



USER MANUAL FOR INDUSTRIAL & COMMERCIAL BATTERY CABINET

GreenB Series

ALL-IN-ONE BATTERY 100K

Master Battery, S.L.



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Overview

This Manual introduces the main features, performance indicators, system principles, appearance and structure of the **GreenB** industrial and commercial battery cabinet, and also provides installation, use and operation instructions, maintenance management, etc.






Target readers

This document is primarily intended for the following engineers:

- Sales engineer
- Technical support engineer
- System engineer
- Hardware installation engineer
- Commissioning engineer
- Maintenance engineer

Convention of Symbols

The following symbols may appear in this document, and their meanings are as follows.

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Used to convey equipment or environmental safety warning information. If not avoided, it could result in equipment damage, data loss, degraded equipment performance, or other unpredictable results. "NOTICE" does not cover personal injury.
	Supplementary explanation of key information in the main text. "NOTE" is not safety warning information, and does not involve personal, equipment and environmental damage information.

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1. General Safety Precautions

1.1 General Safety

Statement

Please read this manual before installing, operating and maintaining the equipment, and follow the marks on the equipment and all safety precautions in the manual.

The “Caution”, “Warning” and “Danger” items in the manual do not represent all safety items that should be observed, but are only supplements to all safety precautions. Master Battery does not assume any responsibility caused by violation of general safety operation requirements or violation of safety standards for design, production and use of equipment. This equipment should be used in an environment that meets the design specifications, or it may cause equipment failure, and the resulting abnormal equipment function or component damage, personal safety accidents and property losses are not within the scope of equipment quality assurance.

Comply with local laws, regulations and norms when installing, operating, and maintaining the equipment. The safety precautions in the manual are only a supplement to local laws, regulations and norms.

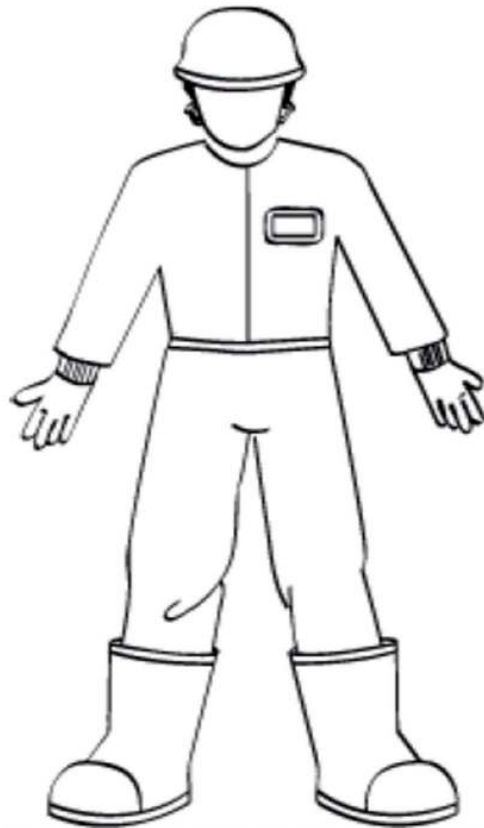
Master Battery is not liable for any of the following situations.

- Fail to operate under the conditions of use described in this manual.
- The installation and use environment doesn't comply with the regulations in relevant international or national standards.
- Unauthorized dismantling, changing the product or modifying the software code.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, etc.).
- Damage caused by the customer's own transportation.
- Damage caused by storage conditions not meeting documentation requirements.

General requirements

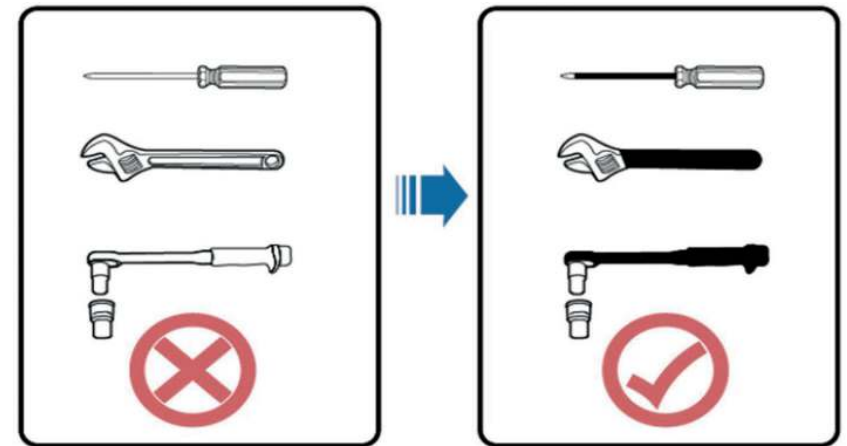
- It is strictly forbidden to install, use and operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, plugging/unplugging signal interfaces connected to outdoor, working at heights, outdoor installation, etc.) in severe weather such as lightning, rain, snow, and 6-scale wind.
- Do not wear watches, bracelets, rings, necklaces or other conductive objects during installation, operation and maintenance, so as to avoid electric shock.

- Special protective equipment must be used during installation, operation and maintenance, such as wearing insulating gloves, goggles, safety clothing, safety helmet, safety shoes, etc., as shown in the figure below.

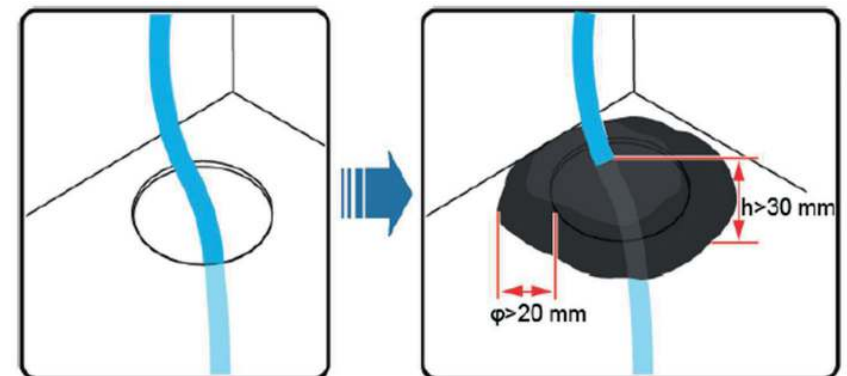


- Installation, operation and maintenance must be carried out in accordance with the sequence of steps in the instruction manual.
- Before touching any conductor surface or terminal, measure the voltage at the contact point to confirm that there is no risk of electric shock.
- After the equipment is installed, empty packing materials in the equipment area, such as cartons, foam, plastic and cable ties, should be removed.

- In case of fire, evacuate the building or equipment area and press the fire alarm bell, or call the fire alarm. Re-entry into a burning building is strictly prohibited under any circumstances.
- Do not disable protective devices and ignore warnings, cautions and precautions in the manual and on equipment. Timely replace hazard signs that have become unclear due to long-term use.
- Except for the personnel who operate the equipment, other personnel are not allowed to approach the equipment.
- The handle of the tool used needs to be insulated and protected, or use an insulated tool, as shown in the figure below.



- The wiring holes with cables routed need to be sealed with fire putty, and un-routed wiring holes need to be sealed with the cover that comes with the cabinet. The correct construction standard for fire putty plugging is shown in the figure below.



- It is strictly forbidden to alter, damage or cover the identification and nameplate on the equipment.
- Use tools to tighten the screws when installing the equipment.
- Live operation is strictly prohibited during the installation process.
- Paint scratches that occur during equipment transportation and installation must be repaired in time; it is strictly prohibited to expose the scratched parts to the outdoor environment for a long time.
- Before operation, securely fix the equipment on the floor or other stable objects, such as a wall or a mounting bracket.
- Do not wash the electrical components inside and outside the cabinet with water.
- Do not change the structure and installation sequence of the equipment without authorization.

Personal safety

- If a fault that may cause personal injury or equipment damage is found during the operation of the equipment, terminate the operation immediately, report to the person in charge, and take effective protective measures.
- To avoid the risk of electric shock, it is forbidden to connect the safety extra low voltage (SELV) circuit to the telecommunication network voltage (TNV) circuit.
- Do not power on the equipment until it is installed or confirmed by a professional.

1.2 Personnel Requirements

- The personnel responsible for the installation and maintenance of Master Power equipment must first undergo strict training to comprehend the safety precautions and master the correct operation methods.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the equipment.
- Only qualified professionals are allowed to remove safety devices and repair equipment.
- The personnel who operate the equipment, including operators, trained personnel, and professionals, should have the special operation qualifications required by the local government, such as high-voltage operation, climbing, and special equipment operation qualifications.
- Professionals: People who have experience in training or operating equipment, and who can clearly understand the potential sources and levels of danger in the process of equipment installation, operation, and maintenance.
- Trained personnel: A person who has received appropriate technical training and has the necessary experience can be aware of the dangers that may be brought to him when performing a certain operation, and can take measures to minimize the danger to him or other personnel.
- Operators: Operators who may come into contact with the equipment except trained personnel and professionals.
- Replacement of equipment or components (including software) must be done by professionals or authorized personnel.

1.3 Electrical Safety

Grounding requirements

- When installing equipment that needs to be grounded, the protective ground wire must be installed first; when removing the equipment, the protective ground wire must be
- Do not damage the grounding conductor.
- Do not operate the equipment without a grounding conductor installed.
- The equipment should be permanently connected to the protective earth. Before operating the equipment, check the electrical connection of the equipment to ensure that the equipment is reliably grounded.

General requirements

- When performing high-voltage operation, please use special insulated tools.

AC and DC operating requirements



It is forbidden to install or remove the power cord while it is live. When the power wire core touches the conductor, an arc or electric spark will be generated, which may cause fire or personal injury.

- If the equipment is marked with “High Leakage Current”, the protective grounding terminal of the equipment case must be grounded first before connecting the AC input power to prevent the leakage current of the equipment from causing electric shock to the human body.
- Before installing or removing the power cord, the power switch must be turned off.
- Before connecting the power cord, make sure the label on the power cord is correct.
- If the equipment has multiple inputs, all inputs should be disconnected, and the equipment can be operated only after it is completely powered off.
- It is not recommended to configure an air switch with leakage protection function.
- If the power cord is damaged, it must be replaced by the manufacturer, service agent or professionals to avoid risks.
- Personnel performing high-voltage operations and installing AC equipment must have high-voltage and AC work qualifications.

Wiring requirements

- Use of the cable in a high-temperature environment may cause aging and damage to the insulation layer. The distance between the cable and the outer periphery of the heating device or heat source area must be at least 30 mm.

- Cables are not allowed to pass through the air inlet and outlet of the equipment.
- The cables should meet the VW-1 flame retardant requirements.
- Cables of the same type should be bundled together, and cables of different types should be laid at least 30 mm apart. Intertwining or crossing of cables is prohibited.
- When the temperature is too low, severe impact and vibration may cause the plastic sheath of the cable to be brittle and crack. To ensure construction safety, the following requirements should be followed:
 - All cables should be laid and installed above 0°C. When moving cables, especially when constructing in low temperature environments, they should be handled with care.
 - If the storage environment temperature of the cables is below 0°C, the cables must be stored at room temperature for more than 24 hours.
 - It is forbidden to push the cables directly from the truck or have other non-standard operations.
 - The selection, installation, and routing of cables must comply with local laws, regulations, and specifications.

Static protection requirements

NOTICE

The static electricity generated by the human body will damage the static-sensitive components on the board, such as large-scale integrated circuits (LSI).

- The static electricity generated by the human body will damage the static-sensitive components on the board, such as large-scale integrated circuits (LSI). Before touching the equipment, holding a board or an application-specific integrated circuit (ASIC) chip, you must wear ESD gloves or ESD strap. The other end of the ESD strap should be properly grounded.
- When holding the board, you must hold the edge of the board that does not contain components, and do not touch the components with your hands.
- The disassembled board must be packed in ESD packaging materials before storage or transportation.

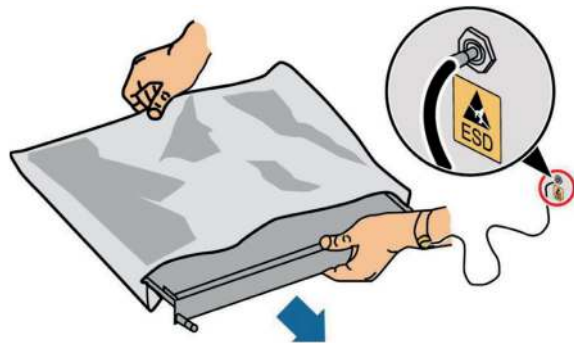


Figure 1-1: Diagram of wearing ESD strap

Neutral ground voltage

- It is recommended that the user balance the three-phase load so that the neutral-ground voltage is less than 2V and meets the power distribution requirements.

1.4 Requirements of Installation Environment

- When the equipment is running, do not cover the vents or heat dissipation system in order to prevent fire due to high temperature.
- The equipment should be installed in an area away from liquids; it is forbidden to install it under water pipes, air outlets and other places that are prone to condensation, or under places that are prone to water leakage, such as air-conditioning outlets, vents, and outlet windows in the machine room, so as to prevent liquids from entering the inside of the equipment and causing malfunction or short circuit.
- If any liquid enters the equipment, please turn off the power immediately and notify the administrator.
- Do not place the equipment in an environment with flammable or explosive gas or smoke, and do not perform any operations in such environment.
- The equipment should be installed away from desert or sandy environment.

High-altitude installation

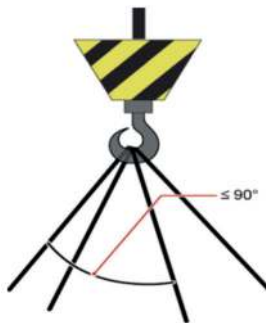
- The operations carried out more than 2m above the ground are all high-altitude operations.
- The high-altitude operations must be stopped in case of one of the following situations: the rainwater on the steel pipe is not dry, and other situations that may cause danger. When the above-mentioned situation has passed, the company's safety director and relevant technical personnel must check the operating equipment, and the operation can only be carried out after confirmation and approval.
- High-altitude operations must meet the requirements of local laws and regulations on operations at heights.
- The person must accept relevant training and obtain relevant certificates before taking up work and perform high-altitude operations.
- Before high-altitude operations, carefully check the climbing tools and safety appliances, such as safety helmets, safety belts, ladders, springboards, scaffolding, lifting equipment, etc. Any incompliance must be improved immediately or the high-altitude operations should be stopped. Take appropriate safety protection, wear a safety helmet, safety belt or waist rope, and tie it to a solid structural member. It is strictly forbidden to hang on an unstable object or metal with sharp edges and corners to prevent the hook from slipping and causing a fall accident.
- At the high-altitude operation site, the dangerous restricted area should be marked out, and obvious signs should be set up to strictly prohibit irrelevant personnel from entering.

- Carry the operating equipment and tools properly to prevent the tools from falling and hurting others.
- It is strictly forbidden to throw objects from high altitude to the ground or throw objects from the ground to high altitude. Strong cables, hanging baskets, elevated vehicles or cranes should be used to transport objects.
- Guardrails and signs should be set up at the edges and holes of high-altitude operations to prevent stepping into the air.
- On the ground below the high-altitude operation area, it is strictly forbidden to pile up scaffolding, springboards, and other sundries. Ground personnel are strictly prohibited from staying or passing directly under the high-altitude operation area.
- Scaffolding, springboards and workbenches for high-altitude operations must be inspected and appraised for safety in advance to ensure that the structure is firm and the scaffolding is not overloaded.
- If the person in charge of the site and the safety officer find that the construction personnel working at heights do not operate according to the regulations, they should immediately ask them to make corrections; otherwise, their operations must be stopped.

1.5 Machinery Safety

Hoisting safety

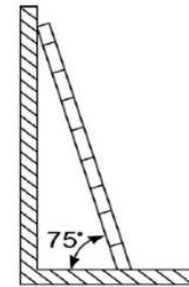
- When hoisting heavy objects, it is strictly forbidden to walk under the boom and the hoisting objects.
- The personnel who carry out the hoisting operation must accept relevant training and can only work after passing the qualification.
- The hoisting tools must be inspected and can only be used if they are complete.
- Before hoisting, ensure that the hoisting tools are securely fixed to load-bearing fixtures or walls.
- During hoisting, ensure that the angle between the two cables is not greater than 90° , as shown in the figure below.



- During hoisting, it is forbidden to drag the steel wire rope and lifting gear, or hit with hard objects.

Ladder use safety

- Use wooden ladder or fiberglass ladder when climbing operations may be involved.
- When using a herringbone ladder, the rope must be firm, and the ladder must be held by dedicated personnel during operation.
- Before using the ladder, please confirm that it is intact and the load capacity meets the requirements. Overweight use is strictly prohibited.
- The ladder should be placed in a stable place. The inclination of the ladder is preferably 75° , which can be measured with a square, as shown in the figure below. The ladder should be used with the wide legs pointing down or with protection at the bottom of the ladder to prevent slipping.



- When climbing a ladder, please pay attention to the following actions to reduce danger and ensure safety.
- Keep your body steady.
- The maximum height at which workers can stand on their feet should not exceed the fourth step from the top to the bottom of the ladder.
- Make sure that the center of gravity of the body does not deviate from the edge of the ladder frame.

Drilling safety

- When drilling holes on walls and ground, consider the following safety precautions:

NOTICE

Drilling holes in the equipment is strictly prohibited. Drilling will damage the electromagnetic shielding performance of the equipment, internal components, and cables, and metal shavings generated by drilling will enter the equipment and cause a short circuit on the circuit board.

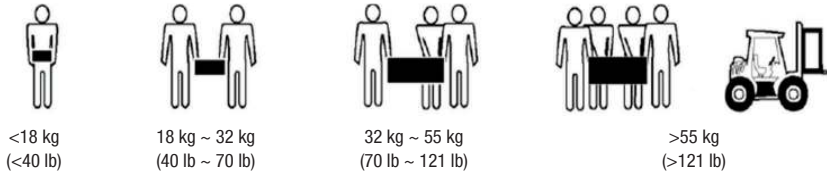
- The consent of the customer, the contractor and Master Battery should be obtained before drilling.
- Wear goggles and protective gloves when drilling.
- During the drilling process, the equipment should be covered to prevent debris from falling into the equipment, and the debris should be cleaned in time after drilling.

Safety when handling heavy loads



When pulling the equipment out of the cabinet, be careful of equipment that may be unstable or heavy on the cabinet to avoid being crushed or smashed.

- When handling heavy objects, be prepared to bear the weight to avoid being crushed or sprained.



- When carrying the equipment by hand, wear protective gloves to avoid injury.
- When moving or lifting the equipment, hold the handle or the bottom edge of the equipment instead of the handle of the module installed in the equipment.
- Avoid scratching the surface of the cabinet or damaging the components and cables of the cabinet when moving the equipment.
- When using a forklift to transport, the fork must be in the middle position to prevent overturning. Before moving, please use ropes to fasten the equipment on the forklift; when moving, special care is required.
- When transporting, try to choose railway, sea or roads with good conditions to ensure the safety of the equipment. Bumps and tilts should be minimized during transportation.
- Move the cabinet carefully to avoid equipment damage caused by any impact or drop.

1.6 Battery Safety

Basic requirements

Before working on the battery, you must carefully read the safety precautions for operation and master the correct connection method of the battery.



- Do not expose the battery to high-temperature environments or heat-generating devices, such as sunshine, fire, transformers, heaters, etc. Batteries may explode if overheated.
- Do not incinerate the battery, or it may cause an explosion.
- It is strictly forbidden to disassemble, modify or destroy the battery (such as inserting foreign objects, immersing in water or other liquids), so as to avoid electrolyte leakage, overheating, fire or explosion.

- Wear goggles, rubber gloves, and protective clothing to prevent harm caused by electrolyte spillage. If the electrolyte leaks, do not let the skin or eyes come into contact with the electrolyte. If it touches the skin or eyes, rinse with clean water immediately and go to the hospital for medical treatment.
- Please use special insulation tools.
- When moving the battery, carry in the direction required by the battery; it is strictly forbidden to invert or tilt it.
- During installation and maintenance operations, the battery circuit should be kept disconnected.
- Please use the specified type of battery, or it may cause damage to the battery.
- Please dispose of used batteries according to local laws and regulations, and do not dispose as domestic waste. Improper battery disposal may cause the battery to explode.
- There must be fire-fighting facilities that meet the requirements on site, such as fire-fighting sand and dry powder fire extinguishers.

NOTICE

In order to ensure the safety of battery use and the accuracy of battery management functions, please use the battery provided with the PCS host by Master Battery. Master Battery will not be responsible for any battery-related failures caused by using batteries not provided by Master Battery.

Battery installation specifications

- Before installing and operating the battery, the following basic precautions should be observed in order to ensure safety:
- The battery should be installed in a ventilated, dry and cool environment, away from heat sources, flammables, humid, large amounts of infrared radiation, organic solvents, and corrosive gases, and fire prevention measures should be taken. The battery should be placed and fixed horizontally.
- Pay attention to the battery polarity during installation. It is strictly forbidden to short-circuit the positive and negative poles of the same battery or the same battery string, or it will cause a short circuit.
- Check the battery connection terminal screws regularly to make sure they are tight and not loose.
- It is strictly forbidden to place installation tools on the battery during installation.

Battery short circuit protection



A short circuit of the battery will generate an instantaneous large current and release a large amount of energy, which may cause personal injury and property damage.

In order to avoid battery short circuit, the battery does not allow online maintenance.

Lithium battery special scene

Refer to lead-acid batteries for the safety precautions of lithium battery operation. In addition, the following matters need to be noted.



WARNING

There is risk of explosion if battery is replaced by an incorrect type.

- Replace only with the same or similar type battery recommended by the manufacturer.
- Inversion, tilting and collision are prohibited when handling the lithium batteries.
- During installation, maintenance and other operations, the circuit of the lithium battery module should be kept disconnected.
- Charging is prohibited when the lithium battery is lower than the lower limit of the working temperature (charging is prohibited at 0°C), so as to avoid internal short circuit of the battery due to low temperature charging crystallization.
- Do not exceed the temperature range, which will affect the performance and safety of the battery.
- Do not throw the lithium battery module into a fire source.
- After the maintenance is completed, return the used lithium battery module to the maintenance site.

1.7 Others

Transportation, storage and maintenance

- For long-term storage, charge and discharge every 6 months according to the method specified in the manual.
- Be careful not to drop the battery when loading and unloading it during transportation. Do not turn it over.

Warnings and precautions

Please read the specifications and the warning signs on the surface of the battery box carefully before using the battery. Improper use of the battery may cause overheating and damage to the battery. Master Battery will not be responsible for any accidents caused by failure to operate according to the specifications. In order to ensure the safe use and disposal of the battery, please read the operating instructions carefully before use.

2. Overview

2.1 Product Introduction

The industrial and commercial battery cabinet includes high-voltage box, battery module, EMS, MBMU (optional) and other modules, which can store and release electric energy according to the requirements of the ESS energy management system. The input and output ports of battery cabinet use high-voltage direct current.

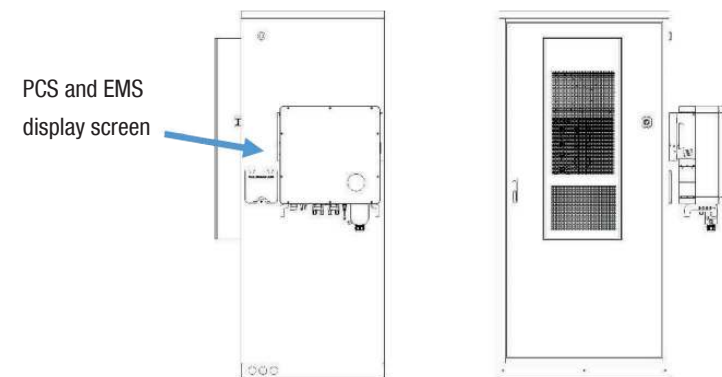
- Battery charging: The output of the battery cabinet is connected to the energy storage terminals (BAT+, BAT-) of the energy storage converter. Under the control of the energy storage converter, it charges the battery, and transfers the energy in the photovoltaic or mains to the battery.
- Battery discharging: When the photovoltaic energy is not enough to supply power to the load, the system needs to control the battery to supply power to the load, and output the stored battery energy to the load through the energy storage converter.

According to the functional configuration, industrial and commercial battery cabinet can be divided into master battery cabinet and slave battery cabinet. Each battery cabinet contains 2 battery clusters with independent output. Wherein:

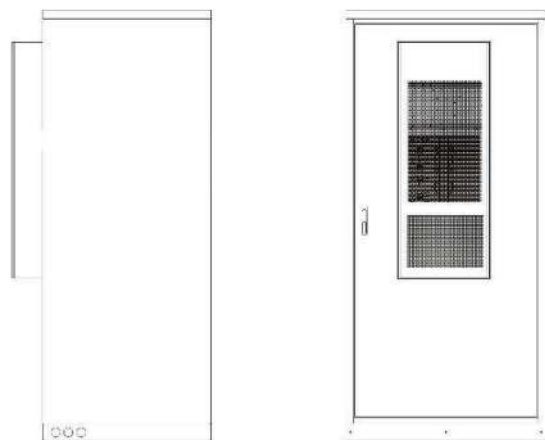
Master battery cabinet includes 2 battery clusters, EMS module, and MBMU battery array management module.

Slave battery cabinet includes 2 battery clusters, MBMU battery array management module (optional).

2.1.1 Product Appearance



Master battery cabinet



Cluster slave

Figure 2-1: Battery cabinet

Functions of the master battery cabinet: manage battery clusters, communicate with PCS, display and save all system data, EMS management, modify system parameters, etc. There is an EMS display on the side panel of the cabinet of the master battery cabinet.

Functions of the cluster slave: accept the energy management of the master battery cabinet, judge the fault information and report it to the master battery cabinet, perform protection actions, obtain the current and voltage information of the battery cluster, and perform fault judgment, etc.

The cabinet of the cluster slave does not contain a display screen.

2.1.2 Product Structure

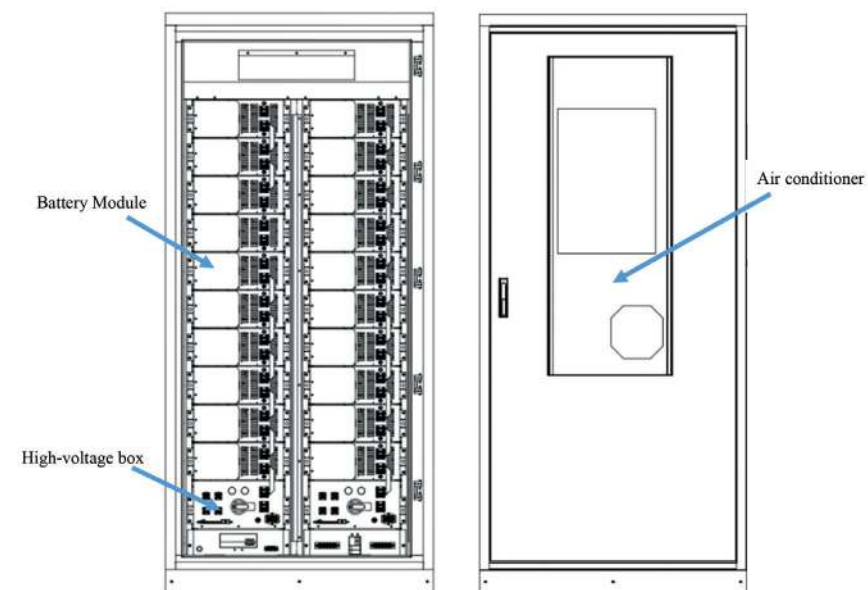


Figure 2-2: Product structure

2.1.2.1 High-voltage box

The high-voltage box contains the protection components of the whole system, such as relays, MCCBs (Molded case circuit breaker), fuses, SPDs (surge protection device), etc.

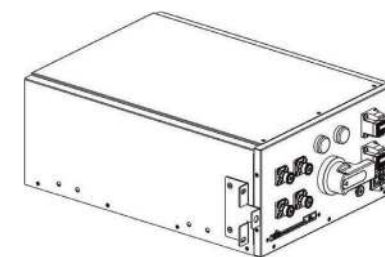


Figure 2-3: High-voltage box

Features

The High-voltage box is used to collect information such as cluster voltage, current, temperature, and external digital input signals, and cooperates with the BMS to implement system operation strategies. The dimensions of the High-voltage box are as follows:

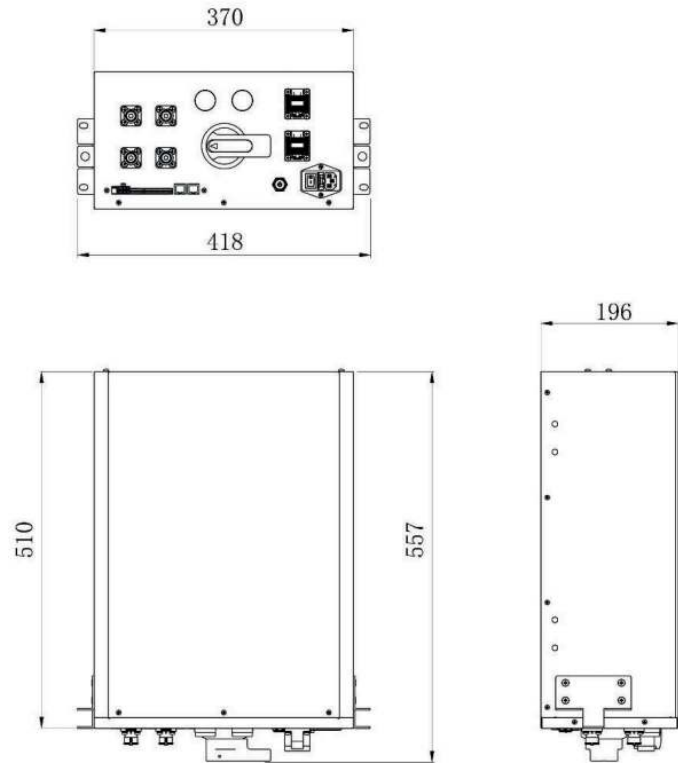


Figure 2-4: Dimensions of High-voltage box (mm)

2.1.2.2 Battery Module

The high-voltage box contains the protection components of the whole system, such as relays, MCCBs (Molded case circuit breaker), fuses, SPDs (surge protection device), etc.

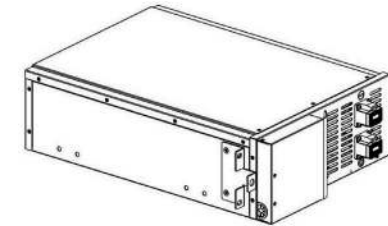


Figure 2-5: Battery module

Features

The battery module composed of cells, which is the power source of the entire system. The BMU unit is used to collect information such as the voltage and temperature of the lithium battery, and upload the information to the SBMU control unit. There is also a firefighting unit for automatic fire extinguishing inside the battery module. The battery module dimensions are as follows:

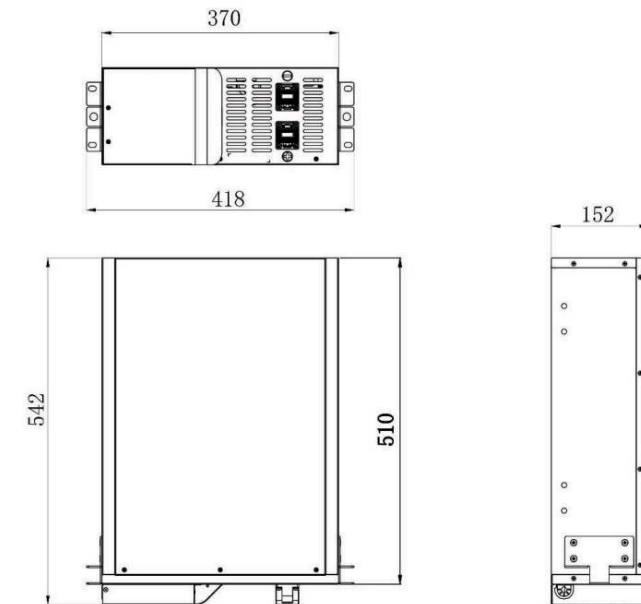


Figure 2-6: Dimensions of the battery module (mm)

2.1.3 Product model and naming scheme

2.1.3.1 Naming scheme of Battery cabinet:

BC XXX D E
 | | | |
 Part1 Part2 Part3 Part4

Part1	Part2	Part3	Part4
BC: Battery cabinet	Energy 100:100 kWh 090:90 kWh 080:80 kWh	D: Outdoor	E: EMS unit Blank: No EMS unit

2.1.3.2 Naming scheme of Battery Module:

BC - PACK - 5.1 - 16S - 100A
 | | | | |
 Part1 Part2 Part3 Part4 Part5

Part1	Part2	Part3	Part4	Part5
BC: Battery cabinet	Battery Pack	Energy 5.1:5.1 kWh	16S:16 cells in series	100 A: The max current of Cell

2.2 Battery System Parameters

2.2.1 Cell Parameters

No.	Item	Characteristics
1	Cell type	LFP (LiFePO ₄)
2	Rated voltage	3.2 V
3	Rated capacity	100 Ah
4	Rated energy	320 Wh
5	Maximum continuous charging current	1 C
6	Recommended charging current	≤ 0.5 C
7	Maximum continuous discharging current	1 C
8	Recommended discharging current	≤ 0.5 C

2.2.2 Battery Module Parameters

No.	Item	Characteristics
1	Cell connection	16S1P
2	Rated voltage	51.2 V
3	Rated capacity	100 Ah
4	Rated energy	5.1 kWh
5	Rated charging voltage	57.6 V
6	Recommended charging and discharging current	≤ 50 A @ 25 ± 5°C
7	Weight	About 44 kg

Charging instructions for battery module:

If the user wants to charge a separate battery module, it is necessary to set the charger parameters in strict accordance with the above battery module parameters, otherwise the battery module may be damaged.

2.2.3 Battery Cluster Parameters

No.	Item	Characteristics
1	Cell connection	16S1P
2	Rated voltage	512 V
3	Rated capacity	100 Ah
4	Rated energy	51.2 kWh
5	Rated charging voltage	576 V
6	Recommended charging and discharging current	≤ 50 A @ 25 ± 5°C

2.2.4 Battery Cabinet Parameters

No.	Item	Characteristics
1	Total Energy	102.4 kWh
2	Rated Voltage	512 VDC
3	Depth of Discharge (DOD)	90%
4	Operating Voltage Range	448 VDC - 576 VDC
5	QTY of Battery Cluster Per Cabinet	2
6	Maximum Charging Current	50 A (0.5 C)
7	Maximum Discharging Current	50 A (0.5 C)
8	Monitoring Parameters	Battery cluster voltage, current, cell voltage, cell temperature, ambient temperature, etc.
9	Communication	CAN / Ethernet
10	Operating Temperature Range	-30°C - +50°C
11	Storage Temperature Range	-30°C - +55°C (Recommended temperature 25°C for long term storage)
12	Related Humidity	5% ~ 95%, no confidence
13	Ventilation Type	Air conditioner
14	Net Weight	About 1400 kg
15	Dimension	1100 mm* 1100 mm* 2380 mm
16	IP degree	IP54

Charging instructions for battery cabinet:

Rated charging voltage: 576 V

Charging current: The charging current limit of each cluster in the battery cabinet is calculated and defined by BMS system according to voltage and temperature.

When the cell voltage is lower than 3.5 V, the recommended charging current of the system is 50 A; When the cell voltage is higher than 3.5 V, the battery enters the floating charge mode, and the charging current recommended is 0.1C ~ 0.5 C. At this time, the specific charging current is calculated and defined by BMS according to the system working state.

2.2.5 Interfaces of High-voltage box

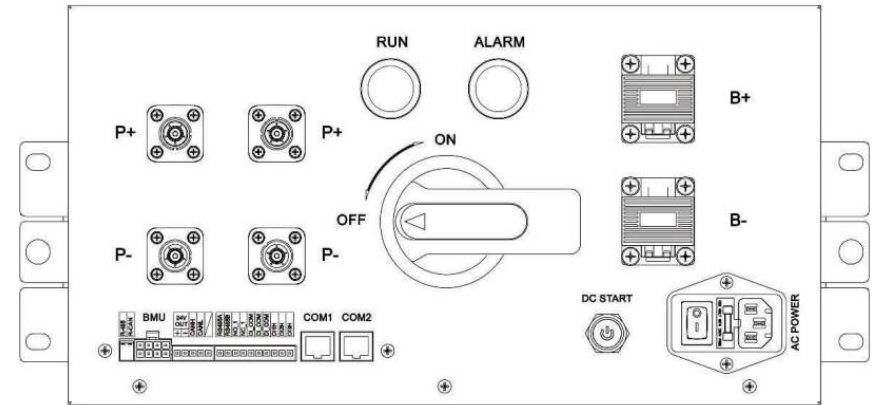


Figure 2-7: Danel of High-voltage box

Definition of components on panel:

Port	Description
P+	Positive terminal of DC output
P-	Negative terminal of DC output
B+	Positive terminal of battery modules in series
B-	Negative terminal of battery modules in series
DC START	DC start button/black-start button
AC POWER	220 VAC input
RUN	Run indicator
ALARM	Warning indicator
MCCB switch	DC output switch

Definition of weak current/communication ports:

Port	Description
R-485	Resistor DIP of RS485 communication terminal
R-CAN	Resistor DIP of CAN communication terminal
BMU	Battery modules communication port
24VOUT	24 V power output port
CANH/L	CAN communication interface
RS485A/RS485B	Air conditioner communication interface
NO_1/NC_1	Switch output port 1
DI1H	Digital input port 1
DI2H	Digital input port 2
DI3H	Digital input port 3
DI_COM	Digital input negative common terminal
COM1/COM2	Communication ports between high-voltage boxes inside or outside the cabinet

3. Installation

3.1 Site Planning

3.1.1 Dimensions of Battery Cabinet

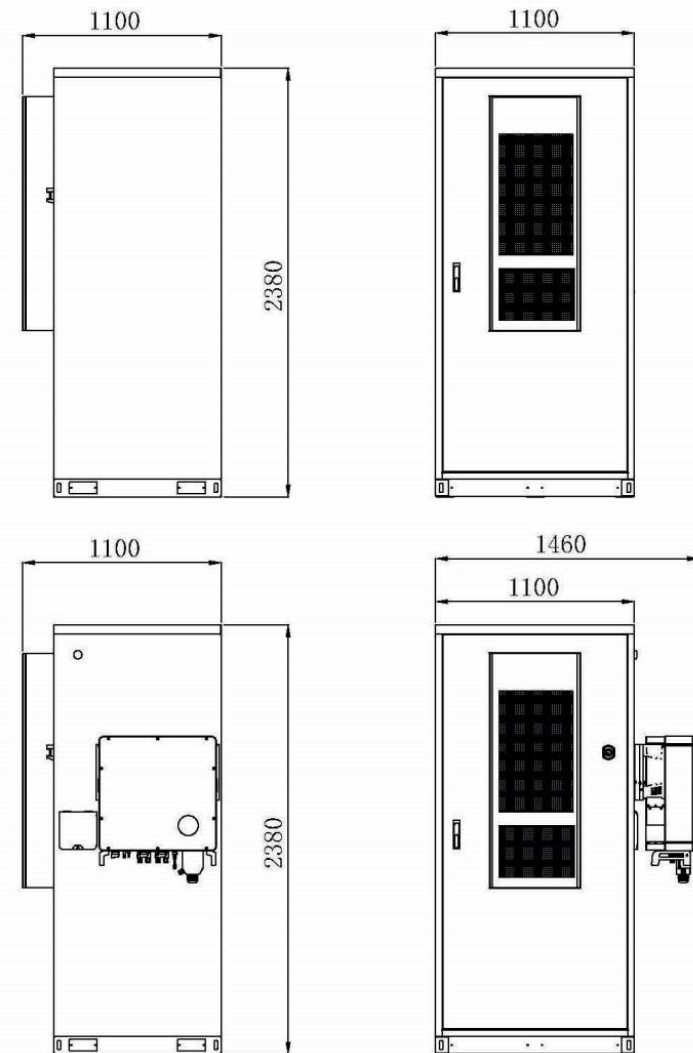


Figure 3-1: Dimensions of the cabinet (mm)

3.1.2 Precautions for Installation

Please place the battery cabinet on a level ground and ensure it is stable without shaking or tilting.

The bearing and load capacity of the installation ground and floor (according to the requirements of the architectural drawings) should be considered for the installation of the battery cabinet.

Do not cover the ventilation holes with objects, so as not to hinder the heat dissipation of the battery cabinet, which will cause the internal temperature of the system to rise and affect the safety and life of the battery.

Please keep the installation environment of the battery cabinet well ventilated. Avoid installing in places with high or low temperature and high humidity. Keep away from water, flammable gases, corrosive agents, heat sources, and direct sunlight. Keep the air inlet/outlet dust-free.

Please avoid using it in an environment with dust, volatile gas, corrosive gas or high salt content, and do not place flammable and explosive items around the battery cabinet.

In order to reduce the possibility of fire and reduce the damage, the walls, ceilings and floors of the room where the battery cabinet is placed should be made of fireproof materials as much as possible, and should be provided with portable dry powder fire extinguishers.

During the installation process, please refer to the relevant applicable safety regulations for installation.

3.1.3 Space Reservation

A certain space for operation and ventilation should be reserved around the cabinet:

- At least 1200 mm of space for ventilation and operation must be reserved in front.
- At least 1200 mm of operating space must be reserved on the back.
- At least 600 mm of operating space must be reserved on the side.







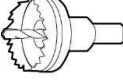

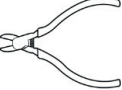
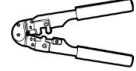
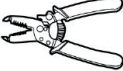






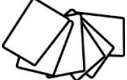
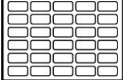

3.2 Preparation of Tools and Instruments

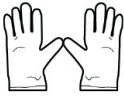




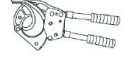



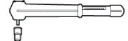




DANGER

Use insulated tools to avoid electric shock.

Table 3-1 Preparation of tools and instruments

Tools and instruments			
<i>Electric forklift</i>	<i>Manual forklift</i>	<i>Ladder</i>	<i>Rubber hammer</i>
			
<i>Impact drill</i>	<i>Manual impact drill</i>	<i>Alloy hole saw</i>	<i>Heat gun</i>
			
<i>Diagonal cutters</i>	<i>Crimping tool</i>	<i>Wire stripper</i>	<i>Electro-hydraulic press</i>
			
<i>Clamp ammeter</i>	<i>Multimeter</i>	<i>Cable ties</i>	<i>Measuring level</i>
			
<i>Insulating tape</i>	<i>Cotton cloth</i>	<i>Label</i>	<i>Electrician's knife</i>
			

<i>ESD gloves</i>	<i>Lead rubber gloves</i>	<i>Heat insulation gloves</i>	<i>Insulation protective shoes</i>
			
<i>Torque screwdriver</i>	<i>Manual impact drill</i>	<i>Alloy hole saw</i>	<i>Heat gun</i>
			
<i>Phillips screwdriver (M3/M4/M5/ M6/M8)</i>	<i>Insulated torque wrench (M6/M8/M12/M16)</i>	<i>Heat shrink tube</i>	<i>Insulated adjustable rench</i>
			

3.3 Preparation of Power Cables

The cables between the cabinets should be 25 mm², low-smoke, halogen-free and flame-retardant cables.

3.4 Unpacking

Steps

Step 1 Transport the battery cabinet to the designated location with a forklift.

Step 2 Remove the outer packaging of the battery cabinet.

Step 3 After confirming that the equipment is in good condition, remove the bolts fixing the battery cabinet and the pallet and remove the battery cabinet from the pallet.

3.5 Single Cabinet Installation

3.5.1 Installation Environment

- Do not install the battery cabinet in a place with high temperature, low temperature or humidity beyond the technical specifications.
- Keep the battery cabinet away from water sources, heat sources, and flammable and explosive items.
- Avoid installing the battery cabinet in the desert or the surrounding environment of the desert.
- Avoid installing the battery cabinet in an environment with direct sunlight, dust, volatile gas, corrosive substances, and high salt content.
- Avoid installing the battery cabinet on unstable or vibrating foundations.
- Do not install the battery cabinet in a working environment with metal conductive dust.
- The optimum temperature for battery operation is 20°C ~ 30°C. Working in an environment with a temperature higher than 30°C will reduce the service life of the battery, and working in an environment lower than 20°C will shorten the battery backup time.

3.5.2 Installing the Cabinet

Step 1 According to the design requirements, determine the installation position of the cabinet on a flat ground and draw a line mark.

Step 2 Transport the battery cabinet to the designated location by means of a forklift and install it at the marked location.

Step 3 After the installation is complete, check whether the cabinet body is tilted and whether the gap between cabinets meets the requirements.

Fix the battery cabinet on the foundation with fastening bolts. After fixation, U-shaped angle steel shall be treated with anti-rust treatment, such as spraying anti-rust paint.

--- Installation ends

3.5.3 Installation Instructions for Copper Bars between Battery Modules

3.5.3.1 Battery Module

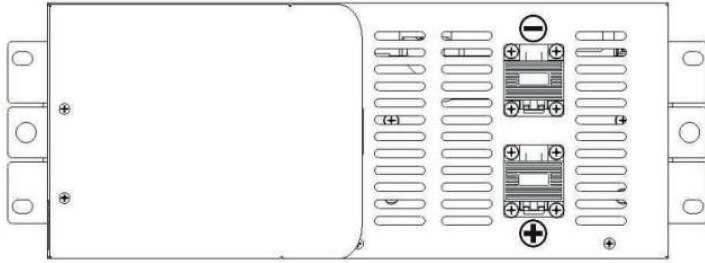


Figure 3-2: Battery module

NOTE:

: The negative terminal of the battery module

: The positive terminal of the battery module

3.5.3.2 Instructions for Battery Module Power Connection

The connection between the battery modules has been completed before the battery cabinet is shipped. If the customer still needs to maintain the connection between the battery modules, please refer to the following:

Part specifications:

Name	Description
Soft copper bar -1	Connecting soft copper bar between battery modules
Power cable "B-"	Connection cables of module 01 "B-" and High-voltage box "B-"
M8*12 combined bolts	Used to fix copper bars and "B-" power cables
Cable tie	Used to fix "B-" power cable

Copper bar connection between battery modules:

Wear insulating gloves, and lock the copper bars from the top battery module to the bottom. Place the soft copper bars on the "+" of the top battery module 01 and the "-" of the battery module 02, and fix the copper bars (M8*12 combined bolts, torque 5.5 ~ 6.0 N.M). Lock the battery modules 02, 03...10 down in this order until the "B+" connection of the High-voltage box is completed.

Note: Do not open the covers of all the DC connection terminals at the same time in order to avoid short circuit caused by misuse. It is recommended to only open the terminals on both sides of the copper bar (or power cable) to be locked, and close the cover of the terminal after the copper bar (or power cable) is fixed.

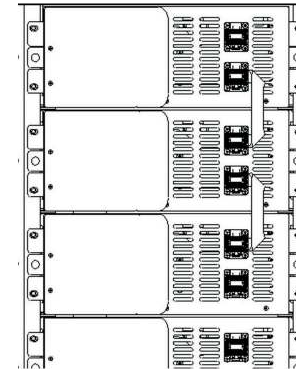


Figure 3-3: Copper bars connected in series

Step 3 Install the "B-" power cable. One end of the "B-" power cable is connected to the "-" position of the battery module 01 on the top, the other end is connected to the "B-" terminal position of the High-voltage box, and fastened with bolts (M8*12 combined bolts, torque 5.5 ~ 6.0 N.M). Secure the "B-" power cable with the cable tie from the accessory bag.

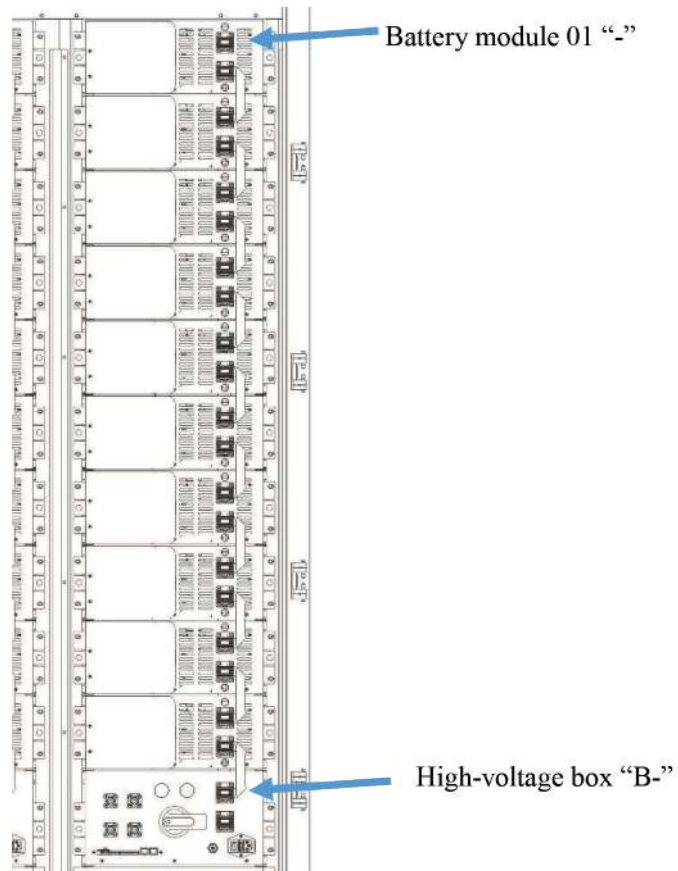


Figure 3-4: Slot diagram of the battery module

Step 4 Install another cluster of battery modules. Repeat steps 1 ~ 3 to complete the connection and fixation of the power cables and soft copper bars of another cluster of battery modules in the battery cabinet in sequence, as shown in Figure 3-5.

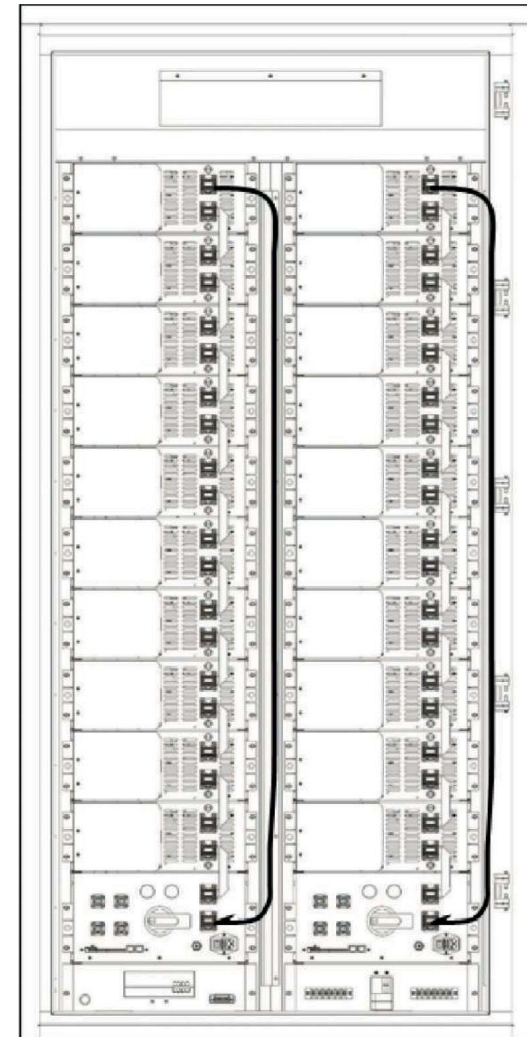


Figure 3-5: “B-” power cable connection

3.6 Electrical Connection

⚠ DANGER Before installation, make sure MCCB breaker switch on the High-voltage box is off.

3.6.1 AC Input Connection

Step 1 Confirm that the AC Switch is in the OFF state.

Note: The AC input is 220 VAC single-phase alternating current. Please confirm whether it is live before wiring.

The 220 VAC power supply will be used for power the air conditioner and the AC/DC power supply module.

Step 2 Connect the L/N/PE cables of the 220 VAC power cable to the corresponding terminals according to the marks in the figure below, and fasten them with bolts (torque ≤ 2 N.M).

Note: The 3 terminals (L/N/PE) at the right side of the “INPUT” side are reserved AC input terminals which can be used as AC power source when connected to the another battery cabinet.

The two groups of terminals at the “OUTPUT” side are used for internal wiring to power the High-voltage box and the air conditioner.

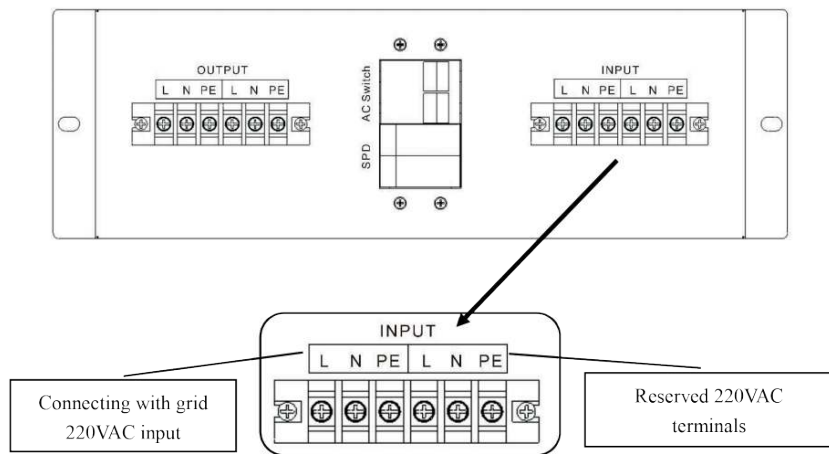


Figure 3-6: AC input connection

3.7 Cabinet Installation

3.7.1 Parallel Connection of Battery Clusters in the Cabinet

Step 1 Connect the P+/P- ports of the High-voltage box 01 and the High-voltage box 02 with the parallel power cable (accessory 9), and connect the P+/P- power cable connected to the PCS to the P+/P- port of the High-voltage box 01 or 02. The connection method is shown in the figure below.

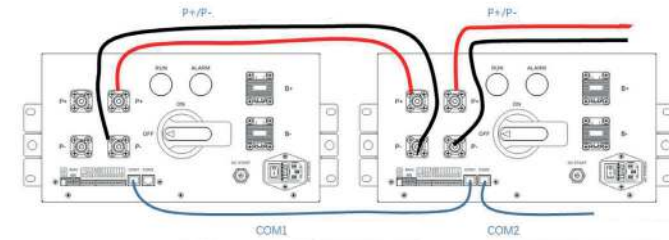


Figure 3-7: Parallel power cable connection

Step 2 When the number of battery cabinets in the energy storage system is greater than or equal to 2, connect one end of the parallel CAN/power communication cable (accessory 05) to the COM2 port of the high-voltage box shown above (both high-voltage box 01 and 02 are acceptable), and connect the other end to the COM2 port of the High-voltage box in other battery cabinets.

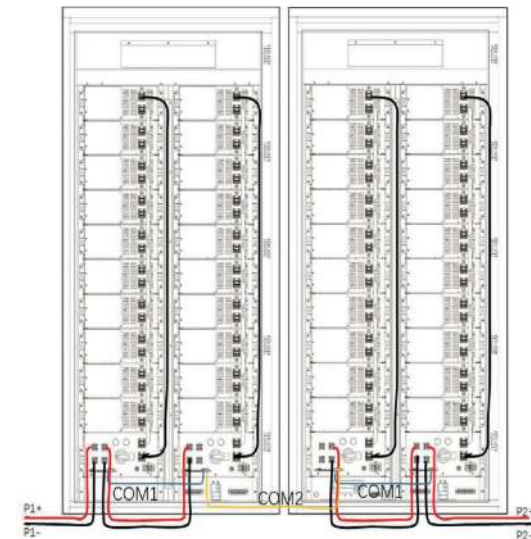


Figure 3-8: Parallel wiring cable connection when the number of battery cabinets is greater than or equal to 2

3.7.2 Parallel Connection of Battery Cabinets

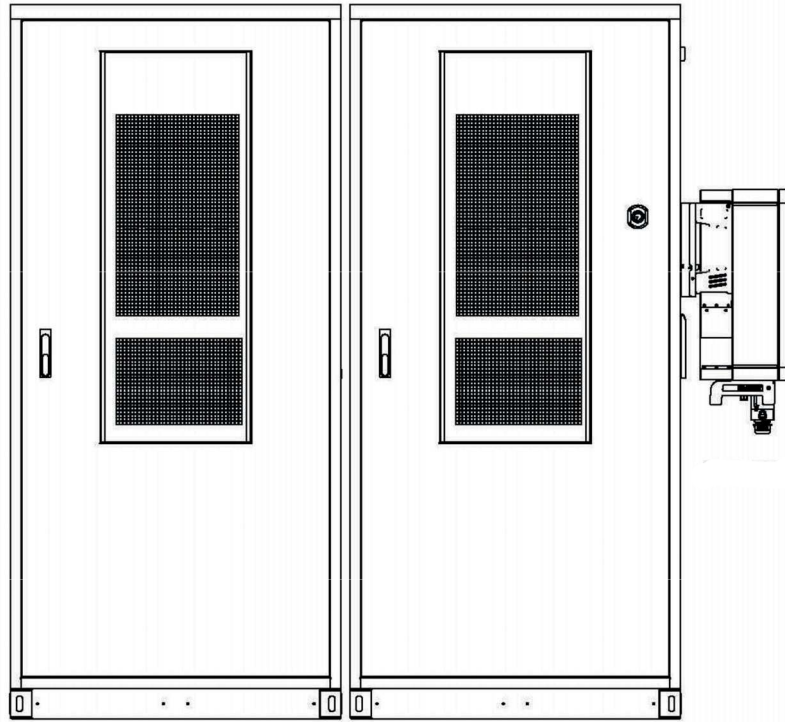


Figure 3-9: Schematic diagram of placement of 2 parallel battery cabinets

Step 1 Connect the P+/P- ports of the High-voltage box 01 and the High-voltage box 02 with the parallel power cable (accessory 9), and connect the power cable (accessory 11) connected to the P+/P- of the other cabinet to the High-voltage box 01 or 02 on the P+/P- port. The connection method is shown in the figure below.

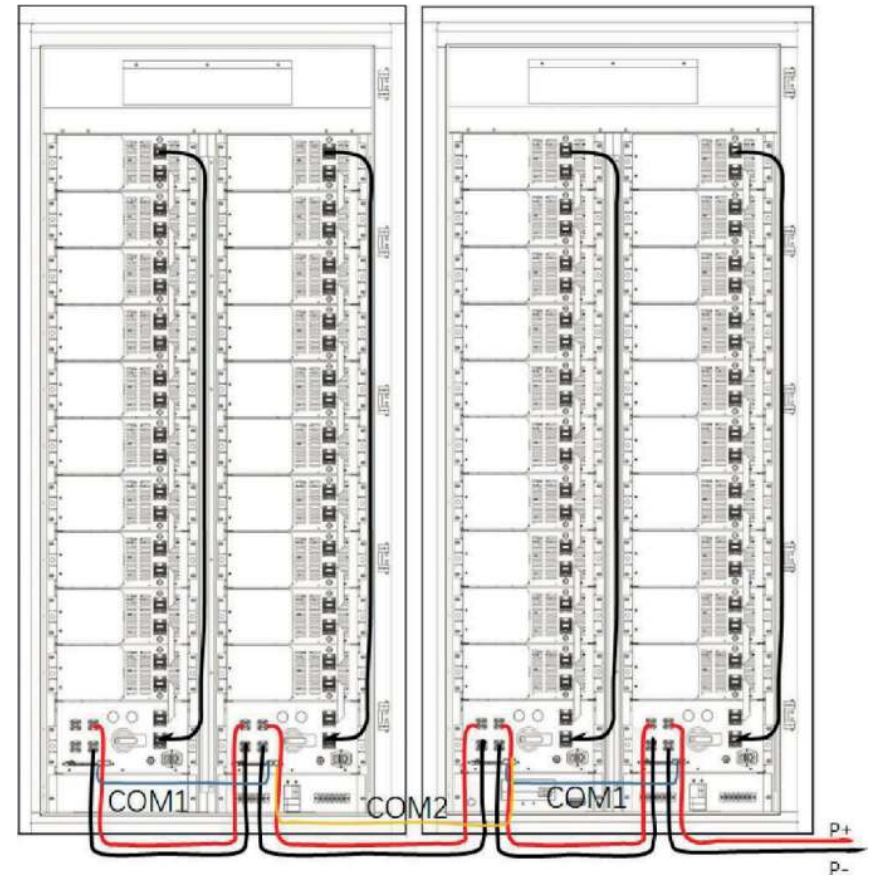


Figure 3-10: Schematic diagram of connecting two battery cabinets in parallel

Step 2 Connect one end of the parallel CAN/power communication cable (accessory 05) to the COM2 port of the high-voltage box in the above picture (both high-voltage box 01 and 02 are acceptable), and connect the other end to COM2 port of the high-voltage box in other battery cabinets.

3.8 Communication Wiring Instructions

1) Network communication interface wiring

The battery cabinet has a built-in switch, which has been connected to the network port of the EMS controller. The user needs to connect it to the cloud platform or the upper monitoring system, and directly connect to the switch through a standard network cable.

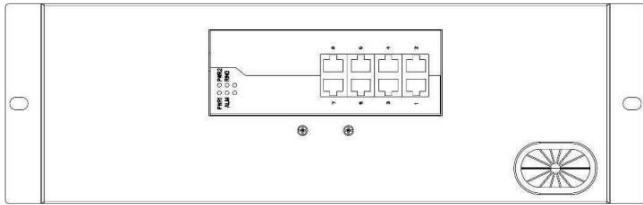


Figure 3-11: Schematic diagram of switch interface

2) PCS (KAC) communication wiring

The four-core signal cable is connected through the position shown in the figure below, and the other end is connected to the PCS communication interface.

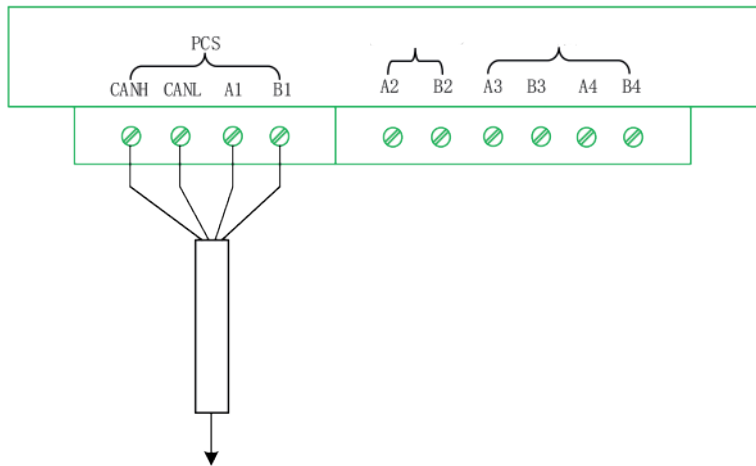


Figure 3-12: PCS communication cable connection diagram

4. Operation Guide

4.1 Inspection after Installation



- Personnel responsible for installing and maintaining equipment must first accept strict training to comprehend various safety precautions and correct operation methods.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the equipment.

Steps of checking:

Step 1 Check fixation of module box

- Check whether the battery module, high-voltage box, and battery cabinet are fixed:

Step 2 Check power cable

- Check whether the copper bars between the battery modules and between the battery modules and the high-voltage box or the fastening bolts of the power cables are missing, loose, or not tightened with recommended torque;
- Check whether the quick plug power cable of P+/P- is reversed, and whether the plug and socket are completely locked;
- Check whether the 220 VAC input cable is reversed, and whether the fastening bolts are missing, loose, or not tightened with recommended torque;

Step 3 Check communication cable

- Check whether the communication cable among the battery modules, the high-voltage box, the MBMU module, and the EMS unit is loose or missing;
- Check whether the communication cable between the PCS and the MBMU module is loose or missing;
- Check whether the CAN communication cable between two battery cabinets is correctly connected, and check whether is loose or missing;

Step 4 Check the power supply, drive and communication cable of the firefighting starter

- Check the power supply of the firefight starter, and the power indicator light or flash. If the power indicator can't be lit, please contact Master Power staff.
- Check whether the firefighting start, power supply, feedback and other wiring cables are loose or missing;

If abnormalities are found and can't be recovered, please contact Master Power staff.

4.2 Running Environment Check

Check environment temperature: -20°C ~ 55°C

Check environment humidity: 10% ~ 95%, no condensation

4.3 Power-on Operation

4.3.1 Prerequisites

- Before powering on, make sure that all items to be checked after installation have been checked.
- Before powering on, measure total battery and it should be within the range of 400 ~ 576 V.
- Before powering on, make sure that all switches are turned off.

4.3.2 Operation Steps

- If there is 220 VAC input
 - Step 1 Supply the grid 220 VAC to the battery cabinet;
 - Step 2 Turn on the “AC Switch” in the cabinet, and close the “AC POWER” switch on the panel of high-voltage box;
 - Step 3 Turn the switch handle of the high-voltage box to the “ON” position, and check whether the indicator light turn green;
 - Step 4 Confirm whether the air conditioner is powered on;
 - Step 5 Check whether EMS screen on the right side of the battery cabinet is power on, and whether there is any fault;
 - Step 6 Repeat steps 2~3 to turn on another cluster of batteries in the battery cabinet;

--- End
- If there is no 220 VAC input
 - Step 1 Turn the switch handle of the High-voltage box to the “ON” position;
 - Step 2 Press the “DC START” button on the high-voltage box for 3-6 seconds. After the indicator light is on, release the button to realize DC black start;
 - Step 3 Confirm whether the run indicator light turn green;
 - Step 4 Turn on the “AC POWER” switch of the High-voltage box;
 - Step 5 Check whether EMS screen on the right side of the battery cabinet is power on, and whether there is any fault;
 - Step 6 Close the “AC Switch” inside the cabinet,
 - Step 7 Repeat steps 2~4 to turn on another battery cluster in the cabinet;

--- End

After the battery clusters in the battery cabinet have successfully self-checked, set the EMS unit and send the control command to close the relays in the battery cabinet. Check whether fault occur during the process, if all the relays are closed successfully, that means the power-on operation of the system is completed.

4.4 Power-off Operation

4.4.1 Power-off Steps

- Step 1 Setting the EMS unit, and turn off the relays in the battery cabinet by the control command.
 - Step 2 Turn the switch handle on the High-voltage box to the “OFF” position;
 - Step 3 Turn off the “AC POWER” on the High-voltage box;
 - Step 4 Repeat steps 2~3 to disconnect the DC output and AC input of another cluster in the cabinet;
 - Step 5 Disconnect the “AC Switch” in the cabinet;
- End

4.4.2 Emergency Power-off

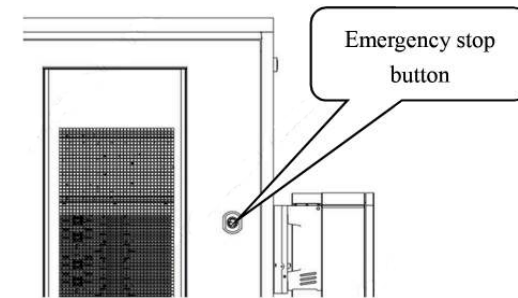


Figure 4-1: Emergency stop button

- Step 1 Press the emergency stop button.
 - Step 2 Turn the switch handle on the High-voltage box to the “OFF” position;
 - Step 3 Turn off the “AC POWER” switch on the High-voltage box;
 - Step 4 Repeat steps 2~3 disconnect the DC output and AC input of another cluster in the cabinet.
 - Step 5 Disconnect the “AC Switch” in the cabinet;
- End

Note: The emergency stop button can only be configured on the master battery cabinet.

4.5 Test Run of Battery Cabinet

The battery cabinet exchanges energy with the outside through the PCS.

The precautions during test run are as follows:

Capacity calibration: to ensure that the battery can finish a complete normal charge and discharge cycle. By default, the rated capacity will be corrected in the first ten times of the initial operation of the system, so deep charging and discharging should be performed during test run and joint debugging. It is recommended to do a capacity calibration during the test run with the charge and discharge depth DOD = 100%, and test according to the rated power of the product. The default process is “empty + stand still (2 h) + fully charge”.

The specific description is as follows:

- Empty: discharged battery to SOC = 0%.
- Stand still: Stand still for more than 2 hours (for SOC correction). When standing still, there must be no charging or discharging current, the aux power supply is allowed to run during the standing still.
- Fully charge: After the standing time is up. charge battery to SOC = 100%.

After the battery is empty, if it is not used for a long time, it should be recharged in time (in 6 months) to > 50% SOC.

Operational stability: All components in the power circuits, communication circuits, and sampling circuits should be validated when run testing if conditions permit. It is used to determine whether there is any abnormality in each link of the system installation, especially in the case of over-temperature, overcurrent, overvoltage, over-discharge and other abnormal conditions, it should be dealt with in time to avoid potential safety hazards.

5. Routine Maintenance

NOTICE

- All maintenance work inside the battery cabinet must use insulated tools and should be performed by personnel who have received relevant training. Components behind protective covers that require tools to be opened are not user-serviceable. If maintenance is required, please consult Master Power for details.
- The battery cabinet must be regularly maintained according to the following requirements, or the normal operation of the battery cabinet will be affected and the normal service life of the battery cabinet will be shortened.

5.1 Monthly Maintenance

The battery system needs to be checked at least once a month to see if the cell voltage is normal and the temperature is normal. Check the historical data to see if there are serious failures.

Table 5-1 Monthly maintenance

Content of check	Baseline requirements	Handling method
Cell voltage	The cell voltage is between 2.55 V ~ 3.60 V	Contact Master Power staff
Cell temperature	The temperature is between -20°C ~ 65°C	Contact Master Power staff
Voltage difference within a single cluster	The voltage difference is less than 500 mV	Contact Master Power staff
During the standing process of the battery system, the cell voltage fluctuation range is small	The voltage jump is less than 10 mV when standing still	Contact Master Power staff
System fault data, is there a cell overvoltage fault	No level-4 fault	Contact Master Power staff
System fault data, is there a cell under-voltage fault	No level-4 fault	Check the cause of the level-3 fault; Feedback level-4 fault;
System fault data, is there an over-temperature fault	No level-4 fault	Check the cause of the level-3 fault; Feedback level-4 fault;
System fault data, is there an under-temperature fault	No level-4 fault	Check the cause of the level-3 fault; Feedback level-4 fault;

System fault data, is there a fault of discharge overcurrent	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
System fault data, is there a fault of charging overcurrent	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
System fault data, is there a low insulation fault	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
System fault data, is there a fault of cluster voltage too high	No level-4 fault	Check the cause of the level-3 fault; Feedback level-4 fault;
System fault data, is there a fault of cluster voltage too low	No level-4 fault	Check the cause of the level-3 fault; Feedback level-4 fault;
System fault data, is there an excessive temperature difference fault	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
System fault data, is there a charging over-temperature fault	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
System fault data, is there a charging under-temperature fault	No level-3 fault	Check the cause of the level-2 fault; Feedback level-3 fault;
Is the fault indicator normal	Fault indicator can be lit	Contact Master Power staff
Is the running indicator normal	Running indicator can always be on	Contact Master Power staff

5.2 Quarterly Maintenance

The battery system needs to be checked at least once a month to see if the cell voltage is normal and the temperature is normal. Check the historical data to see if there are serious failures.

Table 5-2 Quarterly maintenance

Content of check	Baseline requirements	Handling method
Cell voltage	The cell voltage is between 2.55 V ~ 3.60 V	Contact Master Power staff
Cell temperature	The temperature is between -20°C ~ 65°C	Contact Master Power staff
History fault content	Check the cause of level-1/2 fault; Feedback level-3/4 fault;	Contact Master Power staff
Is the fault indicator normal	Fault indicator can be lit	Contact Master Power staff
Is the running indicator normal	Running indicator light can always be on	Contact Master Power staff
Can the system perform a complete charge-discharge cycle	The system can perform a complete charge-discharge cycle	Contact Master Power staff
Cabinet status	The cabinet has no obvious rust, no traces of water ingress, and no abnormal bending	Contact Master Power staff
Cabinet firefighting starter box	The power indicator can be lit	Contact Master Power staff

5.3 Annual Maintenance

Table 5-3 Annual maintenance

Content of check	Baseline requirements	Handling method
Cell voltage	The cell voltage is between 2.55 V ~ 3.60 V	Contact Master Power staff
Cell temperature	The temperature is between -20°C ~65°C	Contact Master Power staff
History fault content	Check the cause of level-1/2 fault; Feedback level-3/4 fault;	Contact Master Power staff
Is the power cable normal	The power cable is normal	Replace the wiring cable
Is the communication cable normal	The communication cable is normal	Replace the wiring cable
Is the fault indicator normal	Fault indicator can be lit	Contact Master Power staff
Is the running indicator normal	Running indicator light can always be on	Contact Master Power staff
Status of fixed power copper bar screw	No rust, no obvious oxidation, no loose	Replace or tighten the screw
Cabinet status	The cabinet has no obvious rust, no traces of water ingress, and no abnormal bending	Contact Master Power staff
Cabinet firefighting starter box	The power indicator can be lit	Contact Master Power staff
Accuracy of battery system current collection	Error < 2%	Contact Master Power staff
Accuracy of battery system cluster voltage collection	Error < 2%	Contact Master Power staff

6. Troubleshooting and Maintenance

For common faults, refer to Table 6-1 for troubleshooting methods. If you encounter other problems during troubleshooting, you can check the alarm list, or contact Master Battery.

Table 6-1 Troubleshooting

Fault Type		Analysis of cause	Handling method
Pre-charge timeout	Product not running	The external load is too large, affecting the pre-charging process	Restart the battery system
Cell overvoltage	Level 1	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 2	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 3	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 4	Abnormal charging, Abnormal communication with PCS	Contact Master Power staff
Cell under-voltage	Level 1	Abnormal discharging Abnormal communication with PCS	Charge or check the communication cable
	Level 2	Abnormal discharging, Abnormal communication with PCS	Charge or check the communication cable
	Level 3	Abnormal discharging, Abnormal communication with PCS	Charge or check the communication cable
	Level 4	Abnormal discharging, Abnormal communication with PCS	Contact Master Power staff
Cluster Voltage difference-fault	Level 3	Abnormal sampling circuit	Contact Master Power staff
Cluster overvoltage	Level 1	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 2	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 3	Abnormal charging, Abnormal communication with PCS	Discharge or check the communication cable
	Level 4	Abnormal charging, Abnormal communication with PCS	Contact Master Power staff

Cluster under-voltage	Level 1	Abnormal discharging, Abnormal communication with PCS	Charge or check the communication cable
	Level 2	Abnormal discharging, Abnormal communication with PCS	Charge or check the communication cable
	Level 3	Abnormal discharging, Abnormal communication with PCS	Charge or check the communication cable
	Level 4	Abnormal discharging, Abnormal communication with PCS	Contact Master Power staff
Cell over-temperature when discharging	Level 1	Abnormal operation of air conditioner or the air temperature is too high	Clean the air conditioner or lower the temperature
	Level 2	Abnormal operation of air conditioner or the air temperature is too high	Clean the air conditioner or lower the temperature
	Level 3	Abnormal operation of air conditioner or the air temperature is too high	Clean the air conditioner or lower the temperature
	Level 4	Ambient temperature too high or battery end of life. A risk of thermal runaway	Contact Master Power staff
Cell over-temperature when charging	Level 1	Abnormal operation of air conditioner or the air temperature is too high.	Clean the air conditioner or lower the temperature
	Level 2	Abnormal operation of air conditioner or the air temperature is too high.	Clean the air conditioner or lower the temperature
	Level 3	Abnormal operation of air conditioner or the air temperature is too high.	Clean the air conditioner or lower the temperature
	Level 4	Ambient temperature too high or battery end of life. A risk of thermal runaway.	Contact Master Power staff

Cell under-temperature when charging	Level 1	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
	Level 2	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
	Level 3	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
Cell under-temperature when discharging	Level 1	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
	Level 2	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
	Level 3	Abnormal operation of air conditioner or the air temperature is too low	Clean the air conditioner, rise the temperature
Cell temperature - difference fault	Level 1	Abnormal cooling channel resistance, abnormal sampling circuit	Clean the air conditioner or contact Master Power staff
Battery cluster charging overcurrent	Level 1	Abnormal charging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting
	Level 2	Abnormal charging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting
	Level 3	Abnormal charging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting

Battery cluster discharging overcurrent	Level 1	Abnormal discharging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting
	Level 2	Abnormal discharging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting
	Level 3	Abnormal discharging, Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable, and PCS setting
Insulation fault	Level 1	Water retention in the cabinet, bad grounding	Check whether the grounding is loose and whether there is water in the cabinet
	Level 2	Water retention in the cabinet, bad grounding	Check whether the grounding is loose and whether there is water in the cabinet
	Level 3	Water retention in the cabinet, bad grounding	Check whether the grounding is loose and whether there is water in the cabinet
PCS communication fault	Level 2	Abnormal communication with PCS	Check whether the communication cable between the PCS and battery cabinet is missing or unstable
Internal communication fault	Level 2	The communication cables in the cabinet is missing or unstable	Check whether the communication cable between the High-voltage box and battery cabinet is missing or unstable
Positive relay fault	Level 4	Relay damaged	Contact Master Power staff
Negative relay fault	Level 4	Relay damaged	Contact Master Power staff
Cell voltage fault	Level 2	Cell sampling circuit abnormal	Check the sampling cables connection of battery module
Cell temperature fault	Level 2	Cell sampling circuit abnormal	Check the sampling cables connection of battery module

AFE IC fault	Level 3	BMU unit damaged	Contact Master Power staff
Cell voltage balance fault	Level 3	BMU unit damaged	Contact Master Power staff
Current sensor fault	Level 3	Current sampling circuit abnormal in High-voltage box	Contact Master Power staff
Battery system fault	Level 3	High-voltage box function failure	Contact Master Power staff
Cluster voltage fault	Level 2	The power cables in the cabinet is missing or unstable	Check whether the communication cable between the High-voltage box and battery cabinet is missing or unstable
B+/B- Terminal over-temperature	Level 1	Abnormal discharging, Abnormal communication with PCS	Stop running and lower the cell temperature
	Level 2	Abnormal discharging, Abnormal communication with PCS	Stop running and lower the cell temperature
	Level 3	Abnormal discharging, Abnormal communication with PCS	Stop running and lower the cell temperature
Ambient temperature fault	Level 1	Temperature sampling failure in High-voltage box	Contact Master Power staff
Ambient Over-temperature	Level 1	Ambient temperature is too high	Change the place of battery cabinet
Ambient under-temperature	Level 1	Ambient temperature is too low	Change the place of battery cabinet
Fire alarm	Level 4	Battery thermal runaway	Contact Master Power staff
Waterproof fault	Level 4	Waterproof failure	Contact Master Power staff
Access control fault	Level 2	The door of cabinet is unlocked	Check the cabinet door and lock it
Cluster voltage-difference fault	Level 2	Connection abnormal between battery module and High-voltage box	Check whether the communication cable between the High-voltage box and battery cabinet is missing or unstable
B+ terminal temperature fault	Level 1	Sampling circuit abnormal in High-voltage box	Contact Master Power staff
B- terminal temperature fault	Level 1	Sampling circuit abnormal in High-voltage box	Contact Master Power staff
SPD fault	Level 3	Abnormal Surge protect device	Contact Master Power staff

Remark:

Blockage of the air conditioner condenser is the main reason for the decline in cooling capacity. In order to make the air conditioner work better, it is recommended to clean the condenser every 6 months.

7. List of Accessories

A single battery cabinet contains the following accessories (placed in the accessories box):

No.	Name	Quantity	Purpose
Accessory 1	Communication cable between battery cabinets	Optional	CAN communication cable for master battery cabinet-slave battery cabinet
Accessory 2	Fire putty	Reserved	Fill the wiring holes for the input and output of the batter cabinet
Accessory 3	Base baffle	Optional	Battery cabinet base baffle
Accessory 4	PCS power cable	2PCS	Power cable connecting the PCS and the battery cabinet
Accessory 5	Parallel power cables	Reserved	Cluster parallel power cable

8. Terms

1. *Cell*
A battery cell
2. *Battery Module*
A combination of multiple cells connected in series, parallel or series-parallel, with only one pair of positive and negative output terminals, used as a power supply.
3. *Battery Cluster*
Multiple battery modules, a high-voltage box and connecting cables form a complete battery cluster, which can independently complete energy transfer and self-protection functions.
4. *Battery Array*
Multiple battery clusters form a battery array, and the energy transfer of the following clusters is managed through the BMS with the three-level architecture.
5. *Battery Management System (BMS)*
An electronic device that controls or manages the electrical or thermal performance of a battery system.
Battery Management Unit (BMU).
Slave Battery Management Unit (SBMU).
Master Battery Management Unit (MBMU).
Energy Management System (EMS).
6. *Battery System*
Energy storage devices, including integration of battery modules or packs, battery management systems, high voltage circuits, low voltage circuits.
7. *Battery Capacity*
The size of the battery storage capacity.
8. *State of Charge (SOC)*
The percentage of the capacity can be released by cell, battery pack or system according to the conditions specified by the manufacturer to the actual capacity, also known as the remaining capacity.
9. *State of Health (SOH)*
The deviation ratio between the actual performance of the battery and the normal design index.