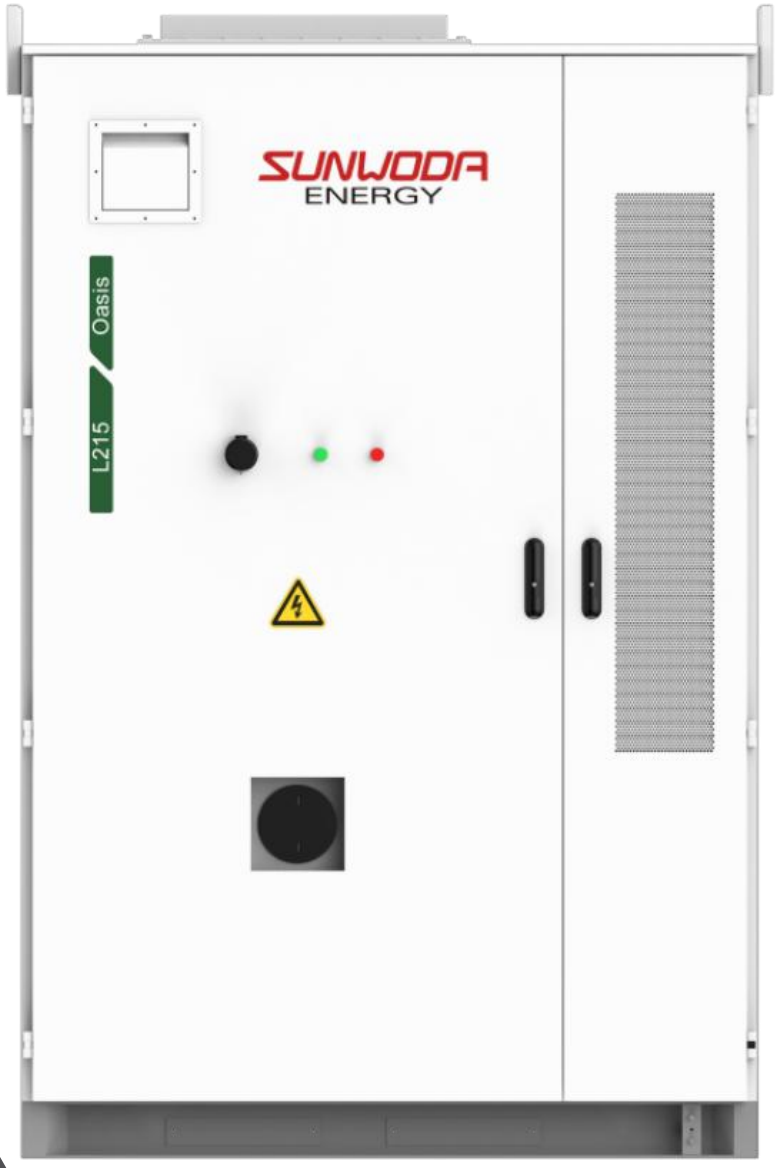
SUNWODA ENERGY



Series: Oasis-L215

Oasis L215

215kWh Battery Cabinet

User Manual

Preface

Dear Customer, Thank you very much for purchasing and getting to know the products designed by Shenzhen Sunwoda Energy Technology Co., Ltd.(hereinafter referred to as Sunwoda). We sincerely hope that the products and manuals can meet your needs. We welcome your valuable comments, and we will continue to improve and enhance.

The copyright of this user manual belongs to Sunwoda, and any rights not expressly granted are not reserved. The content may be changed, please refer to the latest physical object, and forgive our company does not give any notice.

The contents of this document may be updated from time to time due to product version upgrades or other reasons. Unless previously agreed, this document is intended as a product guide only, and all statements, information and recommendations contained in the document do not give rise to any warranty, express or implied.

This document and all information given in the document are the property of Sunwoda only. A party is not allowed to grant a license to another party under this document by implication, estoppel, or otherwise, for patents, copyrights, trademarks, or any other intellectual property rights.

For updates or additional information, please contact Sunwoda.

Content

1. Safety Precautions

1.1 Attention

Oasis L215 battery cabinet is a specialized energy storage device. To ensure your installation and use is correct and safe, be sure to read this manual thoroughly before starting operation.Installers should be professionally trained and have a background in electrical technology, as well as be familiar with local grid codes and related requirements.We will not be liable for any loss or injury of any kind resulting from failure to follow the operating instructions highlighted in this manual.

Centered around the Oasis L215 series, this manual details its product features, installation specifications, usage, troubleshooting, and routine maintenance.Due to product iteration, the content of the manual will be constantly updated, the specific product details also please refer to the actual product you purchased.

1.2 Operational Safety

1. Before using this equipment, please read the "Safety Precautions" carefully to ensure proper and safe use, and please keep the manual properly.

2. When operating, please pay attention to all warning signs and follow the requirements.

1.3 Electric Safety

1. Before powering up, please make sure the power cable of the equipment is correctly connected and the ground wire is connected.

2. When the unit needs to be rewired, turn the unit off, disconnect the power and battery switches, and ensure that the system is completely shut down, otherwise the outputs may still be energized and there is a risk of electric shock.

1.4 Battery Safety

1. The life of the battery is shortened as the ambient temperature rises. Regular maintenance ensures that the equipment works properly and guarantees sufficient backup time.

2. Lithium battery maintenance must be carried out by personnel with specialized knowledge of

batteries.

3. Batteries present an electric shock hazard and a short circuit hazard. To avoid electric shock and injury, observe the following warnings during battery maintenance:

A. Do not wear watches, rings or other metal objects;

B. Use insulated tools;

C. Wear rubber shoes and gloves;

D. Metal tools or similar metal parts cannot be placed on the battery;

E. Before removing the battery connection terminals, the load connected to the battery must be disconnected.

4. Do not expose the battery to fire, so as not to cause an explosion, endangering personal safety.

5. Do not short-circuit the positive and negative terminals of the battery, it will lead to electric shock or fire.

1.5 Symbol Interpretation

Picture	Interpretation
	Read the user manual before use or maintenance!
	High voltage hazard, no contact!
	Take care of your safety, there are potential dangers!
	Warning: Hazardous arcing!
	Pay attention to high temperatures and prohibit contact!

	Watch out for corrosion!
	Sine wave alternating current (AC)!
	Direct Current(DC)!
	Protective grounding!
	Protective gloves are required!
	No fireworks are allowed!
	No trampling is allowed!
	Recyclable!
	When your product reaches the end of its useful life, make sure that it is taken to a WEEE recycling facility in your country. This ensures that the product is disposed of and handled correctly and that no harmful substances are released into the environment.
	When your battery/batteries reach the end of their useful life, make sure that the batteries to be recycled are taken to a battery recycling station in your country.
	Danger! Touching is prohibited! Only professionally authorized personnel may touch the enclosure or enter!

2. Product Introduction

Oasis-L215 liquid-cooled outdoor battery cabinet energy storage system technical solution is based on Sunwoda's mature lithium battery system management experience, adopting long-life lithium iron phosphate batteries with superior performance and technologically advanced equalization management system; Large-capacity power electronic converter technology, massive data monitoring and storage technology, power system optimization and control technology, and other aspects of advantageous technology. It has formed a set of lithium battery energy storage system with leading technology, reliable quality and excellent performance, and adopts balanced battery management and automatic battery maintenance to meet the needs of customers in high-power applications.

2.1 Nameplate Information

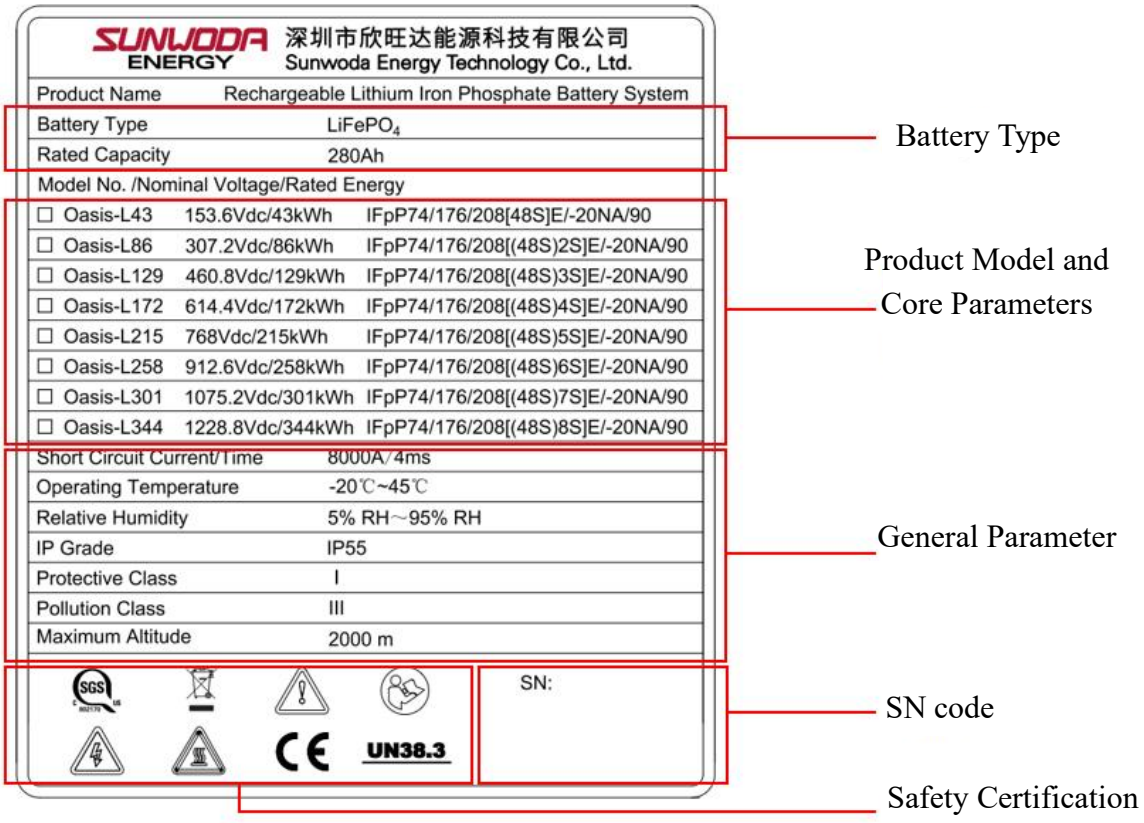


Fig. 2.1

Tip: The above nameplate is for reference only, the actual please refer to the real thing.

2.2 Parameters

Table 2.1 System parameters

Specification Name		Details	Notes
System nominal capacity		215kWh	DC side
Rated charge/discharge power		100kW	
Max discharge power		215kW	
DC Voltage Range		672VDC~864VDC	
Output wiring method		Plug in quickly	
Working environment temperature		-30℃～55℃	-30°C~-20°C; 45°C~55°C; Maximum support 107 kW
Storage ambient temperature		-30℃～60℃	
Operating relative humidity		5～95%	
Storage relative humidity		5～95%	
Altitude		≤2000m	
Protection class		IP55	
Contamination level		III	
Battery cabinet dimensions W *D* H		1570*1350*2380mm	
Battery cabinet weight		2655±100kg	
Battery cabinet port	Power port	1 way	Plug in quickly
	External power take-off port (computing)	2 ways	Electricity for liquid cooler and electricity for monitoring equipment.
	Grounding port	1 way	
	Communication port	1 way	CAN
Transport requirements		Sea/land transport	

2.3 Structural Layout

2.3.1Appearance dimension

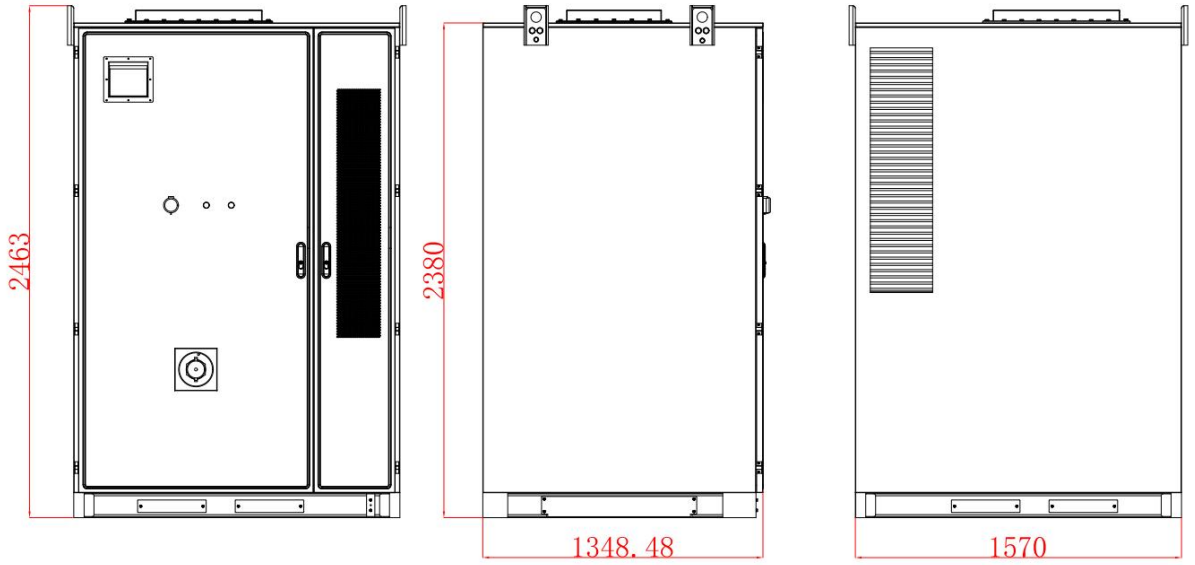


Fig.2.2 Three views

2.3.2 Product structure

The Oasis L215 battery cabinet energy storage system consists of battery box, high voltage control box, switchboard, fire protection system, temperature control system, grounding system and so on：

Designed for easy maintenance, the functional area is divided into two parts, a battery compartment and an equipment compartment.The cabinet is equipped with a water-cooled unit, which is combined with the high-voltage box and switchboard in the equipment compartment; The fire-fighting system is placed in the battery compartment, and there are cable ducts in the battery compartment and the equipment compartment, which are used for power distribution, communication and power cables in and out.

（1）External Layout

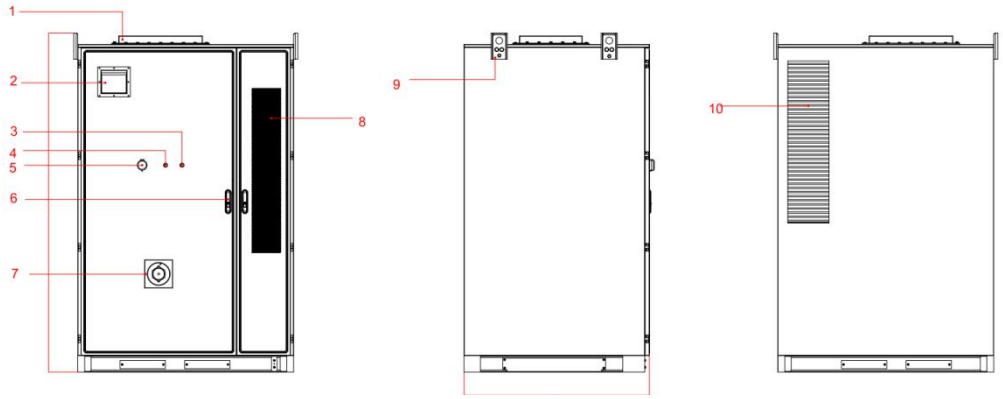


Fig. 2.3 External structure layout

Table2.2 Description of external structures

No.	Structure name	No.	Structure name
1	Explosion plate	6	Door lock
2	Combustible gas exhaust fan	7	Water fire port
3	Emergency stop button	8	Air inlet
4	Running indicator	9	Lifting plate
5	Alarm indicator	10	Air outlet

（2）Internal layout

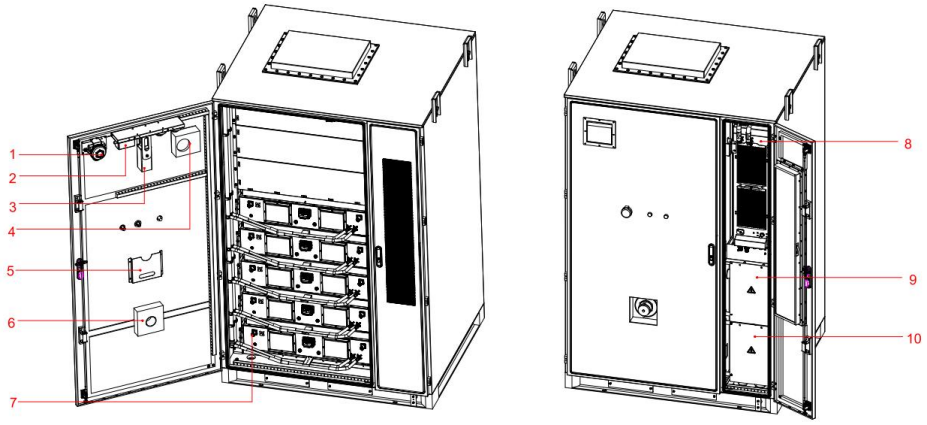


Fig.2.4 Internal structure diagram

Table2.3 Description of internal structure

No.	Structure Name	No.	Structure Name
1	Combustible gas detector	6	Water fire port
2	Fire control controller	7	Battery box
3	Aerosol fire control	8	Liquid cooling unit
4	Combustible gas exhaust fan	9	High voltage control box
5	Folder	10	Electrical Layout Area

2.4 Module Overview

The energy storage battery system consists of an energy storage battery section and a battery management system (BMS).

The energy storage battery part adopts a single 280Ah/3.2V lithium iron phosphate cell, assembled by series-parallel way, 48 strings of single cells form a battery box, 5 battery boxes form 1 battery cluster, and then connect the battery cluster to the customer-side PCS.

The energy storage battery management system (BMS) consists of a battery pack management unit BMN, a battery string management system BCM. The BMS system has the functions of analogue signal high-precision detection and reporting, fault alarm, battery protection, parameter setting, and information interaction with other equipment.

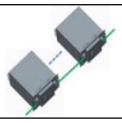
The battery compartment is equipped with an aerosol fire extinguishing device, which can be triggered by the control box to spray and realize the function of extinguishing the battery compartment when the ambient temperature is detected to be >70℃.

2.4.1 Battery module

The lithium iron phosphate battery (LFP) adopted by the battery system is characterized by its high energy density, long cycle life, high charge-discharge rate, safety, and environmental friendliness, and has been widely applied in energy storage fields such as peak shaving and frequency regulation.The battery cells are combined into a battery box by 48 strings in series. Five battery boxes constitute a battery cluster, each battery cluster is controlled by a main control box for power output, and then connect to the PCS side. Through the rational configuration and packaging of the battery cells, effective management and full utilization of the battery cells are achieved.

Table2.4 Battery basic parameters

No.	Item Name	Picture	Rated voltage (V)	Rated capacity (Ah)	Storage power (kWh)	Note
1	Battery cell		3.2	280	0.896	LFP
2	Battery pack		153.6	280	43.008	1P48S

3	Battery Cluster		768	280	215.04	5S1P

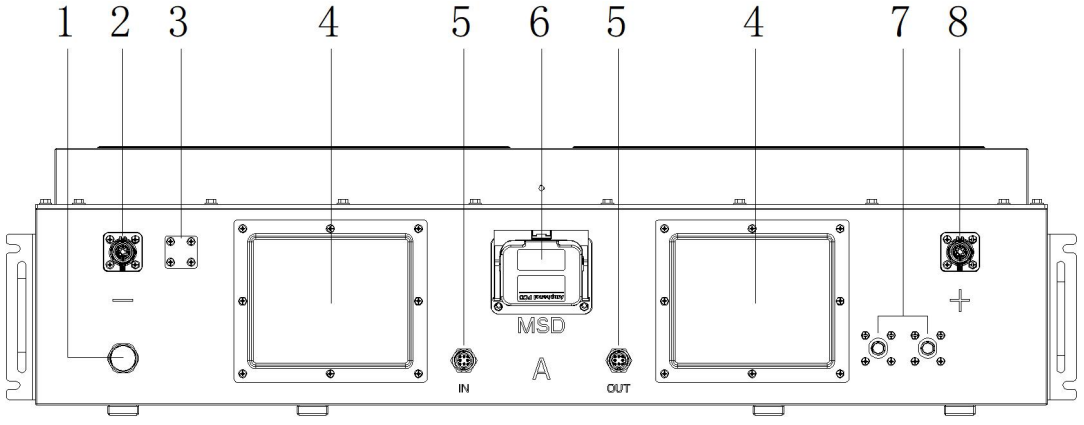
（1）Specification Parameters

Table 2.5 Specification parameters of battery box

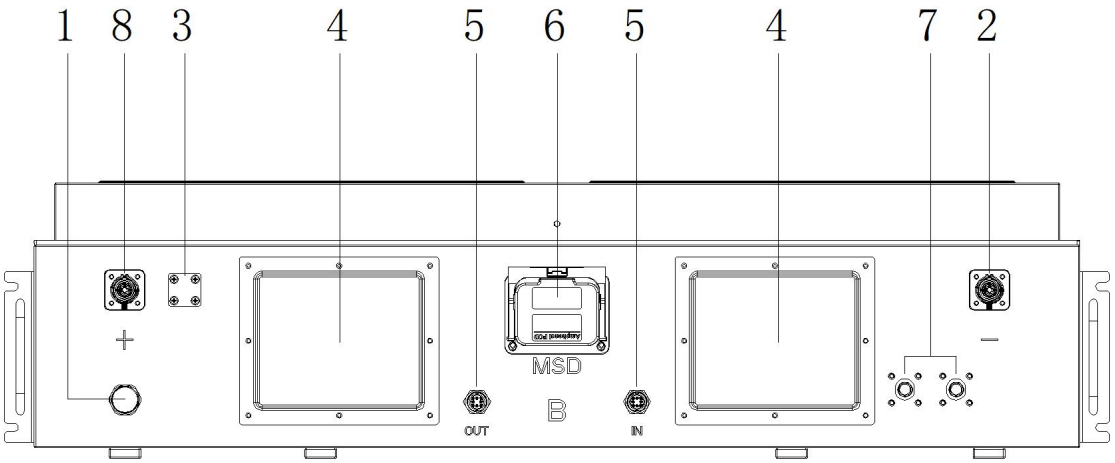
Model	B1F-154/43-CN
Nominal Capacity	280Ah
Nominal Voltage	153.6V
Rated Charge Current	140A
Rated Discharge Current	140A
Maximum Charge Current	280A
Maximum Discharge Current	280A
Voltage Range	134.4~172.8V
Rated Energy	43.008 kWh
Storage Temperature Range（℃）	-30℃~60℃
Working Temperature Range for Charging（℃）	0℃~60℃
Working Temperature Range for Discharging（℃）	-30℃~60℃
Structure dimensions (W*D*H,mm)	980mm*864mm*260mm
Weights	326±5kg

（2）Panel Description

The battery module is divided into two types, A and B, except for the polarity of the positive and negative terminals of the power port, other parameters are the same, the panel schematic is shown below:



Box A panel



Box B panel

Fig.2.5 Battery Pack Panel Diagram

Table 2.6 Description of battery box panel structure

No.	Definition	Instruction
1	Pressure Relief Valve	VE-M582-00-111 Voir
2	Negative Terminal	ES103-01M8-1SYW-07
3	Fire plugs	Fire protection reserved interface inside the module
4	BMU Maintenance Board（L*W*H）	207*172*12mm
5	CAN Communication Connector（IN/OUT）	8 pole airline socket (IN/OUT)
6	Manual Maintenance Switch MSD	GCMSDP000/GCMSDRFS 1500VDC 350A
7	Coolant inlet and outlet	
8	Positive Terminal	ES103-01M8-2SYX-07

Table 2.7 Definitions of battery box communication ports

IN	Pin number	1	2	3	4	5	6	7
	Pin definition	24V-	24V+	IO1	CANL	CANH	Shield Layer	K1
	Pin description	BMU power supply negative port	BMU power supply positive port	BMU code	CAN low port, communicate with the control box	CAN high port, communicate with the control box	Ground after shielding	Repair feedback
OUT	Pin number	1	2	3	4	5	6	7
	Pin	24V-	24V+	IO1	CANL	CANH	Shield	K2

	definition						Layer	
	Pin description	BMU power supply negative port	BMUBMU power supply positive port	BMU code	CAN low port, communicate with the control box	CAN high port, communicate with the control box	Ground after shielding	Repair feedback

（3）Use Instruction

Battery system consists of 5 packs connected in series, 5 packs are connected in series from top to bottom, the total positive and total negative of the battery system are connected to B+ and B- of the high voltage control box; P+ and P- of the high voltage control box are used as the DC high-voltage output interfaces, which connect to the high-voltage DC side of the PCS.

2.4.2 Control box module

（1）Specification parameters:

Table 2.8 Parameters of control box

Rated Voltage	1500Vdc
Max. current	400A
Communication Interface	CAN、RS485
Communication Protocols	CAN/MODBUS
Dimension	600*700*200
Weight	33.2±3kg

（2）Panel Description

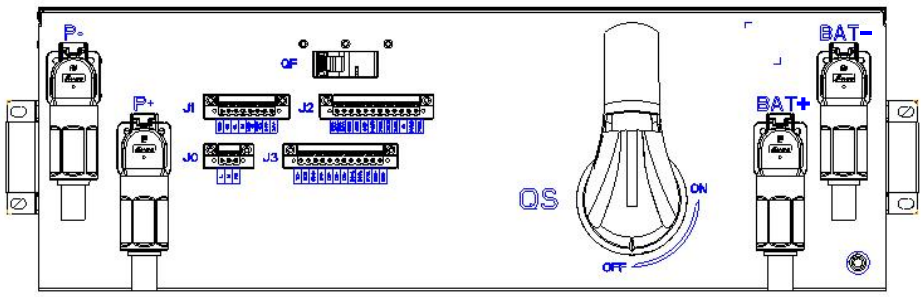


Fig.2.6　Control Box Panel Layout

Table 2.9 Terminal Descriptions of Control Box Panel

No.	Marks	Instructions
1	BAT1-	Connect the negative terminal of the battery

		cluster
2	BAT1+	Connect the positive terminal of the battery cluster
3	P+	Positive output terminal of the battery cluster
4	P-	Negative output terminal of the battery cluster
5	J1	Battery cluster inner-communication
6	J0	AC power supply port for BMS
7	J2	External communication port of battery cluster
8	J3	DODI signal
9	QF	Power supply circuit breaker for control box
10	QS	Battery Cluster Output Circuit Breaker

2.4.3 Power distribution system

The power distribution system consists of air switches, terminals, water immersion detection systems, and other components. The AC power supply of the power distribution system is divided into two circuits.One circuit directly provides power to the water chiller from the utility grid, while the other circuit comes from an external UPS and enters the cabinet to provide auxiliary power to the exhaust fan and high-voltage box. The high-voltage box can provide DC24V power externally to the terminal block located at the cabinet's power distribution panel.

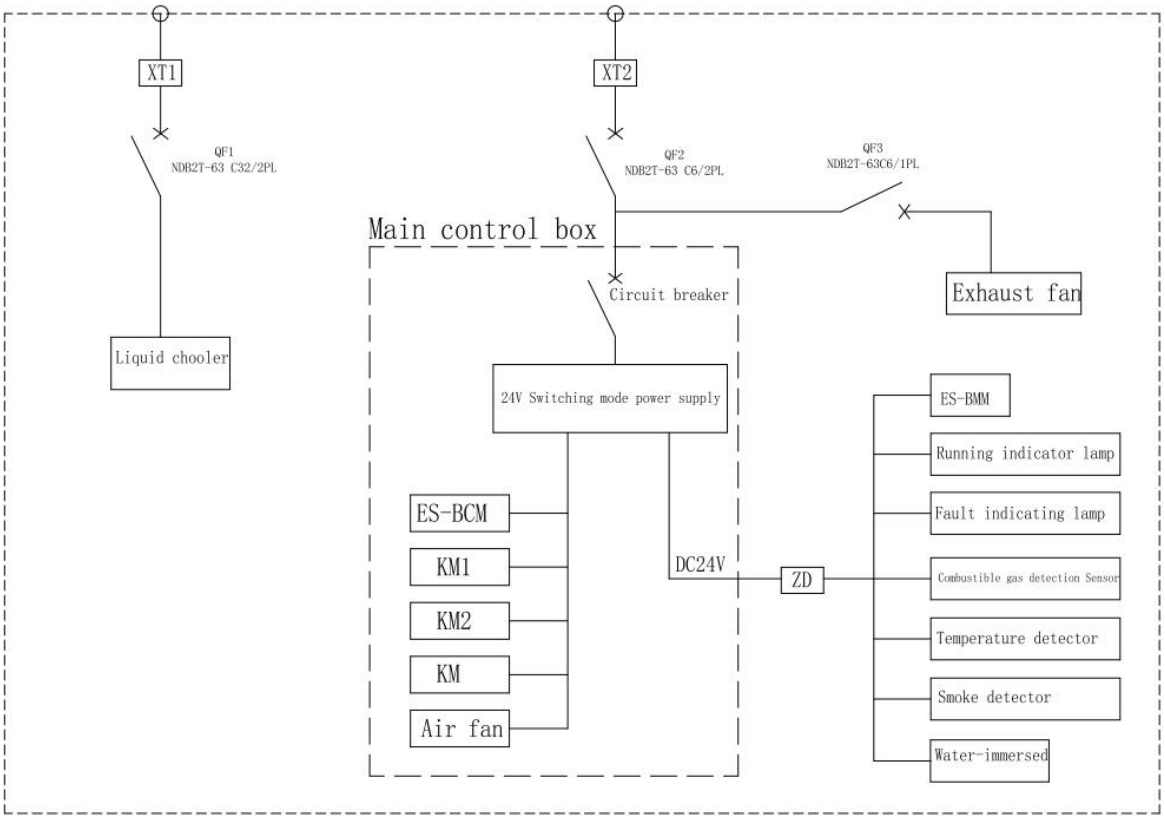


Fig.2.7 Distribution system diagram

2.4.4 Temperature control system

The temperature control system of the battery cabinet consists of liquid cooler, water-cooled pipeline, liquid cooling plate, etc. The BMS turns on the functions of refrigeration and heating according to the temperature of the Battery cell it collects and sets the temperature control mode. The default temperature for cooling on and off is 28℃ and 22℃; the temperature for heating on and off is 10℃ and 15℃.

2.4.5 Fire extinguishing system

The system adopts aerosol as fire extinguishing agent, and the mode is temperature start, when the control box detects the surrounding temperature is higher than 70℃, it will start the aerosol bottle through pulse signal. At the same time, there is a gas detector pre-installed in the cabinet, when the detected combustible gas concentration exceeds the first alarm threshold, it will start the exhaust fan to exhaust; when the detected concentration exceeds the second alarm, or the temperature detector, smoke detector is closed at the same time, or the fire feedback signal, it will shut down the exhaust fan and wait for the aerosol to extinguish the fire.

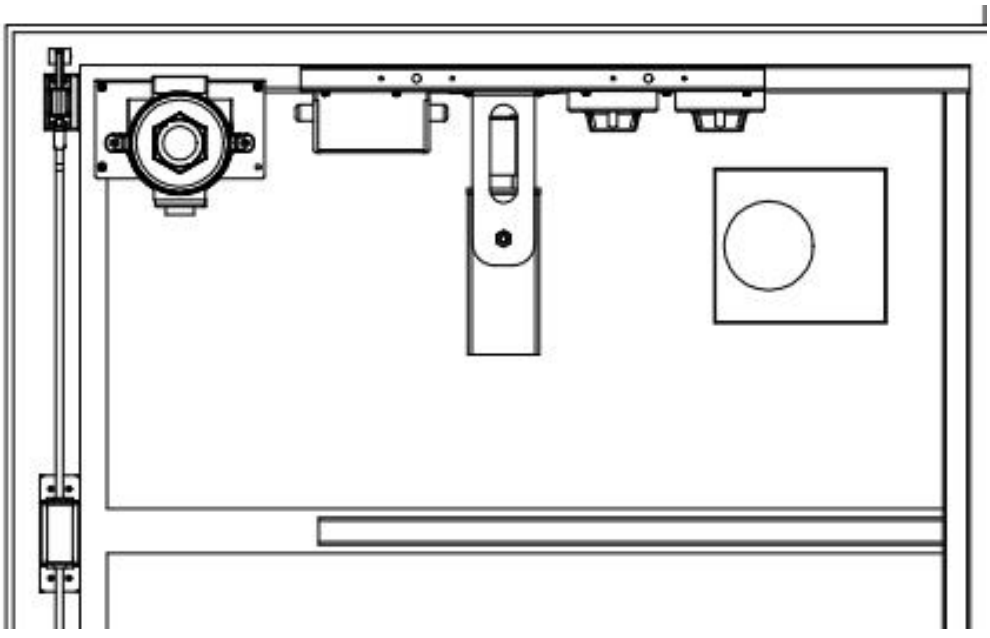


Fig. 2.8 Fire Extinguishing Systems

2.4.6 Grounding system

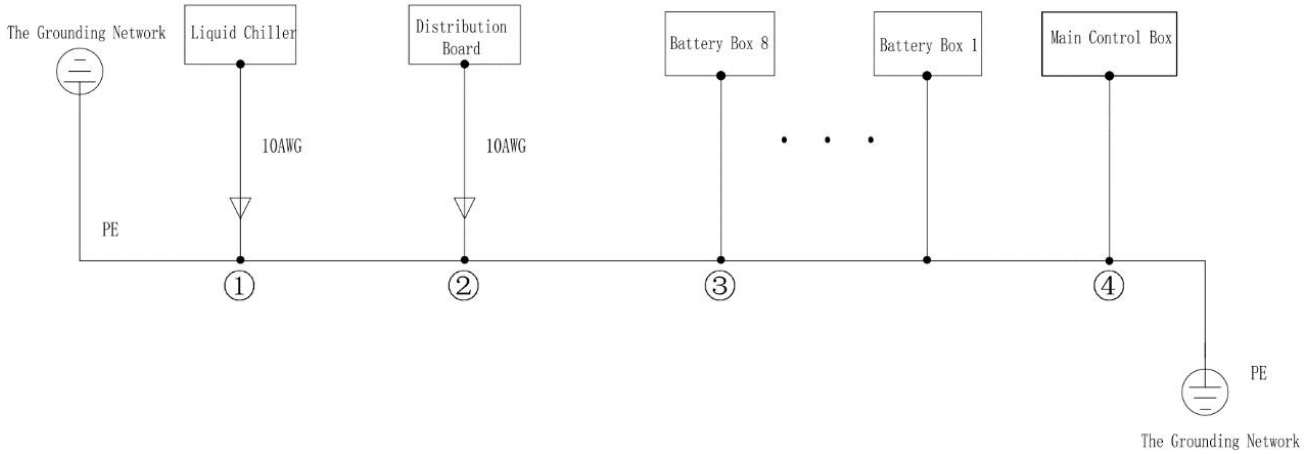


Fig.2.9 Grounding system schematic

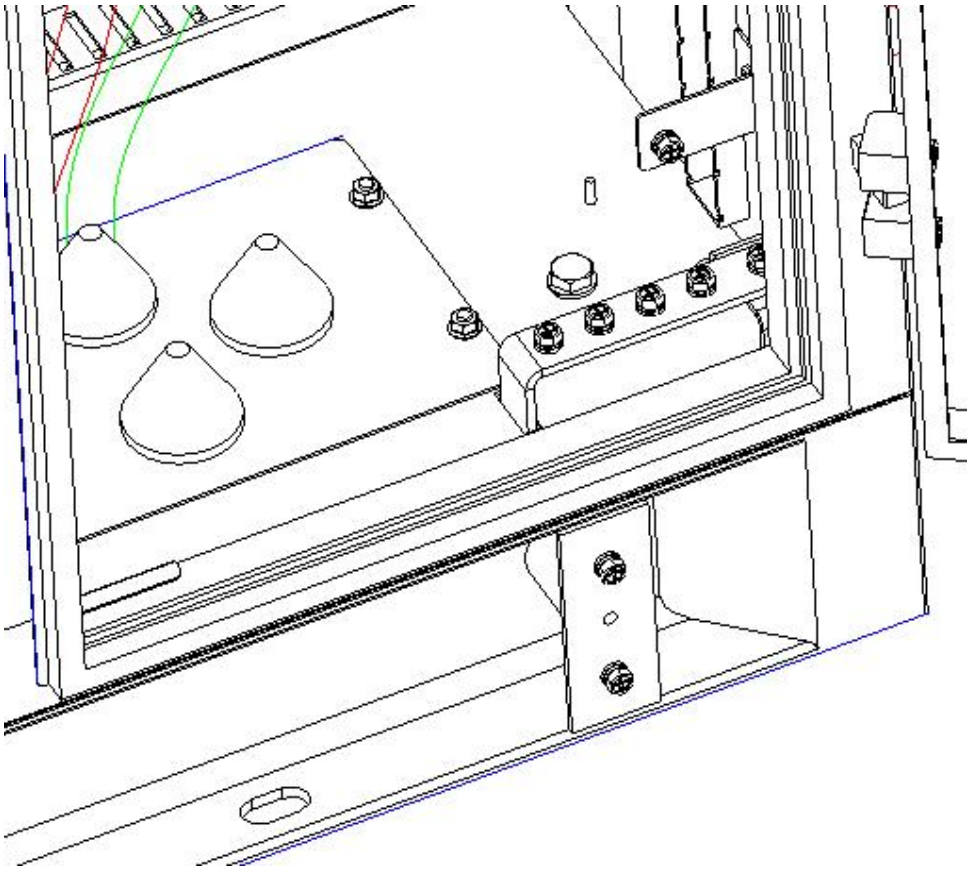


Fig. 2.10 Position of grounding point

3. Installation Instruction

3.1 Storage and transport

3.1.1 Storage

① To avoid condensation inside the battery cabinet, it should be stored in a dry warehouse, or if that is not possible, a heater should be provided to keep the internal temperature higher than the outdoor temperature.

② To keep the interior of the battery cabinet free from rainwater and dust, cover the air intakes and exhaust ports with a cover. Avoid opening the cabinet as much as possible during storage.

③ The ground where the box is placed must be solid, flat, dry, and spacious. It must be able to keep the battery cabinet level and free from distortion or compression. Do not place the battery cabinet randomly on an empty ground, as this can lead to scratches and corrosion.

3.1.2 Transport

① The battery cabinet is a cube that can be transported on a specialized marine container truck using a standard container attachment system.

② If a specialized marine container trailer is not being used, the battery cabinet should be placed on a low-profile transport frame to prevent sliding and keep it as low as possible. Place friction-enhancing pads with a maximum thickness of 3cm under the cabinet, and secure the cabinet to the base frame using durable tie-down straps.

3.1.3 Unpacking and checking

（1）Appearance Integrity

When the battery cabinet arrives at the project site, an integrity check of the system should be performed. Included:

① External check: Check the six sides of the box to see if there is any damage, deformation, breaks, or other abnormalities on the outside, and if so, make a mark on the area to be repaired;

② Internal check: Perform a six-sided inspection of the inside of the box to check for leaks, light leaks, stains, water stains, etc.

③ Installation check at the equipment level: Check for displacement of the fire protection system, monitoring cabinets, battery racks, battery boxes, air conditioning, PCS, and AC switchboard mounting locations.

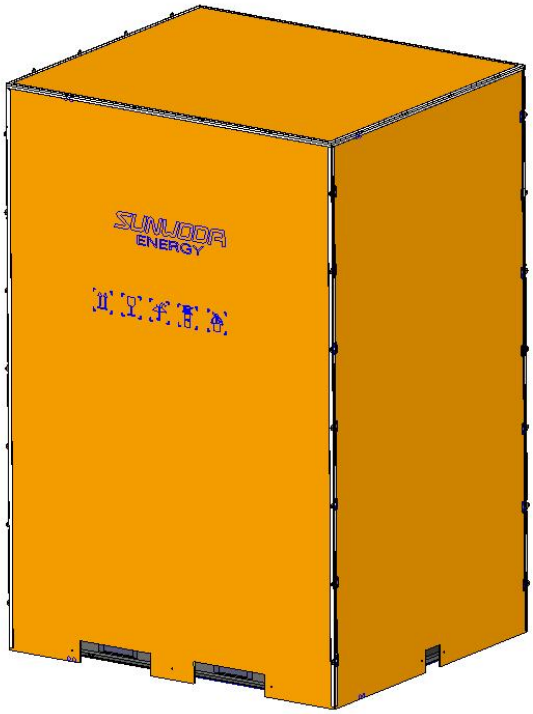


Fig. 3.1 Cabinet Outer Package

Fig. 3.2 Cabinet Appearance

（2）Accessory box check

Table 3.1 Accessories

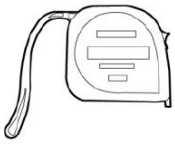
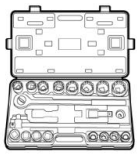
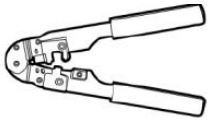
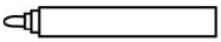
No.	Name	Amount	Note
1	Battery Cluster	1	5 battery boxes in series as 1 cluster, total capacity 215kWh
2	High voltage control box	1	Including disconnect switches, fuses, relays, etc.
3	Liquid cooler	1	Including pipeline
5	Fire fighting system	1	Aerosols, detectors, exhaust fans, explosion relief panel
6	Harness	1	Power cables and Communication Harnesses for Battery Clusters
7	battery cabinet	1	

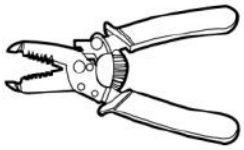
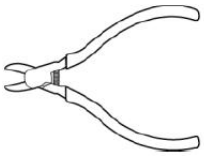
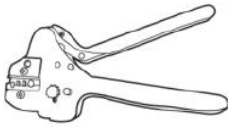
3.2 Mechanical Installation

3.2.1 General requirements

(1) Tools Preparation

Table 3.2 Tools Required for Installation

Lift trolley	Phillips screwdriver	One-piece screwdriver	Insulated adjustable spanner
			
Multimeter	Insulated Protective Shoes	Insulating tape	Insulated gloves
			
Steel Tape Measure	Socket Wrench Set	Crimping pliers for crystal heads	Marker Pen
			

Wire Stripper	Diagonal plier	Tool Knife	crimping plier
			

（2）Environment Requirements

Table 3.3 Installation conditions

No.	Requirements
1	The equipment shall be mounted and fixed at static status, and the mounting surface shall be firm and level.
2	It is recommended that the equipment be installed outdoors on a concrete foundation or a similar pedestal table capable of providing sufficient load-bearing capacity.
3	Make the installation process as smooth as possible without large shock fluctuations.
4	No free fall during installation

3.2.2 Foundation construction

Concrete foundation requirements for the energy storage system: Foundation bearing capacity not less than 5 tons.The design and construction of the foundation of the outdoor energy storage cabinet shall be in accordance with our foundation schematic illustration.

Tips:

When the foundation is constructed, it is necessary to pre-bury the stainless steel connecting plate (also called Q235 steel plate)for welding with the battery cabinet, pre-retain the air duct for chiller supply, and pre-bury the steel ladder. During the construction process, the battery cabinet seating line can be drawn on the upper surface of the foundation, clearly marking the directional signs of the battery compartment and PCS compartment. Details are as follows:

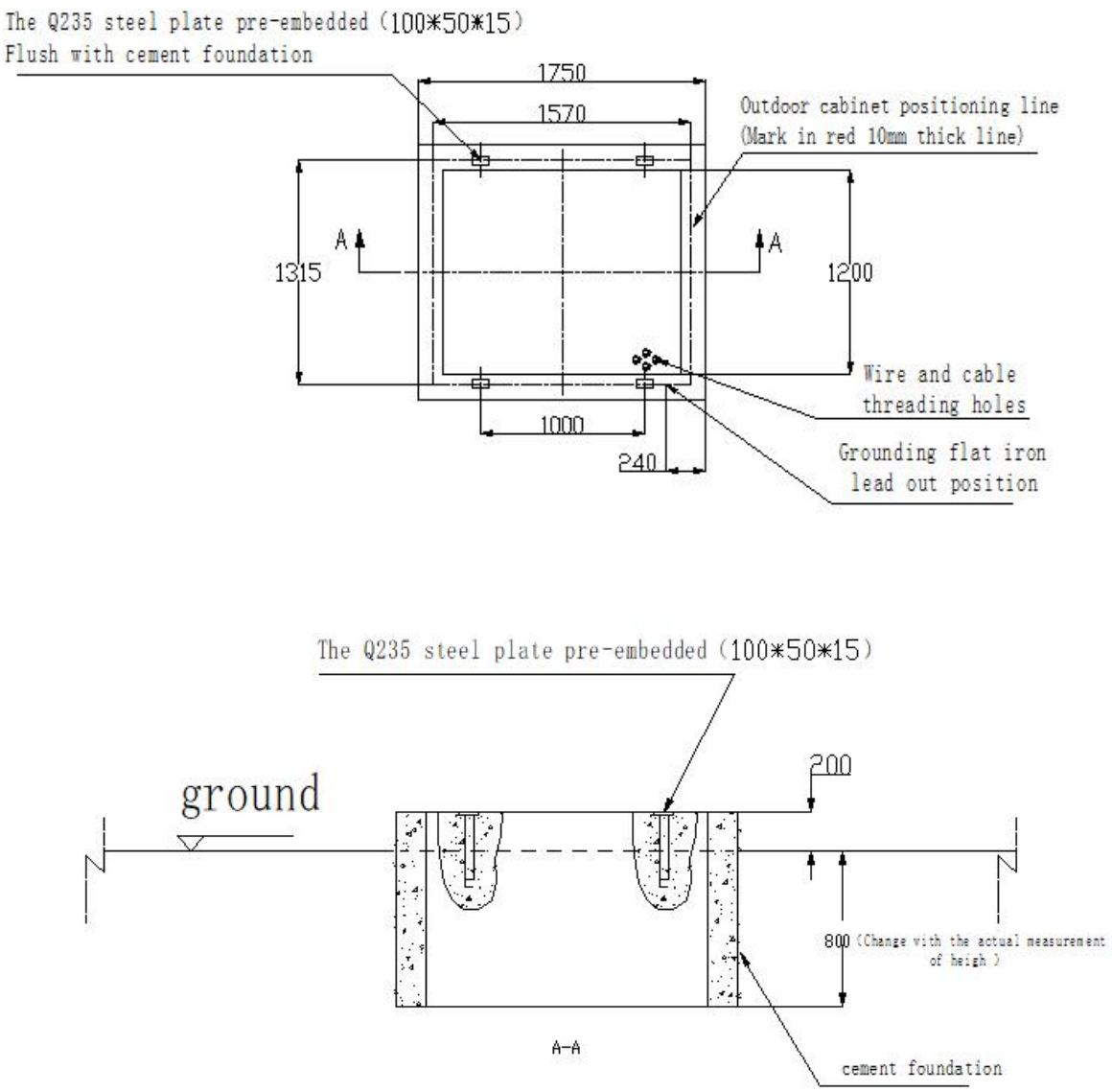


Fig. 3.3 Schematic diagram of foundation construction

3.2.3 Placement of battery cabinet

Align the battery cabinet seating line to drop the battery cabinet, after which the bottom beam of the storage cabinet should be welded to the pre-embedded Q235 steel plate.

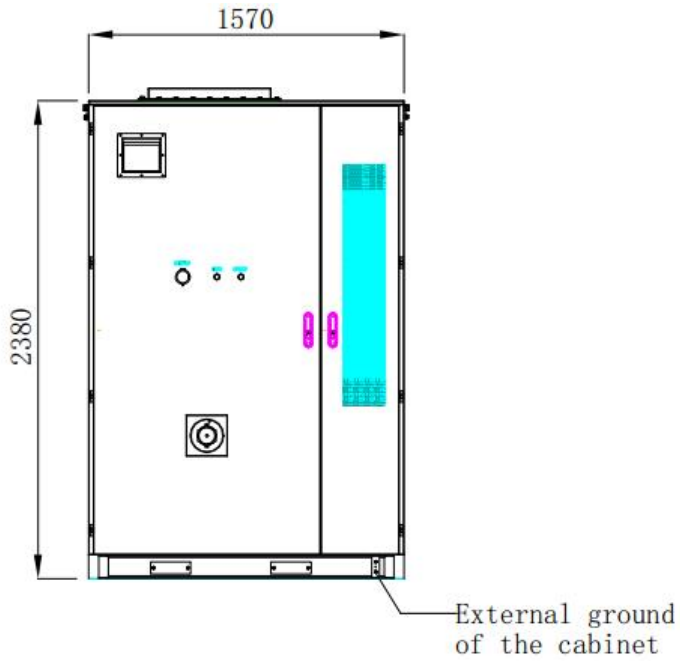


Fig. 3.4 Front View of Battery Cabinet

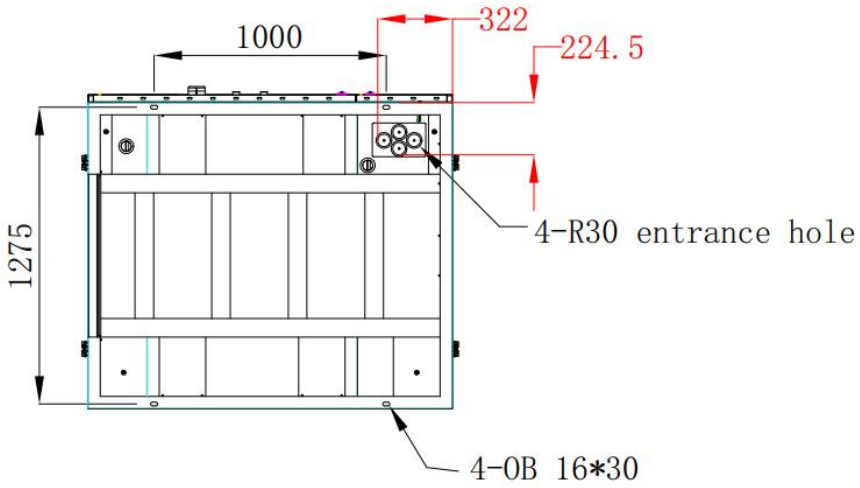


Fig. 3.5 Bottom structure of battery cabinet (bottom view)

3.3 Electric Installation

3.3.1 Installation precautions

In order to ensure the life safety of the installer, the necessary safety precautions must be taken when carrying out the electrical installation of this product. The following procedures must be observed when performing electric installation:

（1）All power sources connected to the battery cabinet must be disconnected to ensure that the battery cabinet is in a non-powered state.

（2）A warning sign must be left at the disconnected location to prevent it from being re-energised during installation.

（3）Necessary grounding and short-circuit connections are required.

（4）Electrically charged parts need to be treated as necessary and isolated with insulating material to avoid injury to personnel.

（5）After the PACK is removed, cover the unused pole with the pole plastic sleeve until it is rewired.

（6）Professionals are required to install and operate the battery cabinets, and the installation process is carried out in strict accordance with the instructions in the user's manual.

（7）The installer must comply with the relevant electrical operating regulations of the country or region in which he is working.

3.3.2 Cable routing requirements

When laying cables, communication lines and power lines should be laid separately, DC and AC circuits should be laid separately, and the distance between different cables should be more than 300mm.

When control cables must be routed through power cables, ensure that the angle between the two cables is kept as straight as possible.

3.3.3 Cable fixing and protection

（1）Cable fixing

In order to prevent the cable and terminal from loosening or contact resistance from becoming large and causing heat or even fire, when tightening the screws of the terminal lugs, the tightening torque should meet the following requirements:

Table 3.4 Torque table（Uint：N.m）

Bolt	Torsion	Bolt	Torsion
M3	0.7~1	M8	18~23
M4	1.8~2.4	M10	34~40
M5	4~4.8	M12	60~70
M6	7~8	M16	119~140

Note: Ensure that the cable is in the proper place to reduce strain on the cable lugs.

（2）Cables protection

The cables have to meet the voltage insulation level and have to be protected from scratches and damage to the cable insulation. This includes protection of power cables and communication cables. The measures are as follows:

① Power cable protection:

To prevent short-circuiting, the cable insulation must not be scratched during installation and connection, and the cable must be properly secured after wiring.

② Communication cable protection:

It is recommended to complete the power circuit wiring first, and then try to take the way to connect the communication cables in the way of the wire groove, without the groove using a tie for fastening, avoiding the heat element and strong electric circuit cable when the line.

（3）Cable selection

Users should follow the specifications in Table 3.5 when configuring cables.

Table 3.5 Cable specifications

Cable wiring location	Maximum voltage and current	Number of screw holes	Hole diameter (mm)	Cable recommendations	Cable terminal selection	Note
Auxiliary distribution box	Voltage: 400VAC Current: 125A	4个	Φ10	35-100mm^2 cable	OT terminal 35-10	Customer choice
Communication line	——		——	Network cable	Crystal head	

Note:

① This table is recommended for insulated copper-core cables. If other types of cables are used, they should be configured with reference to the local wiring regulations, the specific application environment (temperature and physical support media, etc.) and the requirements in IEC62109-1 Table24.

② Terminal selection needs to be matched with the cable. The selection in the table corresponds to the recommended cable, if you do not choose the recommended cable, the user needs

to choose another suitable terminal.

3.3.4 Battery cabinet wiring

The wiring of the battery cabinet is divided into 4 parts, namely DC power cable wiring, AC power cable wiring, communication line wiring, and grounding. For safety reasons, all electrically charged parts of the battery cabinet are covered with protective plates, which cannot be touched by human hands. The protective plate needs to be removed with tools before wiring. After removing the protective plate, the terminals and copper rows are exposed, and the wires should be connected in accordance with the marking and the required specifications.

（1）DC Power Cable Wiring in battery cabinet

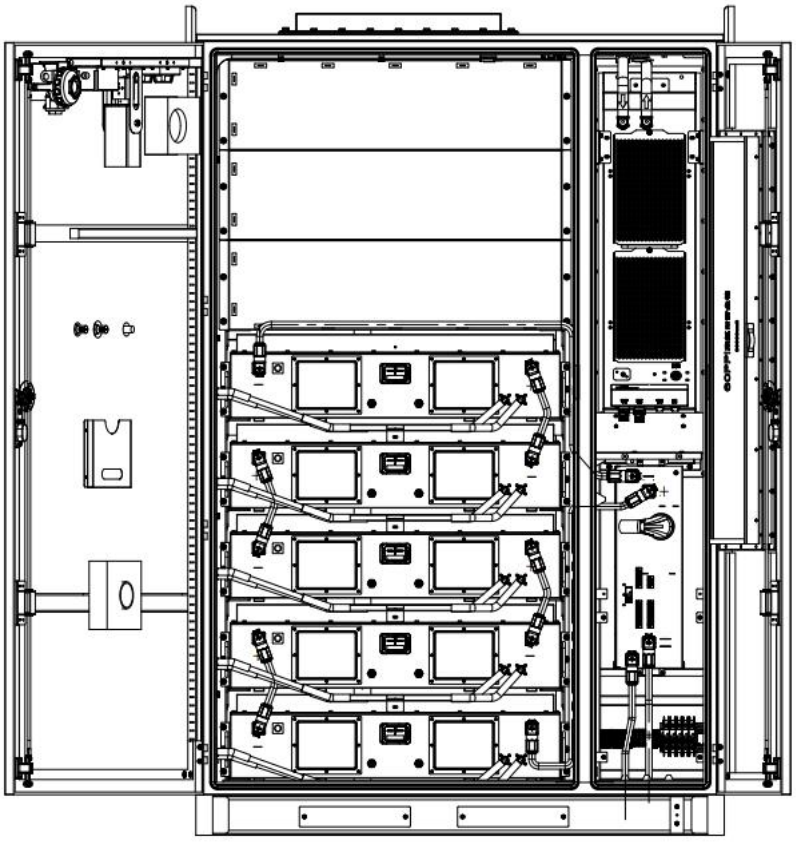


Fig.3.6 Power cable wiring diagram

Step1. Battery box from top to bottom, numbered 1~5, power cable from the main control box negative pole (B-) start connecting to the battery box 1 negative pole, battery box 1 positive pole

start connecting to the battery box 2 negative pole, the battery box 2 positive pole start connecting to the battery box 3 negative pole, and so on, until receiving the negative pole of the battery box 5; after that link the positive pole of the battery box 5 to the positive pole of the main control box (B+) together. During the connection process, only one cable can be connected at a time to prevent accidental short-circuiting during operation;

Step2. On the left side of the main control box panel, use the positive cable to connect the positive terminal of the DC side of PCS and the positive output terminal (P+) of the control box; use the negative cable to connect the negative terminal of the DC side of PCS and the negative output terminal (P-) of the control box;

Step3. After the connection is made, check whether the quick plug of the power cable is tightly locked.

Note：

① All power connectors in the battery cabinet are in quick-plug form, when the plug is inserted into the socket, a clear feedback sound of quick-plug can be heard at the moment of locking, observing the locking key on the side of the quick-plug, the locking key can be seen on the plane bouncing back to the horizontal position.

② Battery connections must be made sequentially from negative to positive, not starting at the positive and negative ends and ending in the middle.

（2）Ground connection

Battery cabinets are equipped with 2AWG grounding wire as standard, and there is a grounding hole under each cabinet, which connects the battery cabinets to the grounding row of the convergence cabinet and then to the grounding system through the grounding wire.

Ground screw: Cross recessed countersunk combination screw GB/T9074.13-M6*16 304 stainless steel. Qty: 2pcs

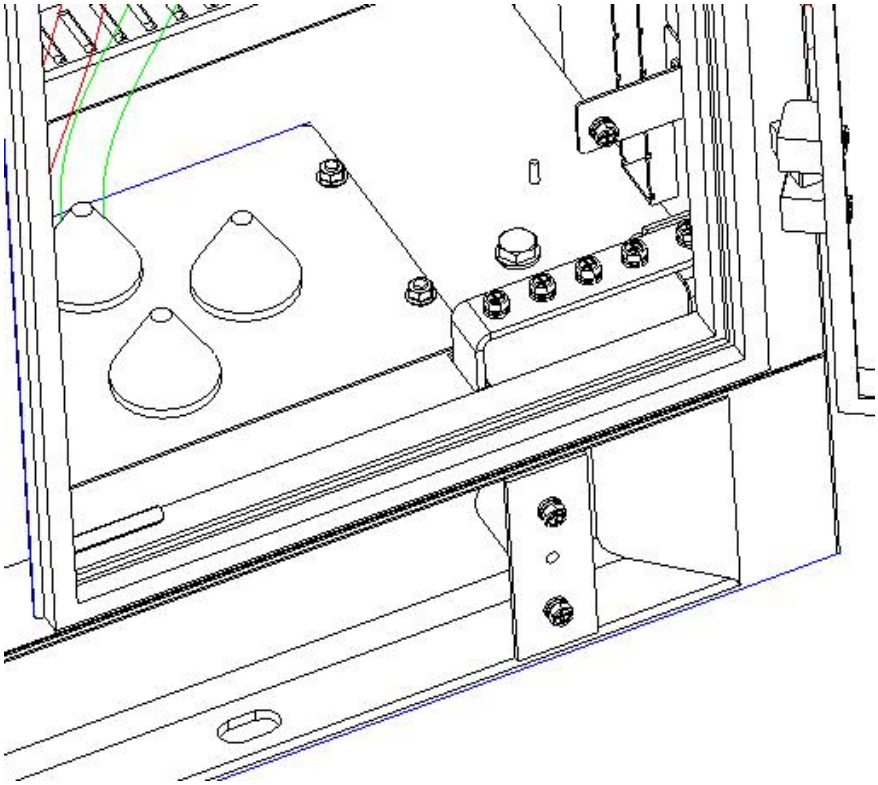


Fig.3.7 External grounding copper

Warning
The grounding cable must be well grounded, otherwise the following hazards apply: ① In the event of a malfunction, there is a risk of fatal electric shock to the operator! ② May result in equipment damage in the event of a lightning strike! ③ It may cause the device to fail to operate properly!

Attention
① Grounding connections must comply with the grounding standards and codes of the country where the project is located. ② Grounding connections to both the equipment and the earth electrode must be tight and reliable. ③ Grounding resistance shall be measured after the grounding is completed, and the resistance value from the grounding row of the battery cabinet to the grounding pole shall not be greater than 0.1Ω. ④ The equipment in the battery cabinet is connected to the main grounding strip in the battery cabinet.

（3）AC distribution cable wiring

AC auxiliary power supply cable wiring channel at the bottom of the battery cabinet, external single-phase AC power into the battery cabinet, connected to the XT1 adapter terminal block, used to supply power to the liquid cooling machine; external single-phase AC power output from the UPS, into the battery cabinet, connected to the XT2 distribution terminal, used to monitor the power supply of the equipment (high-voltage control box, exhaust fan).

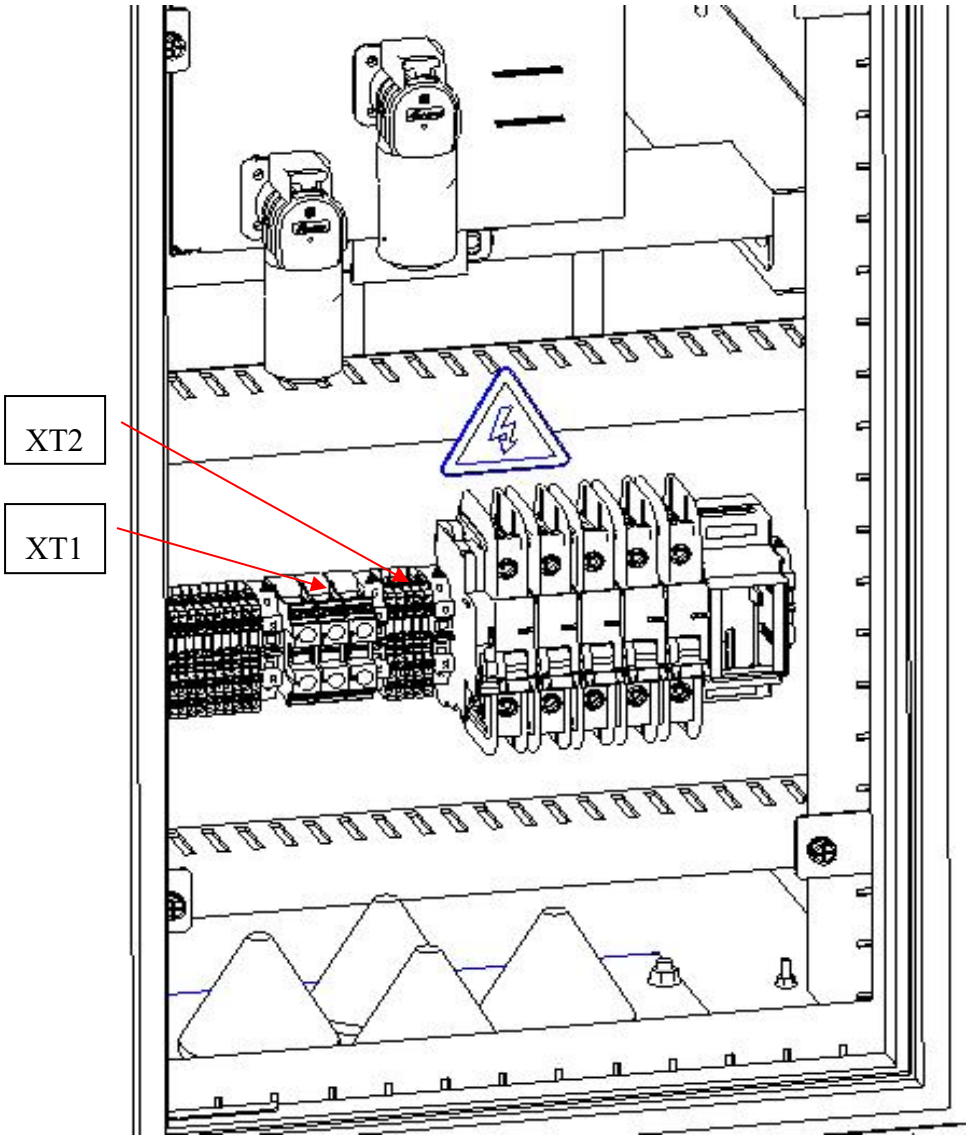


Fig.3.8 Wiring position

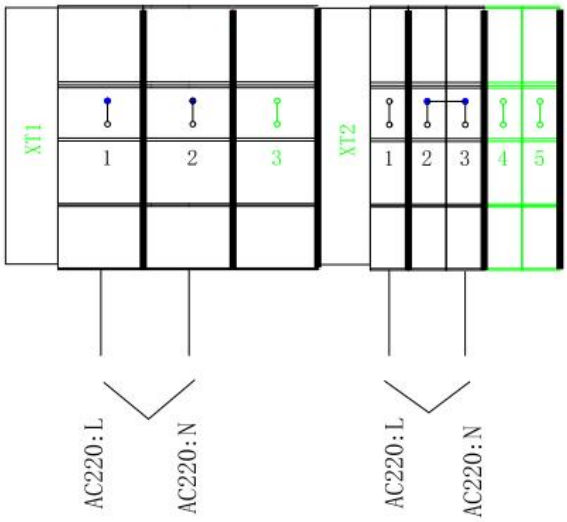


Fig.3.9 Details enlargement

Table 3.6 Terminal block definition

No.	Pin	Definition	Wiring Description
1	XT1:1-2	L	L to external AC220V (inverter cabinet)
2	XT1:2-2	N	N to external AC220V (inverter cabinet)
3	XT2:1-2	L	L to external UPS output (inverter cabinet)
4	XT2:2-2/3-2	N	N to external UPS output (inverter cabinet)

（4）Communication cable wiring

Battery cabinet to the convergence cabinet communication using RVSP shielded twisted-pair cable, battery cabinet signal terminal block is defined as follows：

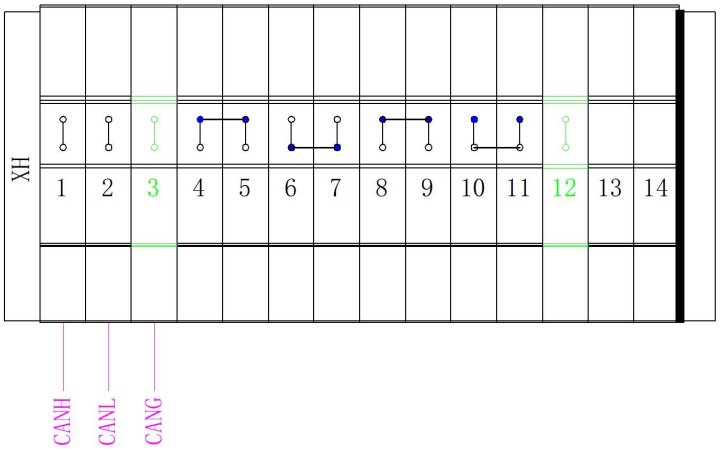


Fig.3.10 External communication terminal block

Table3.7 Terminal block definition

Serial number	Pin	Definition	Wiring Description
1	XH:1-2	CANH	Connects to the CANH of an external EMS
2	XH:2-2	CANL	CANL connected to external EMS (display control)
3	XH:3-2	CANG	Connecting shield of shielded twisted pair cable

3.4 Installation Check

3.4.1 Electric installation check

After the installation is complete, the following must be reconfirmed and measured in order to avoid damage to the equipment and loss of property:

① Disconnect all circuit breakers in the switchboard before measuring.

② Confirm that the positive and negative connections of the DC side battery array are correct and have been tightened. Measure the resistance of the DC positive and negative terminals, normally it should be megohm resistance, if it is K or less need to check the connecting wire.

③ Verify that the grounding and communication wires are tightened.

④ Verify that the earth wire resistance is less than 0.1 ohm.

⑤ Have all protective baffles removed prior to electrical connection been reinstalled.

⚠ Warnings
① The removed lower baffle needs to be reinstalled, this baffle blocks foreign objects from entering the equipment, if not installed there is a danger of foreign objects entering. ② It is strictly forbidden to switch on the machine without installing protective baffles.

3.4.2 Mechanical installation check

（1）The equipment is well installed and free of breakage, rust and paint loss.

（2）Equipment labels are clearly visible and not damaged.

（3）The equipment is firmly and stably installed, and the surrounding space meets the

requirements.

（4）The periphery of the equipment is clean and tidy, and there is no construction residue inside the battery cabinet.

（5）The protective cover and baffle plate removed during wiring have been reinstalled without leakage.

（6）After all electrical wiring is completed, the wiring should be thoroughly and carefully inspected to confirm that there are no errors, adjust the cables to the appropriate position, install the baffle, and fix the cables to the cable tie bridge with cable ties, and seal the gap part of the cabinet inlet holes with fireproof mud to prevent small living organisms from entering the machine.

4. Operation

4.1 Preparation for Start-up

To ensure the safety of the battery cabinet, the following items must be checked before the first power-up or the first power-up after maintenance:

Table 4.1 Inspection items

Sequences	Inspection items	Completion
1	Permitted installation and runtime environments.	
2	Battery cabinets correctly fixed to the foundation.	
3	Proper grounding of battery cabinets.	
4	Each equipment grounding copper, DC positive and negative copper, AC side copper, external power supply copper correctly connected, tightened and safe.	
5	Cable gutter supports are well installed and cable routing meets requirements.	
6	Cabinet is free of tools, external objects and drilling debris left inside the cabinet.	
7	Correct positive and negative polarity.	
8	AC phase sequence is connected correctly.	
9	Check that the cables are not torn or scratched and that the filters in the vents are intact.	
10	The circuit breakers on the AC and DC sides have been disconnected, and the external auxiliary power supply switches have been disconnected, i.e. they are all in the "OFF" position.	
11	The internal baffles have all been installed.	
12	All equipment covers are in place.	
13	All auxiliary safety devices have been installed (fire protection, temperature control system) and are functioning properly. All alarm	

	devices have been installed.	

4.2 System Operation Instruction

4.2.1 Operating instruction for the HVDC section

Before operation and maintenance/connection of power lines, it is necessary to check the status of the disconnecting switch and make sure that the disconnecting switch of the high-voltage box is in the "OFF" state. After all cables are connected reliably and the power lines outside the cabinet are connected, when it is necessary to power up and run, first rotate the isolating switch of the high-voltage box from the "OFF" to the "ON" position, and close the manual breakpoint on the DC side, as shown as following figure.

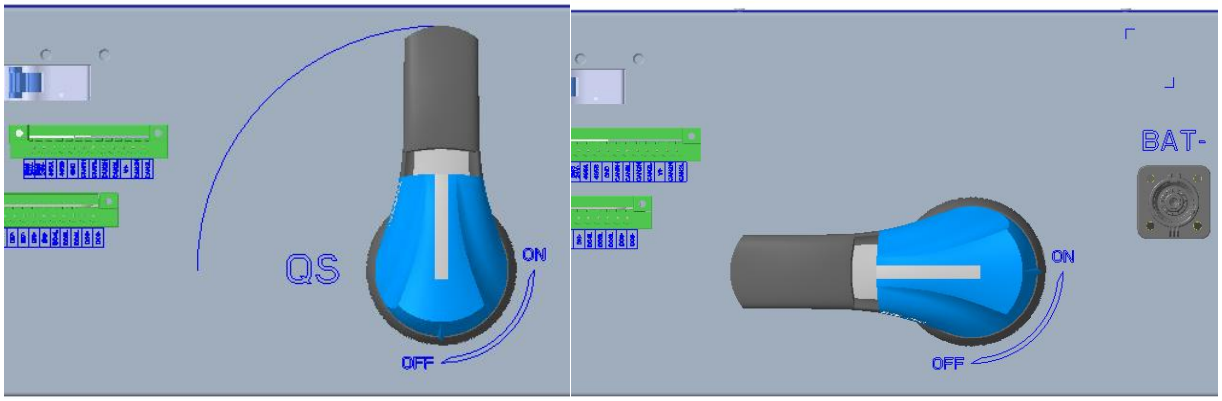


Fig.4.1

4.2.2 Operating instructions for the power distribution section

The layout of the switchboard is as shown in the figure below, with DC distribution terminals, signal transfer terminals, AC transfer terminals for the liquid cooler, and AC distribution terminals for power supply to BMS and other monitoring equipment.

QF1, as shown below, is the switch used to supply power to the liquid cooler, QF2 is the master switch used to supply power to the monitoring equipment, and QF3 is the switch used to supply power to the exhaust fan.

When powering up the system, close QF1 to supply power to the liquid cooler; after closing QF2, then close the air switch on the high-voltage box, then the BMS in the battery cabinet will start and self-check, when the self-check is correct, it will close the main relay in the high-voltage box, and the high-voltage powering up is ready; if QF3 is closed, then the exhaust fan will be ready, and it

can be started and stopped according to the status of the dry contact of the BMS. When the battery cabinet is ready for power-up, the operation indicator of the cabinet door will be lit.

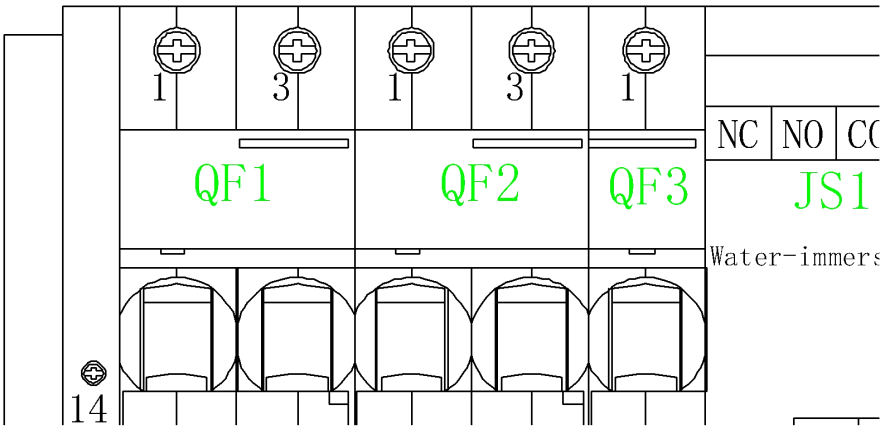
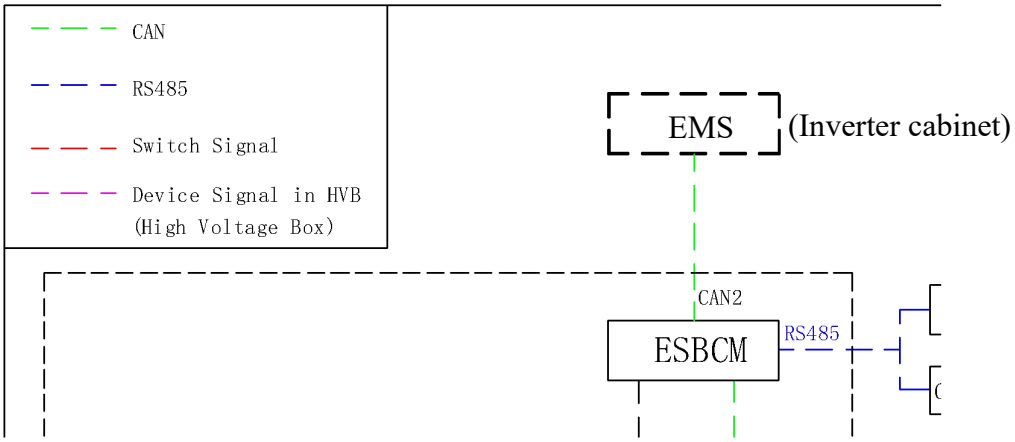


Fig. 4.2 The switchboard distribution section

4.2.3 Description of the fire protection system

The battery cabinet adopts aerosol as the fire extinguishing agent, and a separate fire control box detects the temperature inside the cabinet and starts the aerosol bottle to spray aerosol to extinguish the fire when the starting condition is reached.

4.2.4 Local monitoring operation description



10

Fig.4.3

Table 4.2 List of major communication equipment

Equipment Name	Specification Description	Unit	Quantity
Liquid cooling unit	EMW90HDNC1A	pcs	1
Combustible gas detector	Xgard-Bright-GZ-H-02	pcs	1
ESBMM	ESBMM-2412-F	pcs	10

The ESBCM can collect information on access control, flooding, fire, and switch status through the DI interface, collect information from the ESBMM through CAN communication, and communicate with the EMS in the external Inverter Cabinet through CAN communication. ESBCM will also realize data interaction with the liquid cooler and the combustible gas detection sensor via RS485, and control the operation mode of the liquid cooler according to the battery information collected by the ESBMM.

4.3 Power-up Procedure

（1）Confirm that the wiring on the side of the external inverter cabinet is correct and that the battery cabinet has the conditions for powering up.

（2）Close the disconnect switch of the control box to turn it from OFF to ON.

（3）Close the control power micro-break QF on the main control box, and the switch changes from OFF state to ON state.

（4）Close the 3 micro-terminals QF1, QF2 and QF3 in the switchboard position so that the switches all change from OFF to ON.

（5）Check the status indicator on the door of the battery cabinet. After the system is powered up and self-tested correctly, the operation indicator will be lit automatically and the battery cabinet will enter the ready state.

Note: The fire protection system and the liquid cooling system are not allowed to be disconnected during the operation status. If a problem occurs at a step during operation, stop immediately and check the status of each device.

4.4 Shutdown Procedure

(1) Normal shutdown steps

① Stop the charging and discharging of the battery cabinet by external equipment to ensure that the battery cabinet is in a static state.

② Disconnect the micro-terminals QF1~QF3 at the distribution panel in turn.

③ Disconnect the micro break QF of the main control box control power supply.

④ Disconnect the load disconnect switch of the main control box.

（2）Emergency Shutdown Procedures

In the event of an emergency, press the emergency stop button on the door of the battery cabinet, and the primary circuit inside the battery cabinet will immediately cut off and stop the charging and discharging circuit.

Note: This fault needs to be cleared manually on the EMS touch screen before the system can start again.

5. Maintenance

5.1 General Description

Due to the influence of ambient temperature, humidity, dust, and vibration, the components inside the optical storage unit will age and wear, which leads to potential faults inside the optical storage unit. Therefore, it is necessary to implement daily and regular maintenance of the optical storage unit to ensure its normal operation and service life.

All contribute to good performance of light store all-in-one measures and methods, all belong to the category of maintenance work.

5.2 Maintenance Precautions

To ensure safety, operators must comply with the following safety requirements during maintaining or troubleshooting the energy storage system:

① Only qualified professionals are allowed to maintenance the equipment. Please wear protective equipment before perform work (protective mask, gloves, boots, arc protective clothing, etc.).

② Disconnect all external connections and internal power supply connections of equipment.

③ Ensure that the equipment cannot powered on again accidentally.

④ Use a multimeter to ensure that the equipment is free of power.

⑤ Perform necessary ground and short circuit connections.

⑥ Cover the parts that may be live near the operating part with an insulating fabric.

5.3 Maintenance Work and Period

5.3.1 General system maintenance

Table 5.1 Battery system maintenance schedule

Item	Checklist	Maintenance period
Clean up	Clean the equipment shell to ensure that there is no pest, no garbage, etc.	Monthly inspection
Safety isolation device	Ensure that the device operates within the rated range.	Annual inspection
Cable	Ensure no cable damage	Monthly inspection

Warning sign, nameplate	Ensure that the warning label and nameplate are clear and undamaged	Monthly inspection
Air vent	Visually check that all ventilation holes are clear.	Monthly inspection
Battery state of health	Ensure that the battery system SOH is normal through EMS inspection	Monthly inspection
Working status	Review the system log, the system work without exception	Monthly inspection
System voltage	The DC side voltage of the system is in the normal range	Monthly inspection
System terminal	No corrosion, no obvious discoloration, no loose	Monthly inspection
Appearance, temperature	Check the battery system using the EMS. The module has no deformation and no obvious overtemperature。	Monthly inspection
Ground connection	Use the multimeter test battery module bare metal to ground protection contacts are in good condition.	Semiannual inspection

5.3.2 Battery maintenance

Note: During battery disassembly, Ensure that all the auxiliary power switches and power switches are disconnected.

The steps for removing the battery are as follows:

Tools: lifting trailer (bearing more than 400kg, lifting height 2.5m), ϕ 6 sleeve, Phillips screw driver.

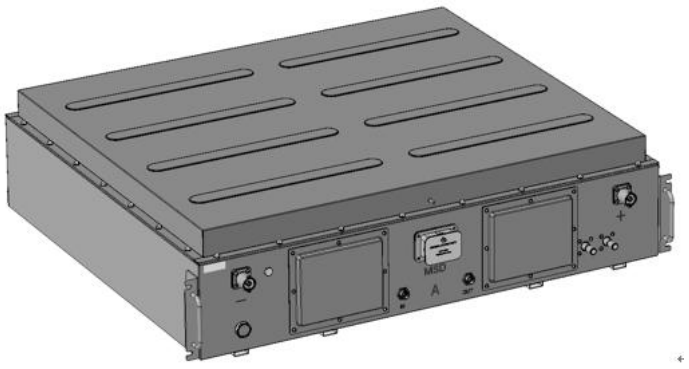


Fig.5.1 Appearance of battery module

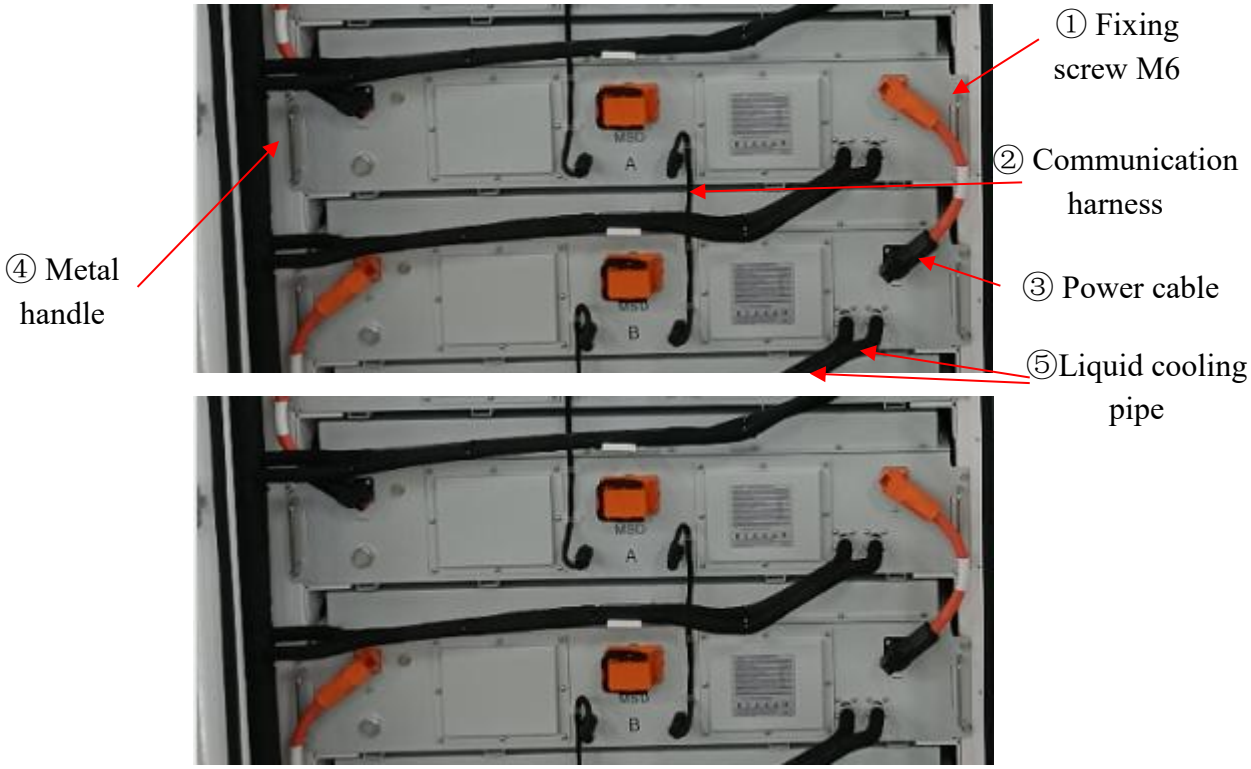


Fig.5.2 Battery module power and communication connection

（1）After power off, drain the antifreeze in the liquid cooling pipe

（2）Remove the the liquid cooling pipes⑤ of the target replacement battery module

（3）Remove the communication harness② of battery module

（4）Remove the power cable③ of battery module

（5）Use ϕ6 sleeves to remove the four fixing screw M6 from the battery module

（6）Pull out the battery module (326kg). Pull both ends of the battery box ④ metal handle and bottom, lift the battery box out to the trailer, and transport to the warehouse for safekeeping.

The steps for installing the battery are as follows:

（1）Transport the new battery by trailer to the replacement battery attachment

（2）Multiple people carry battery metal handle④, lift the battery and push into the battery rack.

（3）Adjust the ϕ6 socket torquee to 5N•m, and fasten the four fixing screw M6①

（4）Connect the power cable③ according to Fig. 5.2.

（5）Clean up the scene, organize the tools

The recommended routine maintenance period and work content are shown in Table 5.2:

Table 5.2 Battery module maintenance

Item	Checklist	Maintenance period
Fan	Observe the temperature sampling of the battery module through the monitoring system.	Monthly inspection
Cleaning module	No foreign objects in the module	Monthly inspection
Appearance	Module no deformation, no leakage	Monthly inspection
Connection of cells or modules	Use the EMS to check whether the internal voltage and insulation of the module are abnormal	Monthly inspection
Ground connection	Use the multimeter test battery module bare metal to ground protection contacts are in good condition.	Annual inspection

5.3.3 Control module maintenance

Note：Main-control module disassembly, Ensure that all the auxiliary power switches and power switches are disconnected.

The steps for removing the Main-control module are as follows:

Tools: lifting trailer (bearing more than 50kg, lifting height 2.5m), ϕ 8 sleeve, Phillips screwdriver.

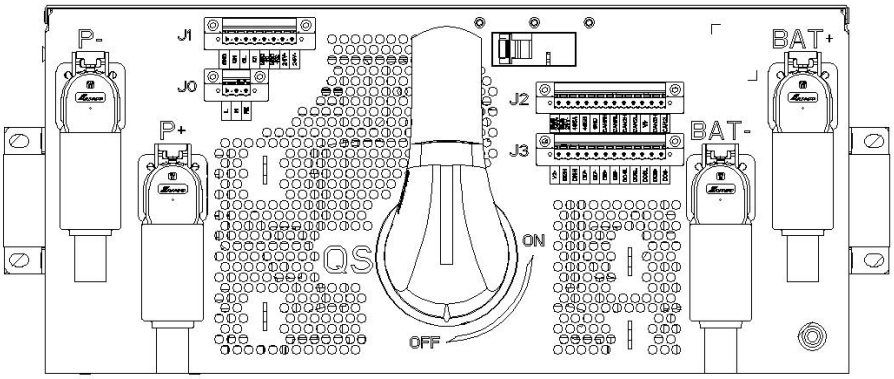


Fig.5.3

Table 5.3 Control Box Terminal Definitions

P-/P+	DC confluence port	BAT+/BAT-	Battery connection port
J1	Internal communication port	J2	External communication port
J0	Power supply port of the control module	J3	Dynamic loop monitoring port

（1）Remove the main-control module communication harness J1、J0、J2 and J3

（2）Remove the power cable (P-/P+) of main-control module to electrical cabinet

（3）Remove the power cable (BAT+/BAT-) of main-control module to battery module

（4）Use a Phillips screwdriver to remove the four M6 screws from the main-control module

（5）Push the lift trailer under the equipment attachment. Pull out the main-control module and lift on the trailer, transport to the warehouse for safekeeping.

The steps for installing the main-control module are as follows:

（1）Transport the new main-control module by trailer to the replacement

（2）Raise the lift trailer to the appropriate position and push the main control box to the battery rack；

（3）Use a Phillips screwdriver to fasten the four M6 screws of the main-control module

（4）Connect the power cable (BAT+/BAT-) of main-control module to battery module

（5）Connect the power cable (P-/P+-) of main-control module to electrical cabinet

（6）Connect the main-control module communication harness J1、J0、J2 and J3

（7）Clean up the scene, organize the tools

The recommended routine maintenance period and work content are shown in Table 5.4:

Table 5.4 Control module maintenance

Item	Checklist	Maintenance period
Appearance	Surface without rust, deformation, dirt, arc and other traces.	Monthly inspection
Communication	Check the parameters of the main-control module through the monitoring system.	Daily inspection
Ground connection	Use the multimeter test battery module bare metal to ground protection contacts are in good condition.	Annual inspection

5.3.4 Liquid-cooled equipment maintenance

（1）Unit repair and maintenance：

Maintenance can be divided into two categories: general maintenance and preventive maintenance. General maintenance consists of routine inspections, which can be carried out by the user's general staff, but preventive maintenance must be carried out by professionally competent maintenance personnel who are familiar with air-conditioning units, cooling and cutting systems, electrical and electronic equipment.

（2）Pump compressor maintenance

Pump and compressor as an important part of the refrigeration circulation system, daily maintenance is very important. The heat of the pump partly relies on cold water circulation for heat exchange, and partly uses the motor tail fan for heat dissipation. Regularly check whether there is dust accumulation on the surface of the pump motor and compressor and remove the dust with a clean rag or a blower.

（3）Condenser cleaning

The dust in the outdoor ambient will be adsorbed on the surface of condenser, affecting the heat dissipation and causing the refrigeration system to not work normally, even high pressure alarm. Especially in the summer when the outdoor temperature is high, the cleaning of the condenser should be often carried out. During cleaning, it should not be damaged to the condenser fins, and the direction of water flushing should be reversed from the air flow.

（4）Calibration of high and low voltage protection value device

In refrigeration system, high and low pressure protection is an essential device. Usually, the high pressure setting value is about 40Bar, and the low pressure protection value is about 6Bar. When the system pressure exceeds the standard, the protector starts to work to avoid damage to the compressor, because the device has a certain error for the control instrument. Therefore, it is required to be calibrated once a year. This is to use the double pressure gauge this high precision test instrument to calibrate. During the test, the high and low pressure are usually artificially created in the system, and then the set value of the high and low pressure protection is calibrated against the scale indication of the dual pressure gauge.

（5）Setting and calibration of temperature and humidity sensor

The temperature and humidity sensor has been correctly adjusted at the time of manufacturing. In case of abnormal conditions and power supply instability, there may be deviations, which need to be corrected in time. When the normal temperature and humidity differ greatly from the actual situation, an accurate standard thermometer should be prepared and calibrated with reference to it.

⚠ Precautions
① Do not use this product in flammable and explosive environments.
② Ensure that the air inlet and outlet of the condenser of the unit are smooth.

③ Do not switch the machine on and off frequently, the unit may be damaged due to frequent startup.
④ Users do not repair by themselves, such as improper repair will lead to unit operation failure or burn out. If the user needs repair, please contact the dealer or manufacturer.

⚠ Warning
① Do not insert your fingers or other things into the air outlet or air intake of the condenser, avoiding injury or damage to the unit.
② Do not damage the power cord, control sensor line, do not pull out or insert the power plug to switch the unit.

The recommended routine maintenance period and work content are shown in below:

Table 5.5 Liquid-cooled equipment maintenance

Item	Checklist	Maintenance period
Electric control component	1.Calibration of temperature, pressure sensors 2.Check the device protection grounding 3.Calibrate instruments, meters, clocks	Annual inspection Annual inspection Annual inspection
Air treatment component	1.Check the rotation of the fan and whether the fan impeller is deformed 2.Clean or replace the air filter 3.Check whether water inlet, drainage valves, and drainage pipes are unblocked 4.Check for air leakage	Quarterly inspection Monthly inspection Monthly inspection Monthly inspection
Compressor component	1.Check suction and exhaust pressure and whether there is supercooling and overheating 2.Check that the refrigerant pipe is fixed 3.Check whether the suction and exhaust valves of the compressor lea	Quarterly inspection Annual inspection Quarterly inspection
Other components	1.Clean equipment surface dirt 2.Check clean condenser fins 3.Check the fan motor support and blades 4.Check the fan motor bearings and lubricate them regularly 5.Check the fan speed adjustment and F.V.S setting	Monthly inspection Quarterly inspection Quarterly inspection Quarterly inspection Quarterly inspection

5.3.5 Fire protection system maintenance

The recommended routine maintenance period and work content are shown in below:

Table 5.6 Fire protection system maintenance

Item	Checklist	Maintenance period
Temperature sense, smoke sense	Close the fire tank and check whether the temperature and smoke sensing are normal.	Annual inspection
Combustible gas detection	Close the fire tank and check whether the combustible gas detection is normal.	Annual inspection
Battery replacement	Batteries in the control box should be replaced regularly	Replace it every 3 years

5.3.6 Cabinet maintenance

The recommended routine maintenance period and work content are shown in below:

Table 5.7 Cabinet maintenance

Item	Checklist	Maintenance period
System cleaning	Check the cleanliness of the box and clean it.	Annual inspection
Ground connection	Check whether the screws on the ground copper bar are loose or corroded.	Each 0.5 or1 years (Depends on the usage environment)
PCS cabin dustproof net	Dust and dirt will cause cold or heat loss, the filter should be replaced regularly (the same size as the filter with the original unit)	Each 3 or 6 month (Depends on the usage environment)
Appearance	Check whether the paint is off everywhere in the box, and re-paint if necessary.	Annual inspection
leakproofness	Check the tightness and water resistance of battery cabinet doors	Annual inspection

5.3.7 BMS/ local monitoring system maintenance

The recommended routine maintenance period and work content are shown in below:

Table 5.8 BMS/ local monitoring system maintenance

Item	Checklist	Maintenance period
System state	Check the system information through the HMI in electrical cabinet to check whether the system works properly。	Monthly inspection
SOC calibration	The energy storage system is full or empty once, so that the SOC can be calibrated in time to avoid excessive error deviation.	Monthly inspection (Depending on the frequency of use, 20 cycles should be calibrated once)

6. Factory Default Parameters

Before the battery cabinet is shipped from the factory, the default parameters have been burned into the ESBCM in the high voltage box, and the default values of the alarm and protection parameters are as follows：

No.	Sports event	Alarm level	Alarm trigger threshold	Alarm return value	Trigger duration	System control Action	Alarm cancellation conditions	Conditions for lifting the ban on charging and discharging
1	Monobloc overvoltage (V)	Level 1	3.55	0.2	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	3.6		3s	Charging prohibited; discharging permitted	Alarm trigger threshold - return difference value	The alarm is cancelled and all clusters have discharge current or the average voltage of the current cluster unit is less than 3.3V.
		Level 3	3.65		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	Alarm is cleared and ESMU clicks on fault resumption
2	Monoblock voltage too low (V)	Level 1	2.8	0.2	3s	Report alarms	Alarm trigger threshold + return	/

							difference value	
		Level 2	2.7		3s	Charging permitted; discharging prohibited	Alarm trigger threshold+ return difference value	Alarm is cleared and all clusters have charging current.
		Level 3	2.6		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	Alarm is cleared and ESMU clicks on fault resumption
3	Individual voltage differential (mV)	Level 1	300	50	3s	Report Alarms	Alarm trigger threshold - return difference value	/
		Level 2	500		3s	Prohibition of charging; prohibition of discharging	Alarm trigger threshold - return difference value	Alarm cancelled with 30min delay
		Level 3	700		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	Alarm is cleared and ESMU clicks on fault resumption
4	High battery charging unit temperature (°C)	Level 1	52	5	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	57		3s	Charging prohibited;	Alarm trigger	Fault resolution

						discharging permitted	threshold - return difference value	
		Level 3	62		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	Alarm is cleared and ESMU clicks on fault resumption
5	Low battery charging unit temperature (°C)	Level 1	5	3	3s	Report alarms	Alarm trigger threshold + return difference value	/
		Level 2	3		3s	Charging prohibited; discharging permitted	Alarm trigger threshold + return difference value	Fault resolution
		Level 3	1		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	Alarm is cleared and ESMU clicks on fault resumption
6	High battery discharge monomer temperature (°C)	Level 1	52	5	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	57		3s	Charging permitted; discharging prohibited	Alarm trigger threshold - return difference value	Fault resolution

		Level 3	62		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	ESMU click fault resumption
7	Low battery discharge monomer temperature (°C)	Level 1	-10	5	3s	Report alarms	Alarm trigger threshold + return difference value	/
		Level 2	-15		3s	Charging permitted; discharging prohibited	Alarm trigger threshold + return difference value	Fault resolution
		Level 3	-20		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	ESMU click fault resumption
8	Large temperature difference of single cell (°C)	Level 1	12	3	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	15		3s	Prohibition of charging; prohibition of discharging	Alarm trigger threshold - return difference value	Fault resolution
		Level 3	18		3s	Output dry node, delay 3s to execute the	Alarm trigger threshold - return	ESMU click fault resumption

						process of jumping machine	difference value	
9	Low SOC (1 per cent)	Level 1	15	2	3s	Alarms only	Alarm trigger threshold + return difference value	/
		Level 2	10		3s	Alarms only	Alarm trigger threshold + return difference value	/
		Level 3	5		3s	Alarms only	Alarm trigger threshold + return difference value	/
10	High SOC (1 per cent)	Level 1	101	2	3s	/	/	/
		Level 2	101		3s	/	/	/
		Level 3	101		3s	/	/	/
11	Total voltage too high (V)	Level 1	3.55*384 =1363.2	10	3s	Report Alarms	Alarm trigger threshold - return difference value	/
		Level 2	3.60*384 =1382.4		3s	Charging prohibited; discharging permitted	Alarm trigger threshold - return difference value	Alarm cleared and all clusters have discharge current
		Level 3	3.65*384 =1401.6		3s	Output dry node, delay 3s to	Alarm trigger threshold -	ESMU click fault resumption

						execute the process of jumping machine	return difference value	
12	Total voltage too low (V)	Level 1	2.7*384=1036.8	10	3s	Report Alarms	Alarm trigger threshold + return difference value	/
		Level 2	2.60*384=998.4		3s	Charging permitted; discharging prohibited	Alarm trigger threshold + return difference value	Alarm is cleared and all clusters have charging current.
		Level 3	2.5*384=960		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	ESMU click fault resumption
13	Power plug-in temperature over-temperature alarm (°C)	Level 1	90	5	3s	Report Alarms	Alarm trigger threshold - return difference value	/
		Level 2	95		3s	Prohibition of charging; prohibition of discharging	Alarm trigger threshold - return difference value	Fault resolution
		Level 3	100		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	ESMU click fault resumption

14	Charge overcurrent (A)	Level 1	320	10	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	330		3s	Charging prohibited; discharging permitted	Alarm trigger threshold - return difference value	Alarm cancelled and (30min delay or all clusters have discharge current)
		Level 3	345		3s	Output dry node, delay 3s to execute the process of jumping machine	A Alarm trigger threshold - return difference value	ESMU click fault resumption
15	Discharge overcurrent (A)	Level 1	320	10	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	330		3s	Charging permitted; discharging prohibited	Alarm trigger threshold - return difference value	Alarm cleared and (30min delay or all clusters have charging current)
		Level 3	345		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	ESMU click fault resumption

16	low insulation (KΩ)	Level 1	2000	10	10S/60s	Charging permitted; discharging permitted	Alarm trigger threshold + return difference value	/
		Level 2	1800		10S/60s	Prohibition of discharge; prohibition of charging	Alarm trigger threshold + return difference value	Fault resolution
		Level 3	1500		10S/60s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	ESMU click fault resumption
17	Battery box voltage too high (V)	Level 1	3.55*48=170.4	5	3s	Report alarms	Alarm trigger threshold - return difference value	/
		Level 2	3.60*48=172.8		3s	Charging prohibited; discharging permitted	Alarm trigger threshold - return difference value	Alarm cleared and all clusters have discharge current
		Level 3	3.65*48=175.2		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold - return difference value	ESMU click fault resumption
18	Battery box voltage too low (V)	Level 1	2.7*48=139.6	5	3s	Report alarms	Alarm trigger threshold + return	/

							difference value	
		Level 2	2.6*48=124.8		3s	Charging permitted; discharging prohibited	Alarm trigger threshold + return difference	Alarm is cleared and all clusters have charging current.
		Level 3	2.5*48=120		3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference value	ESMU click fault resumption
19	Failure of communica-tion between display control and BCU	Level 3			3s	Output dry node, delay 3s to execute the process of jumping machine	Alarm trigger threshold + return difference	ESMU click fault resumption
20	BCU and BMU communicat ion failure	Level 3			3s	Output dry node, delay 3s to execute the process of jumping machine	Communic a-tions restored	ESMU click fault resumption
21	Display control detects external signals: fire fault/emerge ncy stop signal/electr ical operation	Level 3			2s	Output dry node, delay 3s to execute the process of jumping machine	Real-time monitoring	ESMU click fault resumption
22	Single voltage acquisition	Level 3			3s	Output dry node, delay 3s to	Data Sampling Recovery	ESMU click fault resumption

	Fault					execute the process of jumping machine		
23	Failure of monomer temperature acquisition	Level 3	Number of invalid temperatures ≥ 6 or number of slaves with invalid temperatures ≥ 3		3s	Output dry node, delay 3s to execute the process of jumping machine	Data sampling recovery	ESMU click fault resumption
24	Temperature rise alarm	Level 2	Temperature rise rate of single cell temperature >>10 ℃/min		3s	Prohibition of charging; prohibition of discharging	Temperature rise rate of single cell temperature ≤10℃/min	Fault resolution
25	Master: circuit breaker failure/Contactor failure	Level 3			3s	Output dry node, delay 3s to execute the process of jumping machine	Test Recovery	ESMU click fault resumption
26	Slave peripheral failure (DI detection)	Level 1			3s	Warning	Real-time monitoring	/
27	Inter-cluster current imbalance alarm	Level 1	Minimum cluster current * 1.25 < maximum cluster current, and stack cur		60s	Warning	Failure conditions not met	/

			rent > 15 A					

7. Failure Analysis and Handling

7.1 Matters Needing Attention

⚠ Warning
（1）Under the fault condition, there may still be deadly high voltage inside the energy storage system！
（2）Only qualified personnel are allowed to perform the operations described in this chapter. "Meet the requirements" means that the operator has participated in the professional training on the operation of equipment troubleshooting.
（3）Perform only the troubleshooting operations described in this manual.
（4）Observe all safety regulations when performing operations.
（5）If, with the help of this manual, the problem still cannot be resolved or questions still remain, please contact Sunwoda. We need the following information in order to provide you with faster and better service： ① Energy storage system model. ② Energy storage system serial number. ③ Information about the manufacturer, model, and battery configuration of the components connected to the energy storage system. ④ Communication connection scheme of energy storage system. ⑤ Fault information and description. ⑥ Photos of the fault site (if site conditions permit).

7.2 Troubleshooting

If the energy storage system fails to deliver the expected output or the amount of charge and discharge changes abnormally, check the following items before consulting the maintenance personnel：

（1）Open circuit voltage of the energy storage battery；

（2）The power grid is properly connected and energized；

（3）Check whether the communication between the EMS and PCS of the energy storage

system is normal.

7.3 Common Troubleshooting Table

Device	Fault type	Reason	Solution
Cell	Efficiency decline	1、Long time use, individual cell aging serious; 2、Long-term use, individual cell consistency poor Long-term use, individual cell consistency poor;	1、Replace the badly aged cells; 2、Manual balancing of cells with poor consistency Manual balancing of cells with poor consistency.
	The pressure difference of the battery is too large	For a long time, the consistency of the battery inside the PACK decreases.	Manual equalization
	After overdischarge, the voltage is too low to start	1、After being idle for a long time, the battery voltage is lower than the threshold; 2、After emptying, part of the DC load is not cut off and still consumes DC energy.	1、If the energy storage system is idle for a long time, it needs to be charged and discharged every other month; 2、If the system is not used for a long time, cut off the DC load.
	The voltage of the cell is too low	1、Cell fault; 2、Single cell aging seriously; 3、Single cell consistency is poor.	1、Replacement cell; 2、Replace the aging battery; 3、Manual balancing of cells with poor consistency.
	SOC cannot be calibrated	1、The battery voltage exceeds the normal value; 2、The indoor temperature does not meet the requirements.	1、The voltage of the reference cell is too low; 2、Return the room temperature to STC conditions.
PACK	Battery pack anomaly	1、BMU fault; 2、Incorrect PACK coding.	1、Replacing the BMU; 2、Generally, packs are sent to the site separately and need to be re-addressed
BMU	Communication exception	CAN break	Change the line
	Pressure variance	If the internal pressure difference in the PACK is constant, the BMU is faulty	Replacing the BMU

	Single cell anomaly	If the connection is normal, the BMU is faulty	Replacing the BMU
	Failure to start	BMU fault	Replacing the BMU
BCMU &Control Box	Communication exception	1、Loose communication line； 2、CAN break； 3、Line interference； 4、Terminal resistance is not added.	1、Find loose lines, restore; 2、Change the line； 3、Find interference sources, PCS topologies, etc； 4、Check whether the terminal resistance meets the requirements.
	Battery cluster failure	1、Find out if the fault really exists； 2、If no, check whether the BCMU parameters are correctly configured；	1、Solve the corresponding faults, such as over current, over temperature, fuse damage, etc； 2、The parameters are set to proper values.
	Abnormal indicator light	1、Abnormal power input；	1、Restore the power input value to 24VDC；
	The battery cluster is isolated	Loose connector	Reinsert the connector
	Temperature anomaly	1、Internal components are in poor contact； 2、Temperature sampling probe aging； 3、The temperature sampling probe is out of position； 4、The application environment is incorrect.	1、Find if the device is loose and restore it； 2、Replace aging probe； 3、Heat-avoidance device； 4、Use according to the conditions allowed by the energy storage system.
	SOC anomaly	Prolonged operation does not trigger calibration conditions.	Filling or empting every other month is what enables the BMS to calibrate the SOC.
	The pressure difference between battery clusters is too large	1、The setting problem of inter-cluster differential pressure protection value； 2、Automatic quarantine is not set.	1、Adjust the appropriate pressure difference between clusters according to the terminal voltage; 2、Automatically isolate inputs.
	Components in the main	1、The fuse is damaged;	Replacement device

	control box are faulty	2、The contactor is damaged.	
Water Cooler	Compressor fails to start	1、No power supply; 2、Power overload circuit breaker jump open; 3、Loose circuit connection;	Replace damaged parts
	Compressor noise is too high	1、Check for leakage, repair and add refrigerant; 2、Replace the filter; 3、Replace the expansion valve.	Add refrigerant and replace damaged components
Container	Battery cabinet leakage	The screws are loose during transportation;	Tighten all screws.
	The battery cabinet is too warm	The filter cotton is not cleaned	Clean and maintain the filter cotton regularly
	Corrosion of battery cabinet	The damaged area of the battery cabinet is not repainted in time	Regular inspection of battery cabinet paint damage, and timely treatment
Fire fighting	Backup fault	The backup battery is faulty	Replace the backup battery

Shenzhen Sunwoda Energy Technology Co., Ltd.

Sunwoda Industrial Park, No. 18 Tangjia South Road, Guangming New District, Shenzhen, China

www.sunwodaenergy.com