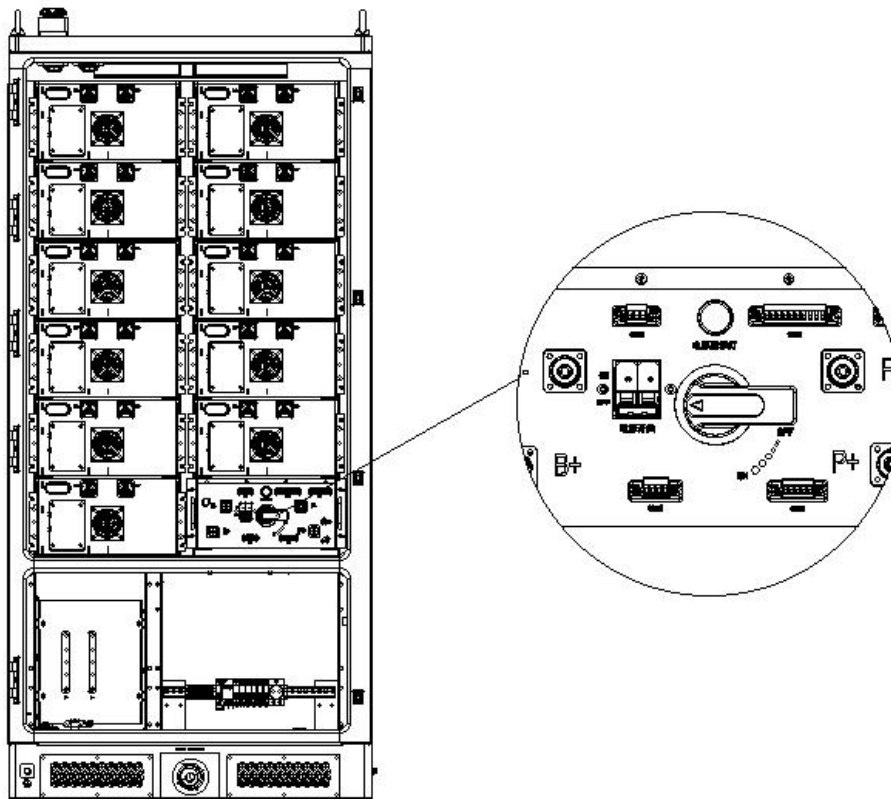


Figure 6.5 Schematic diagram of circuit breaker inspection

- Step 2: Connect the " P+ " and " P- " terminals to the PCS.

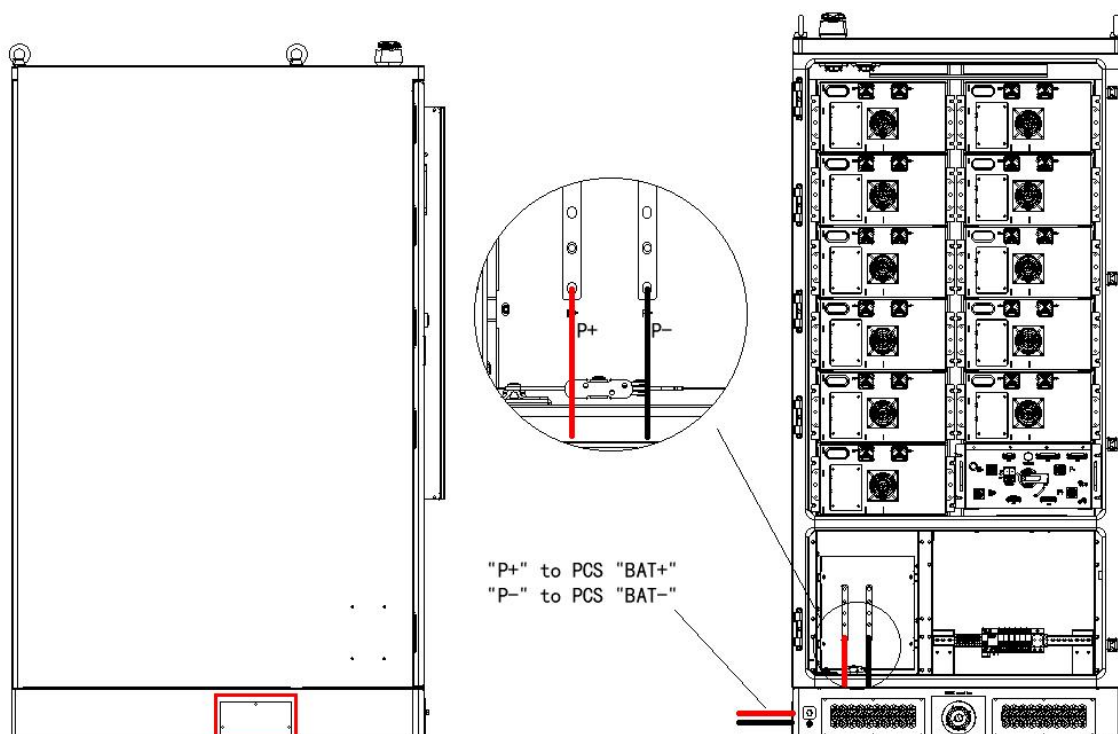


Figure 6.5 PCS Connection Diagram

7. System Power On



Energy storage systems require professional verification and approval from relevant authorities in accordance with local regulations before they can be put into operation.

For equipment that has been stored or not operated for an extended period, a thorough and careful inspection should be conducted before powering it on to ensure that all operating conditions meet requirements.

Please check the following items before powering on the equipment:

- Check that the wiring is correct and secure;
- Check that the emergency stop button is pressed;
- Confirm that the grounding meets requirements using a grounding resistance tester;
- Use a multimeter to confirm that the AC/DC voltage meets the operating start-up conditions and ensure there are no abnormalities such as overvoltage, undervoltage, phase loss, or phase reversal;
- Ensure that there are no tools, parts, or other foreign objects inside the equipment;
- Seal all wiring holes with fire-retardant putty;
- Ensure that all heat dissipation channel openings are free of foreign objects blocking or obstructing them.

7.1 Inspection before powering on

Table 7.1 Power-on Check

No.	Check Items	Check Content
1	Equipment appearance	•The equipment appearance is intact and undamaged. If there is paint peeling, please repair the paint. •The equipment labels are clear and visible, and damaged labels should be replaced in time.
2	Cable appearance	•The cable protection layer is wrapped intact without obvious damage. •The conduit cable and hose are intact.

3	Cable connection	•The cable connection position is the same as the design. •The terminal production meets the specifications and the connection is firm and reliable.
4	Cable routing	•Cut the wire buckle joints neatly without any exposed spikes or other phenomena. •Leave a margin as required at the turning point and do not tighten it.
5	Switch	•The external distribution cabinet switch is in the OFF state. •The battery cluster switch is in the OFF state.

7.2 System power-on

7.2.1 Power on procedures

Table 7.2.1 Power-on Procedure

Steps	Item	Remark
1	Grid connection test AC distribution cabinet power-on	As shown in ①
2	AC distribution power on	As shown in ②
3	Power on the main AC switch of the energy storage system	As shown in ③
4	Battery cabinet auxiliary distribution power on	As shown in ④
5	Cluster control box auxiliary power supply power on	As shown in ⑤
6	Battery cluster DC circuit breaker power on	As shown in ⑥
7	Energy storage converter powered on	As shown in ⑦

Note: Before closing any switch, necessary safety checks should be conducted

The position where this product located in the energy storage system

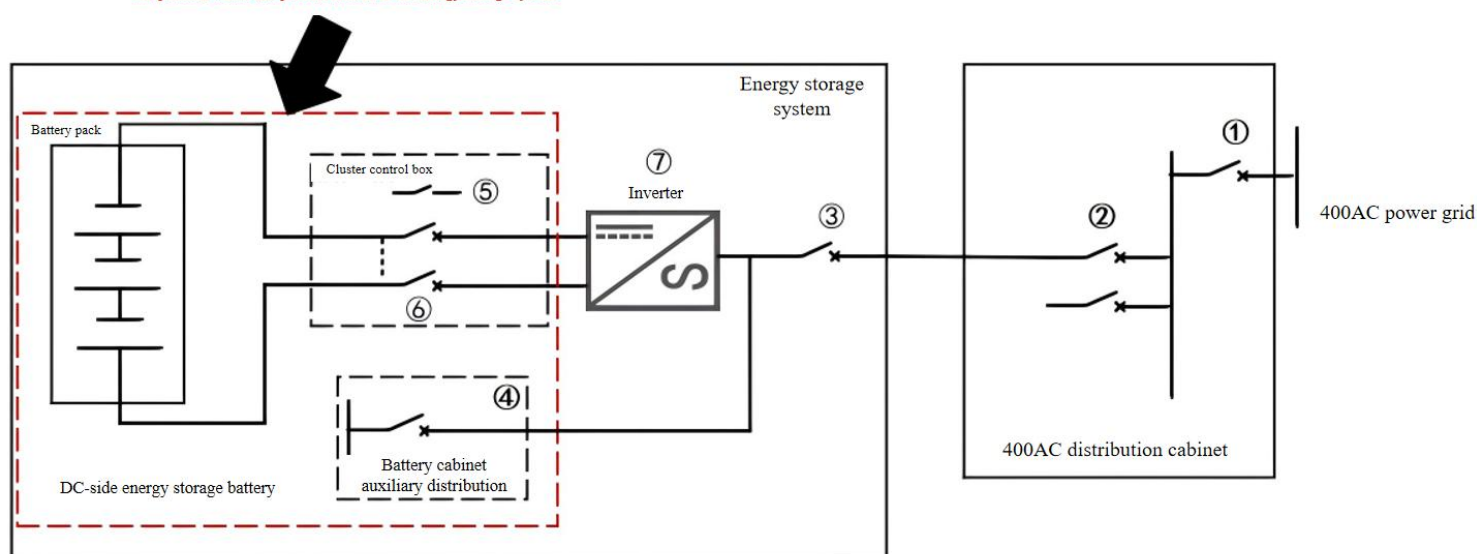


Figure 7.2.1 Power-on process

7.2.2 AC-side power on

Prerequisite requirements:

- Pre-power-on checks have been completed;
- The operator is wearing personal protective equipment;
- Confirm that the three-phase voltage is within the normal range before closing

the circuit breaker;

- Confirm that the three-phase electrical phase sequence is correct before closing the circuit breaker.

Operating steps:

- Step 1: Close the single-phase switch of the remote protection control system (if any);
- Step 2: Close the remote three-phase switch;
- Step 3: Measure the input voltage with a multimeter to ensure that it is within the normal operating voltage range;
- Step 4: Close the single-phase switch of the near end protection control system (if any);
- Step 5: Close the near end three-phase switch;
- Step 6: Measure the output voltage with a multimeter to ensure that it is within the normal operating voltage range;

7.2.3 DC-side power on

Prerequisite requirements:

- Pre-power-on checks have been completed;
- The operator is wearing personal protective equipment;
- Confirm that the AC main switch of the energy storage system is connected to

the three-phase voltage within the normal range;

- Confirm that the AC main switch of the energy storage system is connected to the three-phase electrical phase sequence correctly;

- Confirm that the battery pack is connected correctly;

- Confirm that the battery pack, cluster control box, and inverter are connected correctly;

- Confirm that the power input/output protection cover of the cluster control box is securely closed.

Operating steps:

➤ Step 1: Open the micro-fractions in the direction of the arrows.

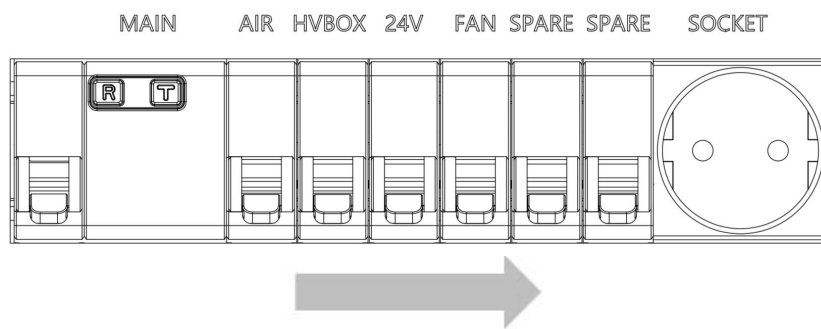


Figure 7.2.3 DC side power-on

➤ Step 2: Turn on the BMS wake-up switch, BMS power supply switch, and battery DC circuit breaker in the order of ③→②→①.

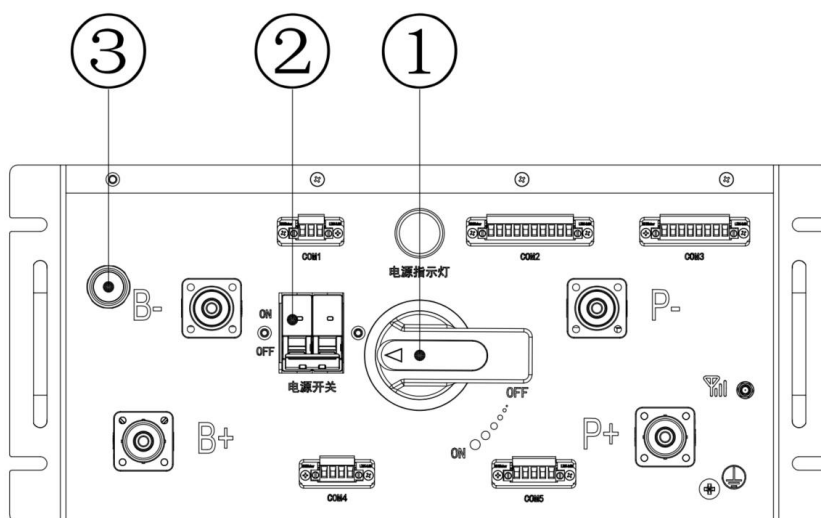


Figure 7.2.3 DC side power-on

7.3 System power off

7.3.1 Issue a stop work command

Prerequisite requirements:

When the system is working normally, it is connected to the bus and operates with power.

Operating steps:

➤ Step 1: Enter the command page of control devices such as PCS, inverters, EMS, etc;

➤ Step 2: Issue the "shutdown" command or control the system power to "0";

➤ Step 3: Enter the relevant device page and confirm that the system power is "0";

Confirm that the system has exited the charging and discharging state;

➤ Step 4: Use a clamp meter to measure and confirm that the system current is "0".

7.3.2 DC side power off

Operating steps:

➤ Step 1: Disconnect the micro-segments sequentially according to the direction of the arrows.

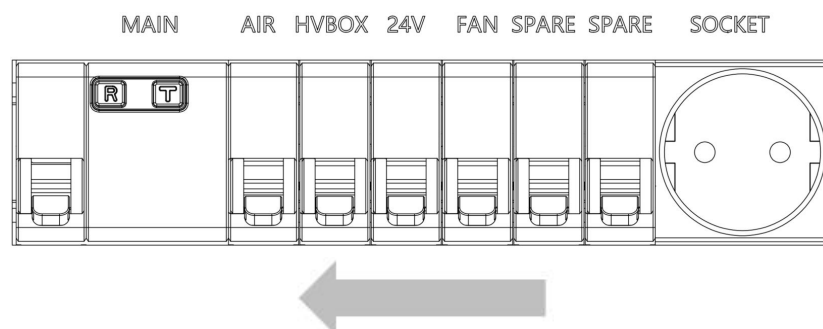


Figure 7.3.2 DC side power off

➤ Step 2: Disconnect the BMS wake-up switch, BMS power supply switch, and battery DC circuit breaker in the following order: ③→②→①.

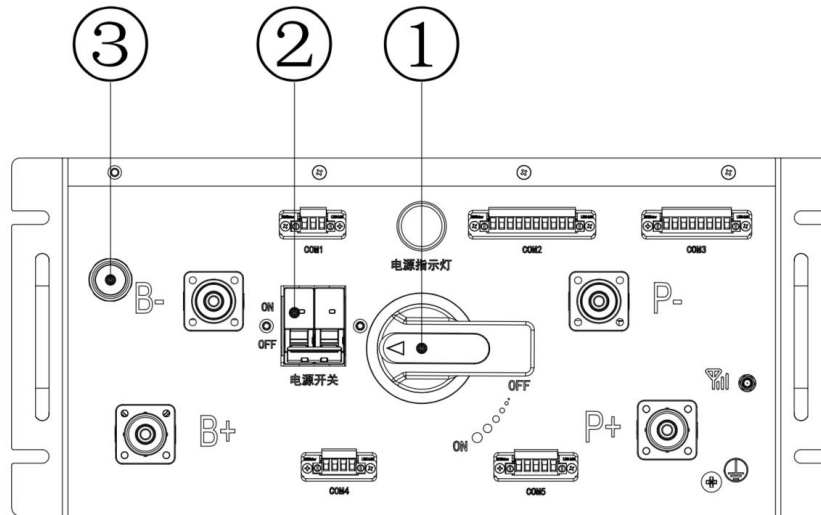


Figure 7.3.2 DC side power off

7.3.3 AC side power off

Operating steps:

- Step 1: Disconnect the AC power distribution switch.
- Step 2: Disconnect the power distribution switch of the grid connection point.

8. Fire Protection System



Please comply with the fire safety regulations of the country or region where the project is located.

Regularly inspect and maintain fire-fighting equipment to ensure the normal operation of the fire-fighting system.

When the detection equipment detects abnormal temperature or smoke inside the cabinet, the audible and visual alarm will light up red and sound an alarm, while simultaneously spraying aerosol to prevent a fire.

※If the fire is too large, evacuate as soon as possible and call the fire department.

8.1 Fire protection layout

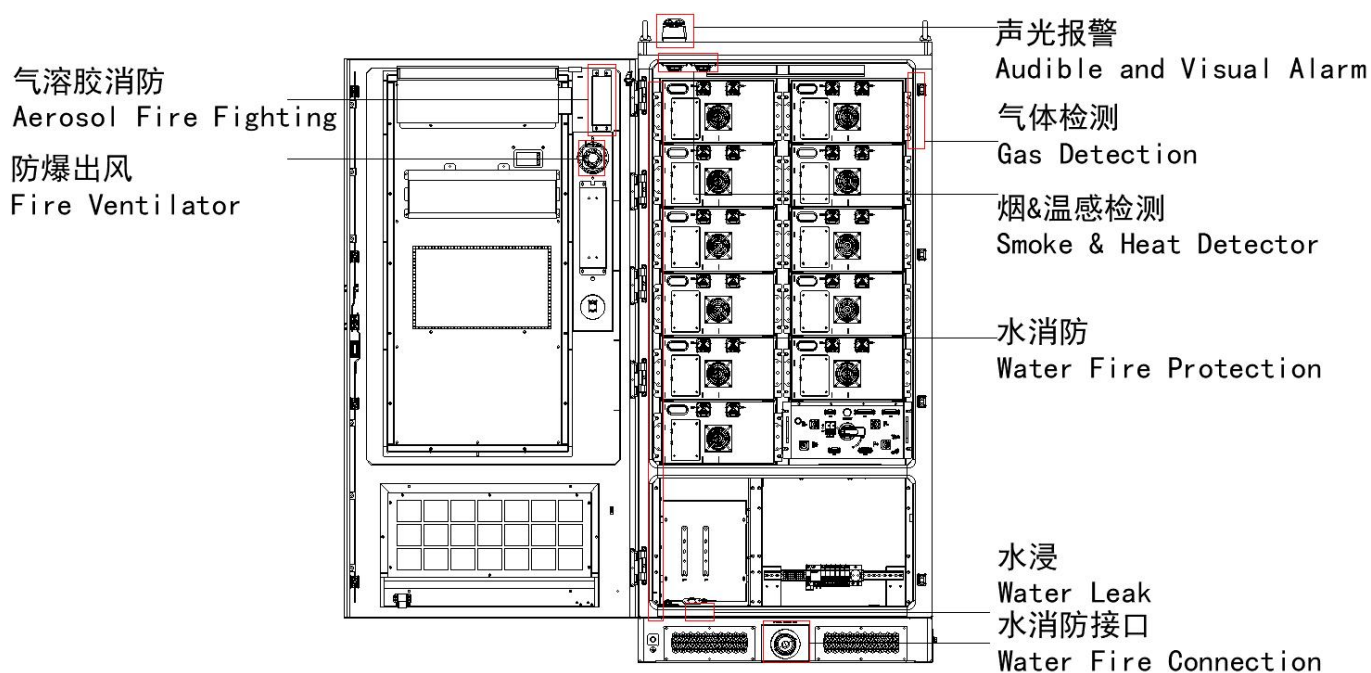


Figure 8.1 Battery cabinet fire protection system diagram

8.2 Working principle of fire protection equipment

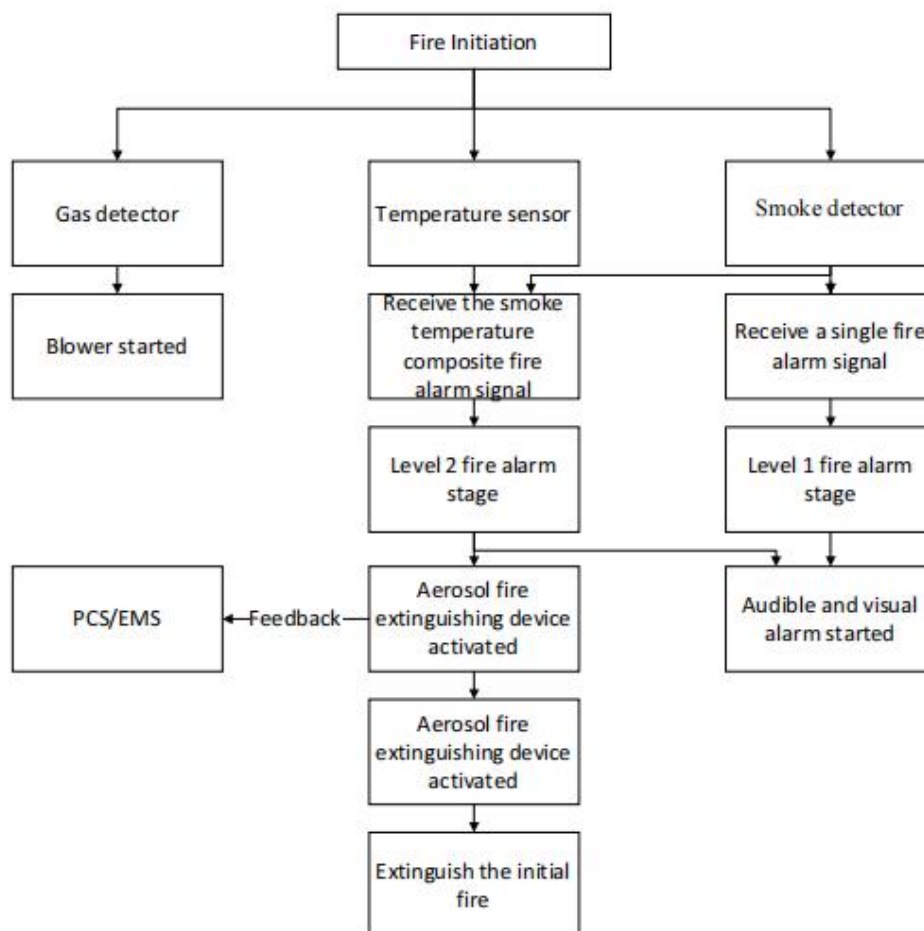


Figure 8.2 Working principle of fire protection system

8.3 Fire extinguishing mechanism

The fire-suppressing effect of thermal aerosols is mainly reflected in the following aspects:

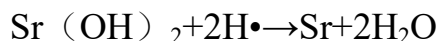
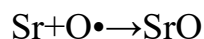
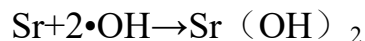
The extinguishing mechanisms of general fire extinguishing agents mainly include isolation, asphyxiation, cooling, and chemical inhibition. Different extinguishing agents have different extinguishing mechanisms. The extinguishing mechanism of thermal aerosols is mainly reflected in two aspects: one is the cooling effect of endothermic decomposition, and the other is the chemical inhibition effect of the gas and solid phases, which work synergistically. In addition, the gaseous components in the aerosol extinguishing agent products also play a certain auxiliary role.

1) Cooling and extinguishing effect of endothermic decomposition

The cooling effect of thermal aerosol fire extinguishing agents mainly relies on the endothermic decomposition of metal oxides and carbonates. The heat released by any fire in a short period is limited. If the solid particles in the aerosol can absorb some of the heat released by the fire source within a short time, the flame temperature will decrease. This reduces the heat radiated to the burning surface and the heat used to break down vaporized combustible molecules into free radicals, thus inhibiting the combustion reaction to some extent.

2) Gas-phase chemical inhibition

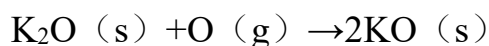
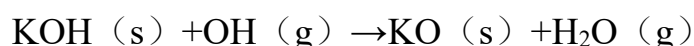
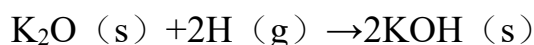
Under heat, the vaporized metal ions such as Sr, K, Mg, or electron-losing cations from the decomposition of thermal aerosol fire extinguishing agents exist in the form of vapor. These vapors undergo multiple chain reactions with active groups $\text{H}\cdot$, $\cdot\text{OH}$, and $\text{O}\cdot$ during combustion. Sr is used as an example below:



This process is repeated, and a large number of active groups in the combustion are consumed, the concentration decreases continuously, and combustion is suppressed.

3) Solid-phase chemical inhibition

Solid particles in thermal aerosol fire extinguishing agents can adsorb chain reaction intermediates $\bullet\text{OH}$, $\text{H}\bullet$, and $\text{O}\bullet$, and catalyze their recombination into stable molecules, thereby interrupting the branched chain reaction in the combustion process. The following example uses K:



In the fire extinguishing process described above, several extinguishing mechanisms interact and work synergistically. However, the transport effect of gases and the heat absorption and cooling effect of metal oxides or carbonates only play an auxiliary role. The main extinguishing effect relies on the chemical inhibition effect of the gas and solid phases.

8.4 Thermal aerosol fire extinguishing equipment

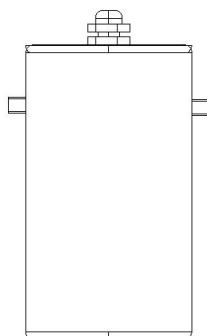


Figure 8.4 Schematic diagram of thermal aerosol

Technical parameters:

Figure 8.4 Description of thermal aerosol

Thermal Aerosol	Content	Technical Parameters
	Startup Method	Electric start
	Feedback Signal	Passive switching signal
	Maximum Protection Volume	3.33 m ³
	Discharge Time	20±5 s
	Validity Period	15 years
	External Dimensions	160×80×80 mm
	Usage Environment	-40℃~+55 ℃
	Extinguishing Agent Quality	200 g

8.5 Temperature sensor

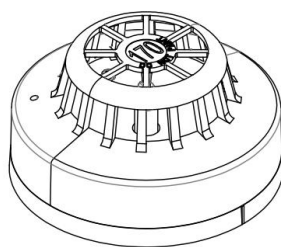


Figure 8.5 Schematic diagram of temperature sensor

Technical parameters:

Figure 8.5 Temperature sensor description

Temperature Sensor	Content	Technical Parameters
	Operating Voltage	24 VDC (16 VDC~28 VDC)
	Static Current	≤60μA
	Alarm Current	≤55 mA
	Category Settings	Can be set to A1R, A2S, BS
	Maximum Ripple Voltage	2 V (peak value)
	Alarm Reset	Instantaneous power outage (10 s Min, 1.0 VDC Max)

	Enclosure IP Rating	IP2X
	Relative Humidity	≤95%, Non-condensing dew
	External Dimensions	Diameter 100mm, height 53.3mm (with base)
	Weight	Approximately 110g (with base)

8.6 Smoke sensor

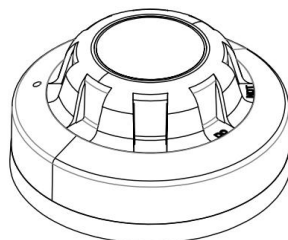


Figure 8.6 Schematic diagram of a smoke sensor

Technical parameters:

Figure 8.6 Smoke Sensor Description

Smoke Sensor	Content	Technical Parameters
	Operating Voltage	24 VDC (16 VDC~28 VDC)
	Monitoring Current	≤60μA
	Alarm Current	≤55 mA
	Environment Temperature	- 10 °C~ + 50 °C
	Maximum Ripple Voltage	2 V (peak value)
	Alarm Reset	Instantaneous power outage (10 s Min, 1.0 VDC Max)
	Enclosure IP Rating	IP2X
	Relative Humidity	≤95%, Non-condensing dew
	External Dimensions	Diameter 100mm, height 44.5mm (without base)
	Weight	Approximately 110g

8.7 Audible and visual alarm device

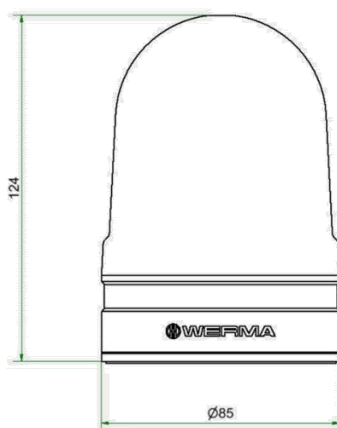


Figure 8.7 Schematic diagram of audible and visual alarm device

Technical parameters:

Figure 8.7 Description of the audible and visual alarm device

Audible and visual alarm device	Content	Technical parameters
	Height	125mm
	Diameter	85mm
	IP rating	IP66
	Operating temperature	-30°C~ + 50°C
	Operating voltage	DC24 V
	Operating current	140mA
	Optical signal image	Flashing, solid light
	Noise	85dB

8.8 Gas detector

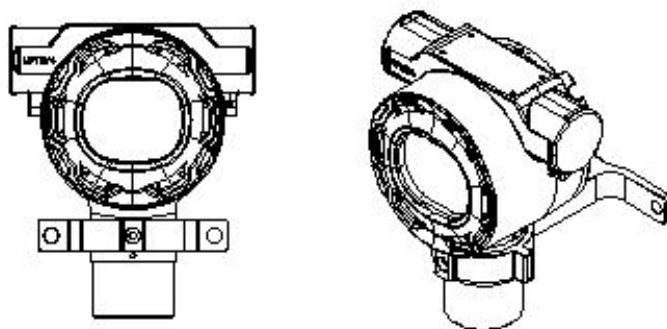


Figure 8.8 Schematic diagram of a gas detector

Technical parameters:

Table 8.8 Schematic diagram of gas detector

Gas Detector	Content	Technical Parameters
	IP Rating	IP66
	Detecting Gas	Combustible gases, oxygen, ammonia, chlorine, VOCs, and other toxic and harmful gases
	Detection Method	Diffusion
	Operating Temperature	-40~70°C
	Pressure Range	(91~111kPa)
	Temperature Range	10~95RHNo condensation
	Measurement Accuracy	≤±5%FS
	Repeatability	±1%F.S
	Operating Voltage	12~24VDC
	Display Method	LED digital display
	Explosion-proof	IECEX, ATEX, China Explosion-proof

8.9 Water fire protection system

Water-based fire suppression systems serve as a last resort, activated only after all other fire suppression systems have failed.

Fire extinguishing was carried out by connecting a fire hose from outside the cabinet.



Figure 8.9.1 Water fire protection system

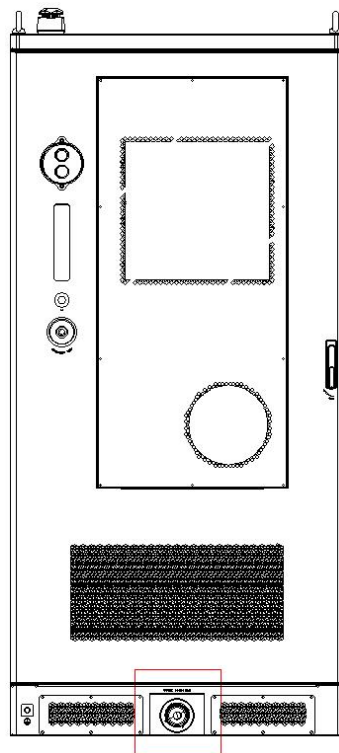


Figure 8.9.2 Water fire-fighting quick interface

9. System Maintenance

9.1 Maintenance Instructions

With the increase of service life and the influence of environmental temperature, humidity, dust, and vibration, the components inside the energy storage system will age, which will affect the performance of the energy storage system and even lead to malfunctions that cannot function properly.

Therefore, it is necessary to implement daily and regular maintenance on the energy storage system to ensure its normal operation and service life. All measures and methods that contribute to the good working condition of energy storage systems belong to the scope of maintenance work.

In case of fault, please contact our company. At the same time, provide the following information to provide you with better service:

- Photos of the fault site;
- Model and serial number of the faulty product;
- Information on relevant components connected to the product;
- Installation and connection plan for energy storage system;
- Fault information and brief description.

9.2 Maintenance precautions



Only personnel who have received relevant training and qualifications can perform maintenance operations on the energy storage system.



When performing maintenance, avoid leaving metal items such as screws and washers inside the energy storage system to prevent potential damage to the system.

When servicing and maintaining the energy storage system, safety should be the top priority. To protect the operators, the following rules must be followed:

- Disconnect the external connection of the energy storage system;
- Ensure that the energy storage system is not accidentally powered on;
- Before maintenance, use a multimeter to measure and ensure that the components being maintained are not electrified;
- Ensure that the system is well grounded.

9.3 Quarterly maintenance

Table 9.3 Quarterly Maintenance Checklist

Maintenance Project	Maintenance Content	Reference Standard	Is the system powered off?
Cabinet	Visual inspection: ·Overall appearance ·Rust condition ·Door lock condition ·Various ports	·No obvious peeling or mottled paint · No obvious paint loss or rust ·Undamaged door lock ·No dust accumulation at the ports ·No animals such as snakes, rats, or insects have entered	No
Air Conditioner	·Inspect the exterior ·Clean the filter	·No obvious damage to the exterior ·No obvious paint peeling or rust ·No loose or missing screws ·The fan rotates normally without jamming or abnormal noise ·The filter screen is clean and unclogging	No
Indicator Lights	Check the indicator light status	The indicator light is solid green	No
Power Distribution Area	Check the power distribution area for foreign objects	The area is clean and free of foreign objects	No
Note: Monthly maintenance is recommended in environments with temperatures $\geq 35^{\circ}\text{C}$ or $\leq 0^{\circ}\text{C}$; other situations will be determined based on the actual circumstances.			

9.4 Semi-annual maintenance

Table 9.4 Semi-annual Maintenance Checklist

Maintenance Project	Maintenance Content	Reference Standard	Is the system powered off?
Air Conditioner	Visual inspection: ·Appearance ·Rust condition ·Screws ·Fan ·Filter Cleaning the fan filter	·No obvious damage to the exterior ·No obvious paint peeling or rust ·No loose or missing screws ·Fan rotates normally without jamming or abnormal noise ·The filter surface is clean and free of blockages. Clean and clog-free filter	No
Temperature Sensor Smoke Sensor Sensor	Note: Disconnect the trigger signal line of the aerosol fire suppression module first to prevent false spraying. Use specialized instruments to randomly inspect the smoke and temperature detectors, testing their trigger and alarm actions.	When the indicator light turns red, it triggers the audible and visual alarm device, suppressing the module's output electrical signal on the model line.	Yes
Aerosol Suppression Module	·Inspect the module for any damage or breakage ·Clean the module as necessary ·Check the cables for damage, looseness, or detachment	·Module intact, nozzle undamaged ·Machine body clean and dust-free ·Cables undamaged, connections secure	Yes
Note: It is recommended to clean up after each sandstorm in dusty areas; other areas should decide based on the actual situation. Note: The trigger connection wires must be disconnected before maintaining the fire protection system to prevent accidental spraying.			

9.5 Annual maintenance

Table 9.5 Annual Maintenance Checklist

Maintenance Project	Maintenance Content	Reference Standard	Is the system powered off?
Battery Pack	Visual inspection: • Appearance • Rust condition • Screws and bolts	•No obvious damage to the exterior. •No obvious paint peeling or rust. •No screws or bolts are loose or	Yes

	• Fan • Connecting cable	missing. •The fan rotates normally without jamming or abnormal noise; the ventilation panel is clean and unobstructed. • Power and communication cables are securely connected and not loose or missing.	
Indicator Lights	Check the indicator light status	The indicator light is solid green.	No

10. Troubleshooting

Table 10 Troubleshooting

Fault Type	Fault Status	Cause of The Fault	Troubleshooting
Communication Failure	Inverter communication failure Internal network communication failure Device data not displayed	Incorrect or loose communication interface with inverter; incorrect protocol or baud rate selection. Incorrect or loose PDU/battery pack connection harness. Incorrect or loose communication harness with device; incorrect protocol or baud rate selection.	Check the wiring harness connections and device settings. If the problem persists, please contact an engineer.
Battery Failure	Battery voltage too high Battery voltage too low Battery leakage	Damage caused by overcharging, resulting in battery voltage consistently exceeding the maximum voltage. Damage caused by over-discharging or prolonged storage, resulting in battery voltage consistently below the minimum voltage. Damage caused by external impacts such as short circuits, punctures, or other injuries.	Repair and replacement
Overvoltage Protection	The battery trips due to a 3.65V overvoltage protection mechanism triggered during charging	Inverter communication or settings malfunction caused the inverter to continue charging.	If the battery cannot recover on its own, please contact an engineer for assistance.

Undervoltage Protection	When the battery discharges, it triggers the 2.5V undervoltage protection of a single cell to cut off power.	Inverter communication or settings malfunction caused the inverter to fail to stop discharging.	If the battery cannot recover on its own, please contact an engineer for assistance.
High Temperature Protection	Maximum single-unit temperature above 55 degrees Celsius	The environment temperature is too high or there is a heat source near the battery.	If the battery cannot recover on its own, please contact an engineer for assistance.
Low Temperature Protection	Minimum single-unit temperature below 0 degrees Celsius	Battery temperature too low	If the battery cannot recover on its own, please contact an engineer for assistance.
Discharge Low Temperature Protection	Minimum single-unit temperature below -20 degrees Celsius	Battery temperature too low	If the battery cannot recover on its own, please contact an engineer for assistance.
BMS Failure	Sampling failure	Sampling point detached or disconnected. Sampling temperature sensor malfunction. Sampling circuit malfunction	Contact an engineer for repair or replacement.

11. Battery Recycling

Advanced hydrometallurgical processes are used to recover aluminum, copper, lithium, iron, and other metals from discarded LiFePO_4 batteries, achieving a comprehensive recovery efficiency of up to 80%. The specific process steps are as follows:

11.1 Cathode material recycling process and steps

Aluminum foil is an amphoteric metal used as a collector.

1) First, it is dissolved in an alkaline NaOH solution, allowing aluminum to enter the solution as NaAlO_2 . After filtration, the filtrate is neutralized with sulfuric acid solution, and then precipitation is performed to obtain Al(OH)_3 . When the pH value is above 9.0, most of the aluminum will precipitate, and the resulting Al(OH)_3 can be analyzed to achieve a level of chemical purity.

2) The filter residue was dissolved in sulfuric acid and hydrogen peroxide, allowing lithium iron phosphate to enter the solution as $\text{Fe}_2(\text{SO}_4)_3$ and Li_2SO_4 , separating it from

the carbon black and carbon coating the surface of the lithium iron phosphate. After filtration, the pH of the filtrate was adjusted with NaOH and ammonia. First, iron was precipitated with $\text{Fe}(\text{OH})_3$, and the remaining solution was precipitated with saturated Na_2CO_3 solution at 90°C .

3) Since FePO_4 is slightly soluble in nitric acid, the filter residue is dissolved in nitric acid and hydrogen peroxide to directly precipitate FePO_4 . Impurities such as carbon black are separated from the acidic solution. $\text{Fe}(\text{OH})_3$ is leached from the filter residue, and Li_2CO_3 is precipitated at 90°C with saturated Na_2CO_3 solution.

11.2 Anode material recycling

The recycling process for anode materials is relatively simple. After separating the anode plates, the purity of copper can reach over 99%, which can be used for further purification of electrolytic copper.

11.3 Diaphragm recycling

The membrane material is harmless and has no recycling value.

11.4 List of recycled equipment

Automatic dismantling machine, crusher, wet metal pool, etc.

12. Appendix

Table 12 System Parameters

Model	BS09-265-D
Name	DC-side Energy Storage Battery System
Battery Parameters	
Battery Type	LiFePO ₄
Pack Energy(kWh)	24.115
Pack Voltage(V)	76.8
Pack Capacity(Ah)	314
Number of Battery Packs	11
Scalability	Up to 10 units in parallel
Rated Voltage(V)	844.8
Voltage Range(V)	739.2~950.4
Nominal Energy(kWh) ^[1]	265.26
Usable Energy(kWh@90%DOD)	238.74

Charge/Discharge Current(A) ^[2]	157
Other Specifications	
Dimension(W*D*H)(mm)	1095*1520*2395
Weight(kg)	2600
Operating Temperature Range	-30~55°C(>45°C derating)
Storage Temperature	0~35°C
Display Mode	indicator light panel
Communication Interface	CAN;RS485
BMS Communication Method	CAN
IP Rating	IP54
Cooling Method	Intelligent Air Cooling
Noise	75dB
Relative Humidity	5%~90% (Non-condensing)
Altitude	≤2000m
Cycle Life ^[3]	≥8000 Cycles (25°C, 0.5C/0.5C,90%DOD,70%EOL)
Installation	Ground-mounted
Warranty Period ^[4]	5 +5 years
Cumulative Discharge Energy	426.0MWh
Certifications	MSDS,UN38.3

[1]DC available energy: Test environment 25°C, 0.5C charge and discharge, 90% DOD; due to different system configuration parameters, the system available energy may vary.

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

[3]Cycle life: A standard for battery cell life; cells that meet this standard are used.

[4]Warranty period: Applicable conditions are subject to the warranty agreement.



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※ The product information and parameters are subject to change without prior notice.