FLEX-233L05/M5P80 Energy Storage System User Manual

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Product model	FLEX-233L05/M5P80
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Approve	**Check**	**Design**

Version record

Ver	Updating	Date	Revision/Formulation
V1.0	New Release	2025.08.03	Design

1 Summary

1.1 Applicable product

Thank you for purchasing the product from Poweroad.This manual applies only to Poweroad outdoor energy storage products.

Product model:FLEX-233L05/M5P80.

Throughout this manual,unless otherwise noted,references to “Energy storage system”are to that product.

1.2 Applicable personnel

This manual is for staff who perform installation and maintenance on this product.Only professional electricians or professionally qualified personnel should perform all operations on the product.The following requirements are required for readers:

- Have some specialized knowledge of electrical and mechanical installation and operation;
- Knowledge of electrical,mechanical schematics and electrical safety for energy storage;
- Fully familiar with the composition and working principle of the whole energy storage system;
- Operators should be fully familiar with the relevant standards of the country/region where the project is located;
- Familiarize with the installation,operation and other related contents described in this manual.

1.3 Symbol usage

 Danger	“Danger”indicates a situation of high potential risk which,if not avoided,would result in death or serious injury.
 Warning	“Warning”indicates a moderately potentially hazardous situation which,if not avoided,will result in death or serious injury.
 Warning	“Warning”indicates a moderately potentially hazardous situation which,if not avoided,will result in death or serious injury.

Caution	“Caution”indicates a potentially hazardous situation which,if not avoided,will result in equipment failure or property damage.

Instruction	“Instruction”are additional information in the manual that highlights and supplements the content and may provide tips on how to optimize the use of the product,help you solve a problem or save your valuable time.

1.4 Explanation of terminology

Abbreviation	Original text	Chinese meaning
ESS	Energy Storage System	能量存储系统
EMS	Energy Management System	能量管理系统
PCS	Power Conversion System	双向变流器
BMS	Battery Management System	电池管理系统
A-BMS	Array-BMS	电池堆管理系统
C-BMS	Cluster-BMS	电池簇管理系统
M-BMS	Module-BMS	电池模组管理系统
HVM	High Voltage Monitor	高压监测器

2 Safety instruction

2.1 Safe use instruction

Battery cabinet product protection level is IP55,the use of altitude does not exceed 2000m,the battery cabinet design and testing in strict accordance with the International Electrotechnical Safety Code,this section describes the installation,operation and maintenance of battery cabinets need to pay attention to the general principles of safety.Please read this safety notice carefully before installation.Specific use,maintenance steps in the safety instructions,please refer to the corresponding section of the warning instructions.

Danger	It is prohibited for non-professional technicians or unauthorized personnel to operate the energy storage system. It is prohibited for non-professional technicians to disassemble,repair,or modify the energy storage system system by themselves. It is prohibited to carry out operations other than installation,operation,maintenance and so on as instructed in the user manual.

Danger	Lethal high voltage exists inside the product! Do not move or touch the inside of electrical equipment with electricity when the equipment is not powered off. Observe and follow the warning signs on the product. Following the safety precautions listed in this manual and other documents related to this equipment.

Danger	Touching the power grid or the power connection contacts，terminals,etc.in the equipment may result in death by electric shock!

Danger	Energy storage battery modules with positive and negative battery clusters are strictly forbidden to be short-circuited! Even when the power is turned-off,lethal high voltage is still present in the battery module inside the device!

Warning	After maintenance,overhaul and other work is completed,the equipment should be powered up in strict accordance with the steps in this manual.

Caution	Ensure that the machine markings are legible at all times. Always replace damaged or obscured machine markings immediately.

2.2 Operator requirement

- The personnel responsible for installing and maintaining the equipment must first undergo strict training, understand various safety precautions, and master the correct operating methods. Installation, operation, maintenance, and replacement of equipment or components are only allowed to be carried out by qualified professionals or trained personnel.
- Professional personnel: Those who are familiar with the principles and structure of equipment, have experience in training or operating equipment, and are able to understand the potential sources and levels of danger during equipment installation, operation, and maintenance.
- Trained personnel: personnel who have received appropriate technical and safety training and have necessary experience, are aware of the potential dangers that may arise when performing a certain operation, and can take measures to minimize the danger to themselves or other personnel.
- The personnel responsible for installing and maintaining the equipment must first undergo strict training, master the correct operating methods, understand various safety precautions and relevant standards of the country/region where they are located.
- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Personnel involved in special scenarios such as electrical operations, high-altitude work, and special equipment operations must have special operation qualifications required by the local country/region.
- The replacement of equipment or components (including software) must be completed by authorized professionals.
- Do not approach the equipment except for personnel operating it.

2.3 General safety precaution

- This product should be used in scenarios that meet the specifications (voltage, current, temperature and humidity, altitude, etc.). Abnormal or damaged product functions caused by excessive use are not within the scope of product quality assurance.

- Before touching any conductor surface or terminal, a multimeter must be used to measure and confirm that there is no voltage at the contact point, or that the voltage is within a predetermined range. During the operation, specialized insulation tools must be used.
- The length of input and output cables must reserve a certain margin and be tied and fixed nearby to avoid cable pulling and affecting the reliability of electrical connections.
- When installing or removing power cables, ensure that the corresponding circuit has been disconnected to prevent arcing or electric sparks.
- Do not use water to clean electrical components inside or outside the equipment.
- It is strictly prohibited to wear conductive or easily conductive objects on the wrist during operation, such as rings, watches, bracelets, etc.
- Installation or maintenance operations must follow the sequence of operation steps in the instruction document and should not be changed arbitrarily.
- Do not block the air inlet and outlet of the cabinet, and maintain smooth air circulation around the cabinet.
- Blockage of the air inlet and outlet of the cabinet can affect the heat dissipation of the cabinet, which may lead to automatic system protection, equipment damage, and even personal injury.
- It is prohibited to place any items unrelated to the system inside the cabinet.

3 Product introduction

3.1 Product overview

Figure 3-1 Appearance diagram of energy storage system

The energy storage integrated cabinet system is a system that can complete storage and power supply. The main circuit of this system consists of 1 PCS, 1 cluster control box, and 5 battery modules. The control circuit includes modules such as power distribution system, fire protection system, lighting system, thermal management system, etc.

3.2 Application scenario

The integrated energy storage cabinet system has the characteristics of simplifying infrastructure construction costs, short construction period, high modularity, strong environmental adaptability, and easy transportation and installation. It can be used in scenarios such as peak shaving and valley filling, power distribution expansion, and

demand response, and can be widely applied in shopping malls, residential areas, schools, factories, farms, and other applications.

3.3 Main function

The energy storage integrated cabinet system includes the power control module, the lithium battery module, and the PCS. It can control the battery cluster control box to store and release electrical energy according to EMS requirements through PCS.

Battery charging: The power conversion system (PCS) is connected to the cluster control box and under the control of the PCS, it charges the battery and stores the excess energy in the battery.

Battery discharge: When the power grid is insufficient to supply power to the load or when discharge is required, the system needs to control the battery to supply power to the load, and output the stored battery energy to the load for use through PCS.

The integrated energy storage system includes power supply and distribution system, monitoring system, environmental control system, fire suppression system, etc. It has the characteristics of safety, reliability, rapid deployment, low cost, high energy efficiency, and intelligent management.

3.4 Basic parameter

Form 3-1 Basic parameter of Energy Storage System

Performance Indicators	**Parameter Specifications**
AC side	
Rated power	80 kW
Maximum power	88 kW
Rated grid voltage	AC 400V
Allowed grid voltage range	400V (-10% to +15%)
Rated grid frequency	50Hz/60Hz
Power factor	>0.99 (Rated output power), 1 (Leading) ~ 1 (Lagging)
DC side	
Nominal energy	233 kWh
Rated voltage	832V
Maximum charging voltage	936V

Performance Indicators	Parameter Specifications
Minimum discharging voltage	728V
Rated charging current	96.1 A
Rated discharging current	96.1 A
General parameters	
Communication method	Ethernet
Operating temperature	-30 to 50℃
Relative humidity	5% to 95%, non-condensing
Protection level	IP55
Cooling method	Liquid cooling
Altitude (m)	≤ 2000m Derating is required above 2000m
Weight	Approximately 2.6t
Product dimensions	Width: 1350±5mm
	Depth: 1300±5mm
	Height: 1965±5mm (without lifting ring) Height: 2050±5mm (with lifting ring)

3.5 System principle

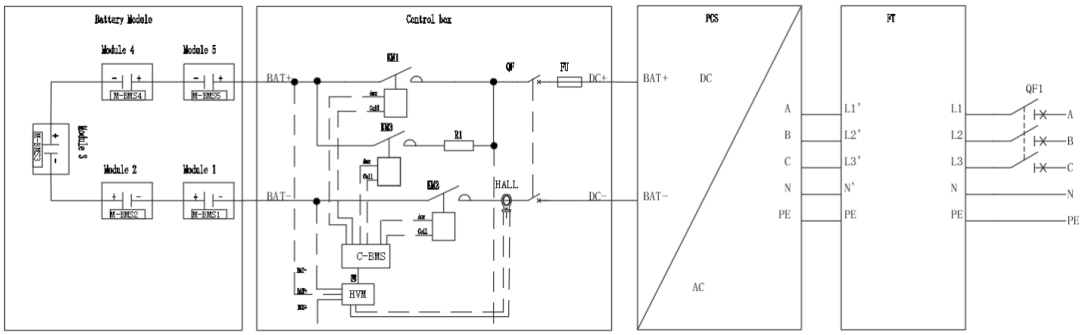


Figure 3-2 Main circuit schematic diagram

3.6 Distribution and functional description of main electrical component

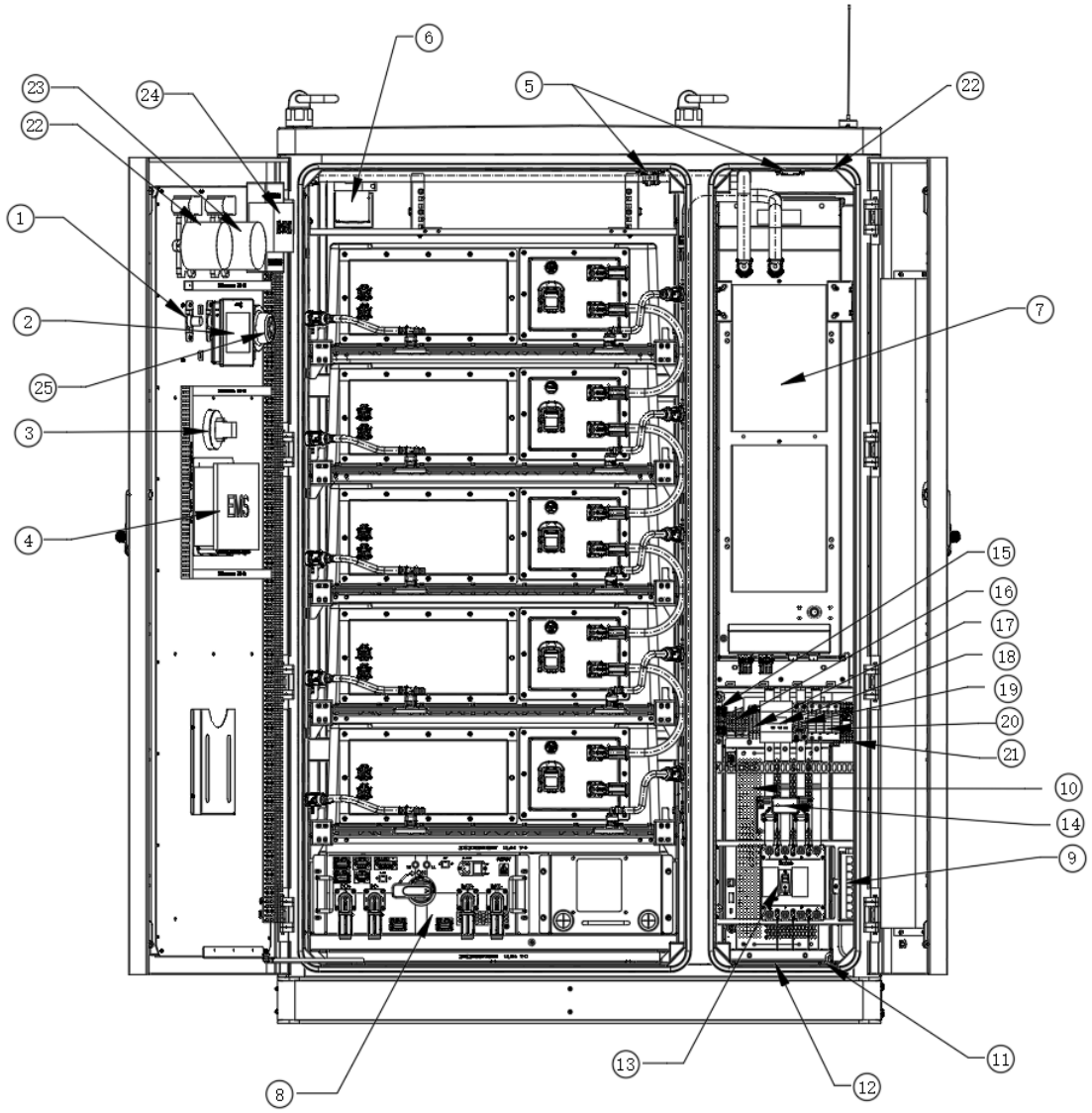


Figure 3-3 Main device layout

No.	Device name	Description
1	HL	Power, operation, and fault indicator light
2	HMI	Human machine interface
3	EPO	Emergency stop button
4	EMS	Energy management system
5	SQ	Access control travel switch
6	Out fire	Firefighting bottle
7	Chiller	Liquid cooling machine
8	C-Box	High voltage control box
9	Switch	Switchboard
10	PCS	Power conversion system(including filter)
11	BL	Water immersion sensor
12	PE BAR	Grounding copper bar
13	QF1	Main circuit breaker
14	CT	Current transformer
15	XT	24V terminal block

No.	Device name	Description
16	XD	220V wiring terminal block
17	FU	Fuse
18	Meter	Measuring electrical energy
19	QF2	Liquid cooling machine air switch
20	SPD	Surge protective device
21	KA1	Relay
22	CO	CO gas detector
23	H2	H2 gas detector
24	DL	Dehumidifier
25	SS	Smoke detector

3.7 Product dimension

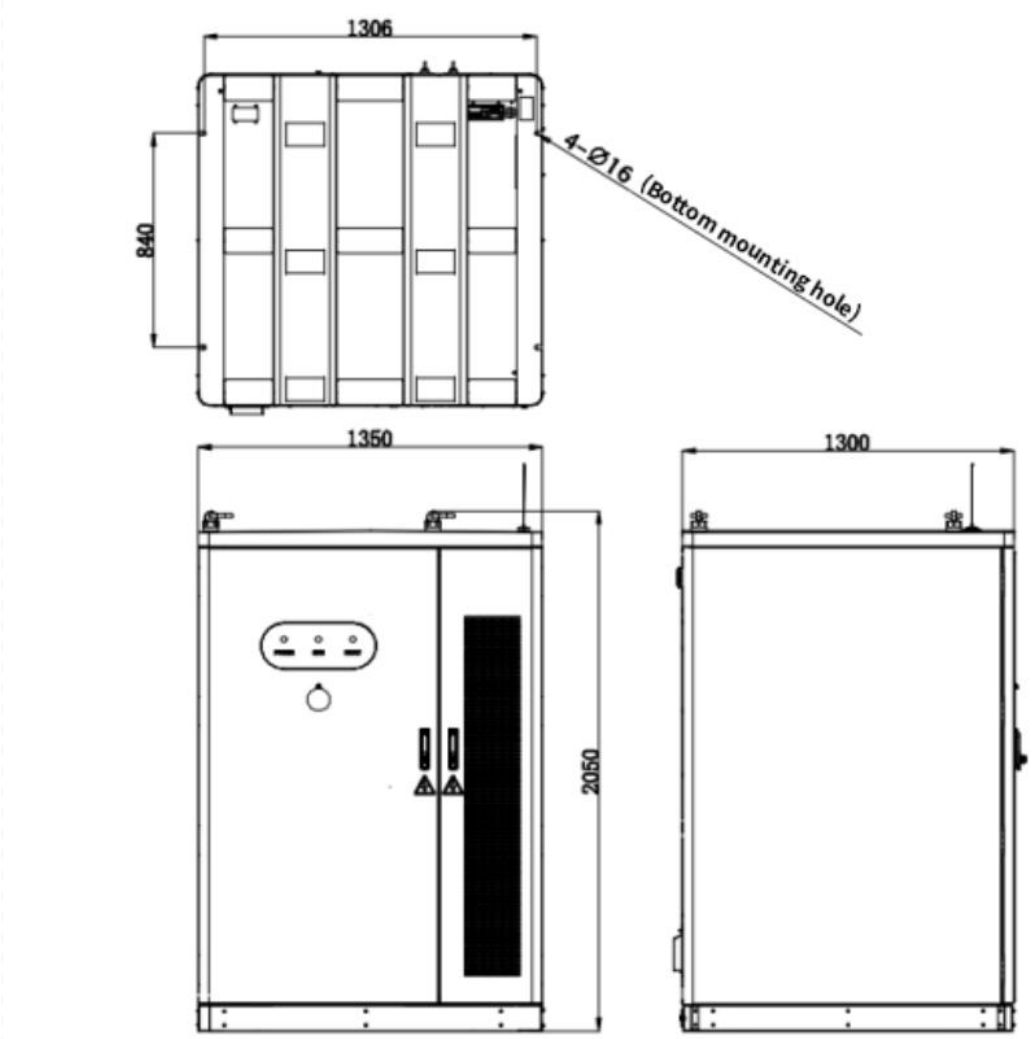


Figure 3-4 Installation dimension diagram

4 Lifting, transportation, and storage

4.1 Lifting operation

Precaution	（1）During the entire lifting process, it is necessary to strictly follow the safety operating procedures of the crane; （2）No one is allowed to stand within a 10 meter range of the operating area, especially under the lifting arm and the machine being lifted or moved, to avoid injury accidents; （3）Determine the personnel involved in the lifting operation, including operators, commanders, riggers, etc., and ensure that they hold relevant certificates and have received professional training; （4）In case of adverse weather conditions such as heavy rain, heavy fog, strong winds, etc., lifting should be stopped.

The weight of the unpacked cabinet reaches 2.6t, and priority should be given to using the bottom of the cabinet for forklift transportation. When the site does not meet the requirements for forklift transportation, lifting transportation can be used. Lifting method: Use two lifting straps to fasten the four lifting rings from the top of the cabinet, and then use lifting tools to fasten the lifting straps.

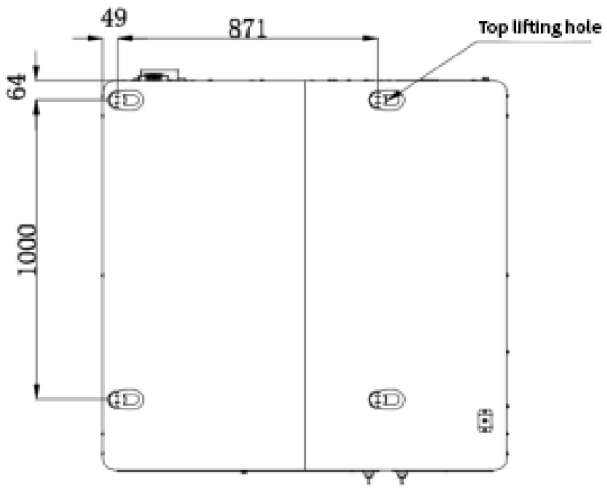


Figure 4-1 Hanging ring size diagram

Lifting and transportation:

1. When lifting heavy objects, it is strictly prohibited to walk under the suspension rod and the lifted object;

2. Personnel conducting lifting operations must hold a certificate to carry out lifting operations, and lifting equipment must be inspected;

3. Before hoisting, ensure that the hoisting equipment is firmly fixed on the load-bearing device or wall;

4. During the lifting process, do not drag the steel wire rope and sling, and do not touch hard objects;

5. Be careful when installing or removing equipment from the cabinet to avoid crushing or injuring unstable or heavy equipment installed on the top of the cabinet;

6. During the lifting process, ensure that the angle between the two cables does not exceed 90 ', as shown in the following figure.

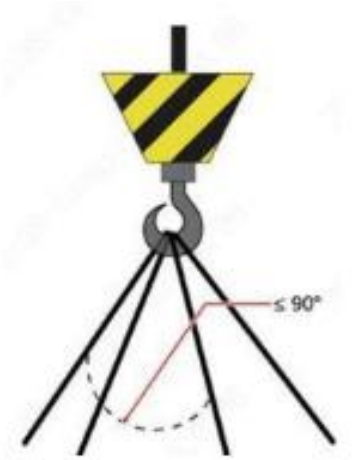


Figure 4-2 Angle diagram between lifting cables

4.2 Forklift operation

1. When using a forklift for handling, follow the packaging material requirements and the following diagram to enter the forklift to avoid overturning;

2. Before moving, secure the cabinet to the forklift with a rope;

3. During transportation, it must be supervised by a specially designated person.

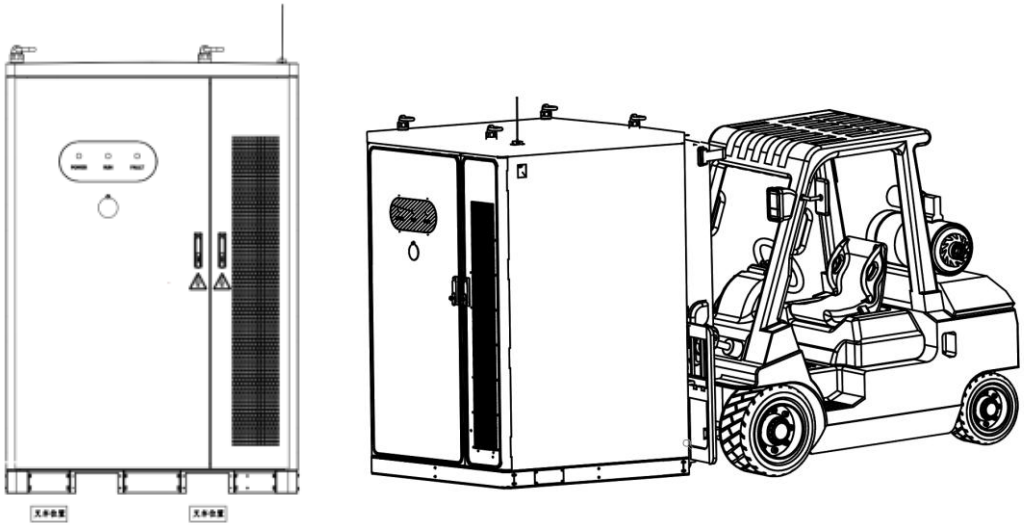


Figure 4-3 Forklift operation diagram

4.3 Storage

Storage environment requirement:

- Operation temperature:-30～50℃
- Storage temperature:-40～60℃
- Relative humidity:5%~95% no condensation
- Dry, ventilated, and clean.
- Avoid contact with corrosive organic solvents, gases, and other substances.
- Avoid direct sunlight.
- The distance between the heat source shall not be less than two meters.

5 Site requirement

5.1 Site requirement

1. When fixing the energy storage integrated cabinet on the foundation, it is recommended to use expansion bolts, M12 * 100mm;

2. The area around the integrated energy storage cabinet should be open, unobstructed, and have a safe escape route; The safe passage shall not be less than 2m;

3. The bottom load of the installation pier foundation for the energy storage integrated cabinet shall not be less than 3000kg/square meter;The foundation construction site should be selected at the highest point of the surrounding terrain to prevent damage from water accumulation;

4. There should be a cable trench for wiring, and the grounding main line and grounding electrode should be made according to the conventional grounding grid of the substation, with a grounding resistance of less than 4 Ω;

5. The foundation should be kept horizontal, and the energy storage cabinet should be kept perpendicular to the foundation.

6 Unpacking and inspection

6.1 Unpacking inspection

Open box inspection content:

✧Check for visible damage to the outer packaging

✧After unpacking, check for visible damage inside

✧Refer to the delivery note to check if the internal accessories are complete

✧Check if internal documents are complete

If any damage or missing parts are found in the product, please contact the Poweroad or supplier. It is recommended not to discard the original packaging and store the product inside the original packaging;

Use a screwdriver and hammer to remove the packaging of the energy storage cabinet:

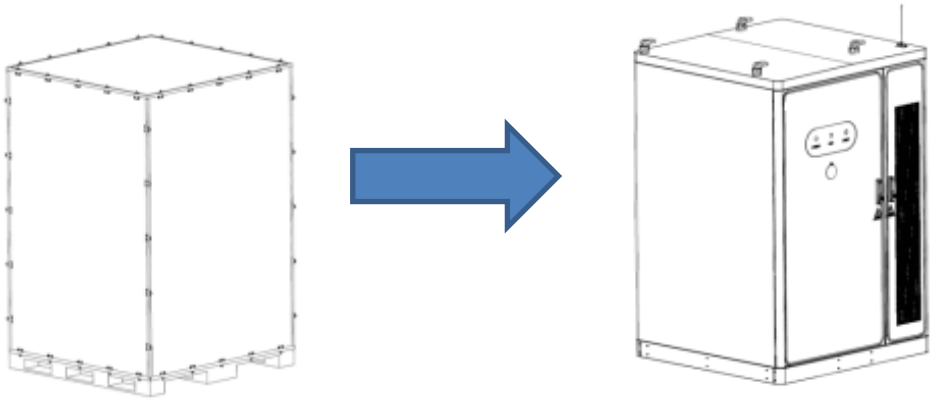


Figure 6-1 Dismantle the wooden box of the energy storage cabinet

Remove the accessories and spare parts tied to the energy storage cabinet, and inspect the following:

6-1 Checklist

No.	Name	Product description	Unit	Quantity	Note
1	Integrated cabinet	80kW/233kWh	PCS	1	
2	Parts list	Customer parts list			Please refer to the accessory list for details
3	Spare parts list	Vulnerable consumables			Please refer to the spare parts list for details

7 Equipment installation

7.1 Pre-installation preparation

1.The pictures of installation tools and protective equipment are for reference only. Please refer to the actual product;

2.Due to varying on-site conditions, a few tools that may be used may not be listed in the installation tools and protective equipment. Please prepare corresponding tools according to the actual situation for on-site installation personnel and users.

7.2 Installation tool and protective equipment

When installing, it is recommended to use the following installation tools. If necessary, other auxiliary tools can be used on site.

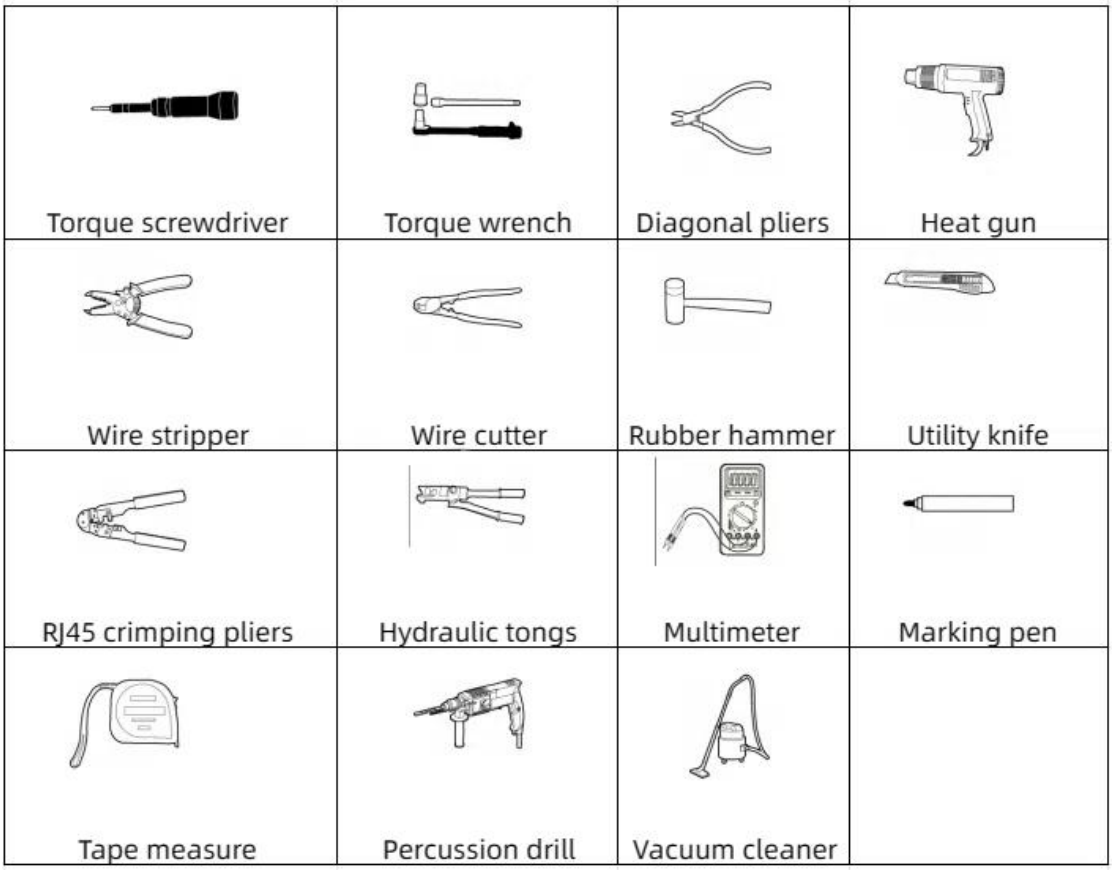


Figure 7-1 Installation tool diagram

Personal protective equipment instructions for energy storage battery cabinets,it is crucial to wear appropriate personal protective equipment (PPE) when operating and maintaining energy storage battery cabinets to ensure the safety of operators.

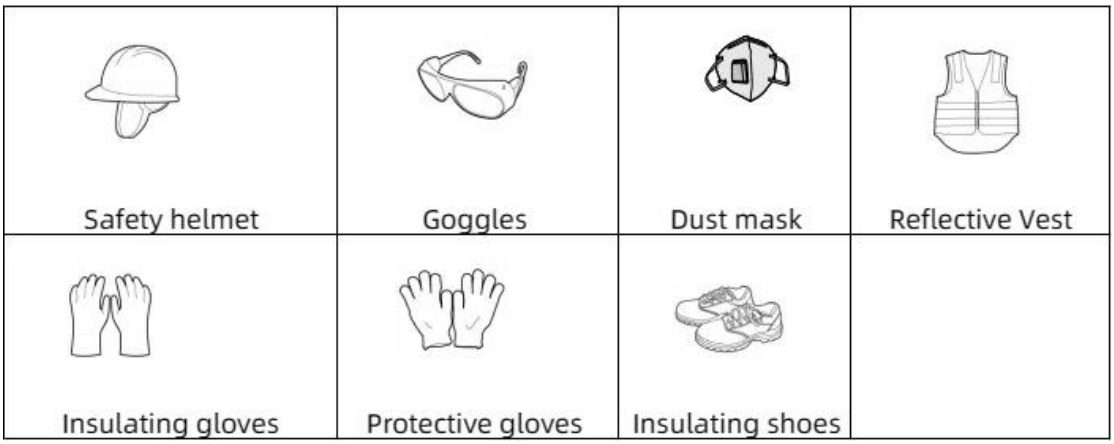


Figure 7-2 Schematic diagram of personal protective equipment

By using the above personal protective equipment correctly, the risks in the operation of energy storage battery cabinets can be effectively reduced, ensuring the safety of operators and the safety of the working environment;

In the scenario of tightening or loosening screws, use a torque screwdriver or torque wrench to tighten the screws with the appropriate torque;

Crimping cable scenario: Stripping pliers can separate the insulation layer of the cut wire from the wire and prevent electric shock. Use hydraulic pliers to crimp the power terminal, use a hot air gun to blow and shrink the heat shrink sleeve, and connect it to the corresponding position after crimping;

Test circuit scenario: Wear insulated gloves, put on insulated boots, and use a multimeter to measure DC current, DC voltage, AC current, AC voltage, resistance, etc.

7.3 Installation precaution

The integrated energy storage cabinet is a high-voltage energy storage equipment, which belongs to hazardous materials. Non professionals and improper operation and use may cause serious consequences such as electric shock, combustion, and explosion. The installation and maintenance of the integrated cabinet for energy storage batteries must be operated by professional technicians, and relevant safety regulations must be strictly followed during use.

1. When lifting the cabinet to the ground, be careful not to touch the workers;
2. When performing installation operations, a dedicated installation isolation area should be set up;
3. During the lifting process, it is important to handle the integrated cabinet with care;
4. Installation can only be carried out by installation personnel who have received training in high-voltage electrical treatment;
5. If the integrated cabinet has defects, cracks, or damage, please do not install;
6. Do not attempt to disassemble, repair, tamper with, or modify the integrated cabinet during installation;

7. Do not install in adverse weather conditions such as rain, dust, etc;
8. To protect the integrated cabinet and its components from damage during transportation, please handle with caution; Do not collide, pull, drag or step on the integrated cabinet. Do not subject the integrated cabinet to any strong external force;
9. Do not insert foreign objects into any part of the integrated cabinet;
10. Do not directly expose the integrated cabinet or its components to flames;
11. Do not install integrated cabinets near heating equipment;
12. Do not immerse the integrated cabinet or its components in water or other liquids:
13. Please place the integrated cabinet on a level surface, ensuring smooth placement without shaking or tilting!
14. The installation of energy storage systems should consider the load-bearing and load capacity of the installation ground.

7.4 Equipment ventilation requirement

The operation of the integrated energy storage cabinet equipment will generate a large amount of heat. If the equipment temperature is too high, it may cause the electrical parameters of the energy storage equipment to deteriorate and may cause damage to the energy storage equipment. To ensure the heat dissipation of energy storage devices, the installation environment must meet the following requirements:

Ventilation requirements:
1.The equipment should be installed in a well ventilated environment, and it is recommended to reserve 2 meters of space for the air inlet and outlet.
2.The air inlet must ensure sufficient fresh air intake.
3.It is recommended to separate the ventilation system of the equipment from other ventilation systems.
4.If overheating of the equipment is detected, please check that the ventilation openings are well ventilated.

When installing an integrated energy storage cabinet, please consider the necessary ventilation space and the space requirements that can be entered when opening the door. The reserved space is shown in the following figure.

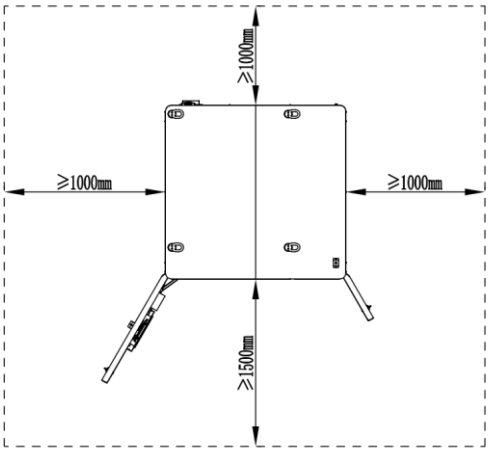


Figure 7-3 Recommended installation space for a single integrated cabinet

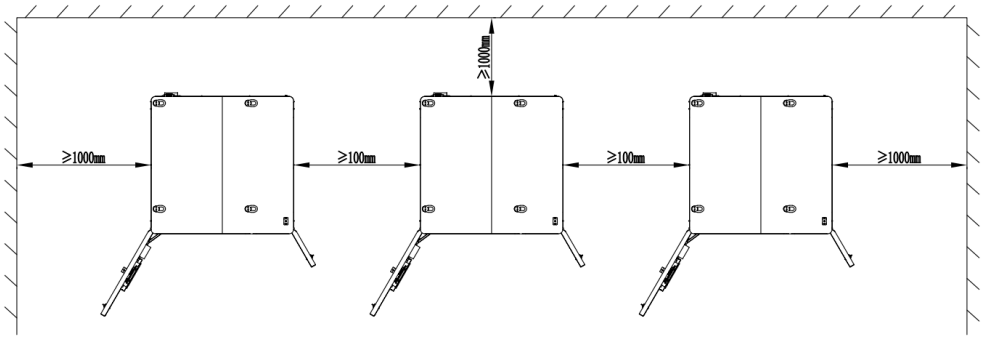


Figure 7-4 Recommended installation space for multiple integrated cabinets

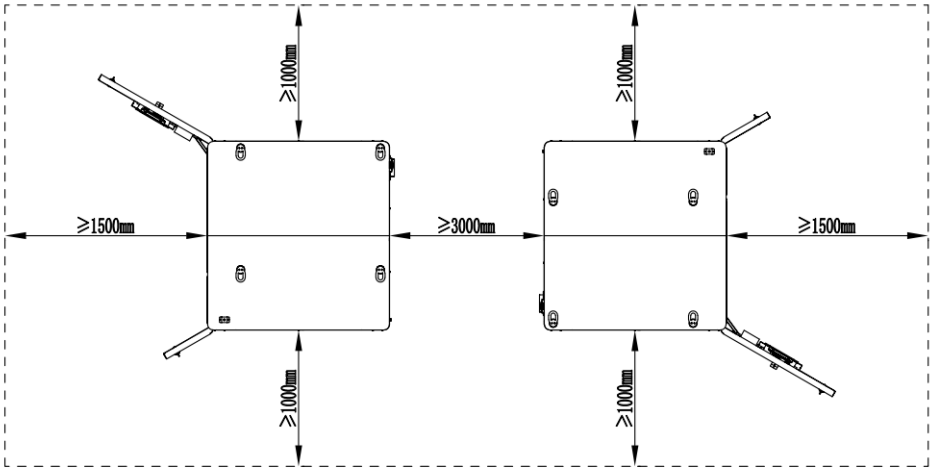


Figure 7-5 Recommended installation space for back-to-back integrated cabinet

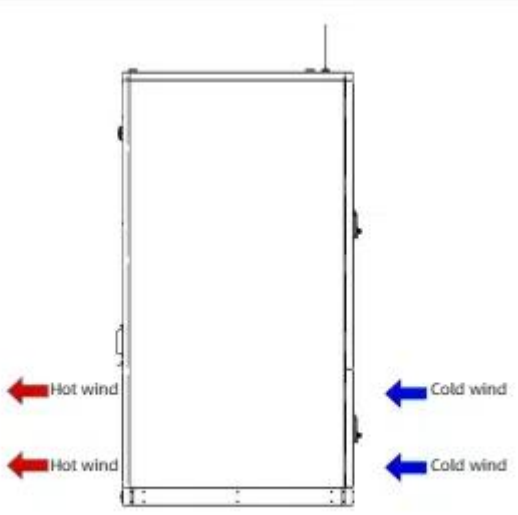


Figure 7-6 Wind inlet and outlet direction of energy storage battery cabinet

7.5 Equipment installation step

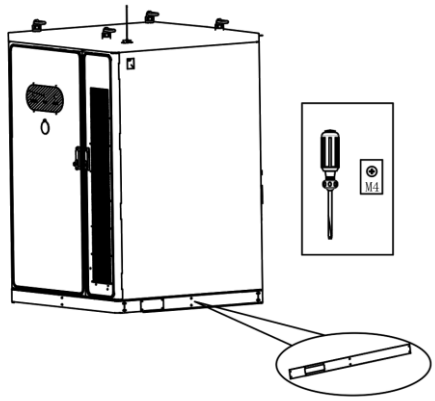
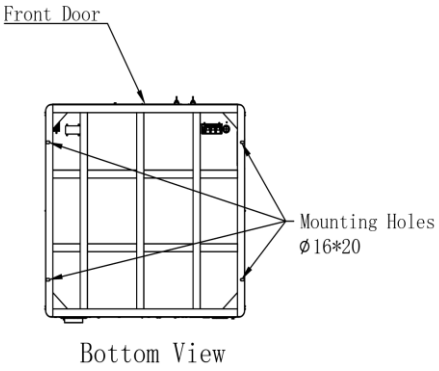
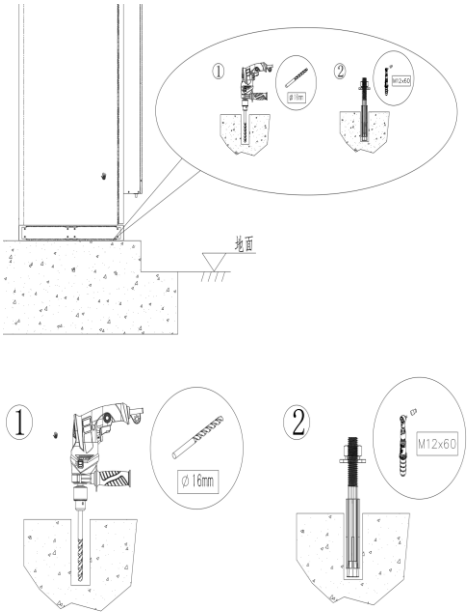
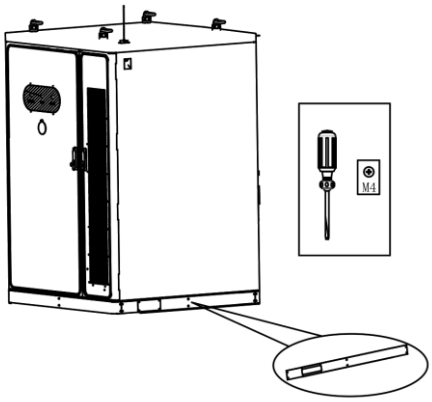
Step 1: Remove the base shields on both sides of the equipment	Step 2: Find the four fixing holes on the base
	
Step 3: Tighten the fixing bolts	Step 4: Install the base baffles on both sides of the device
	

Figure 7-7 Installation step diagram

7.6 Maintenance switch operation process

Attention: For safety reasons, the maintenance switch plug has been unplugged from the energy storage system cabinet before shipment. Before shipment, the maintenance switch on the module inside the battery cabinet will be removed for transportation to ensure safety;

The position of the module maintenance switch is detailed in the following figure:

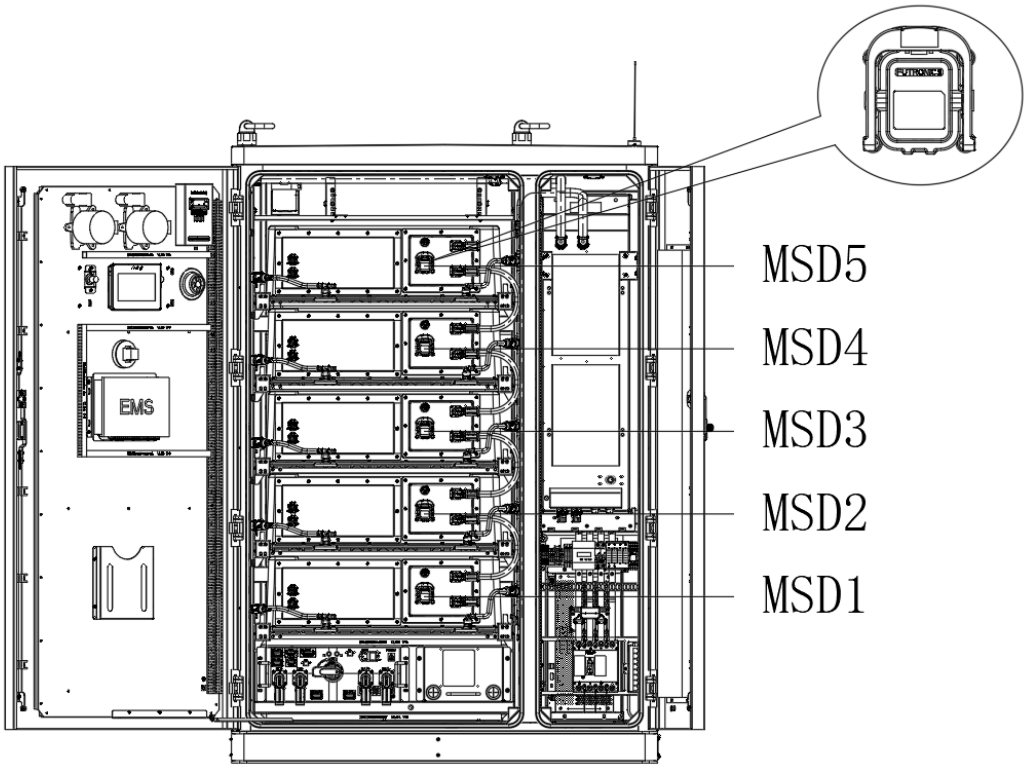
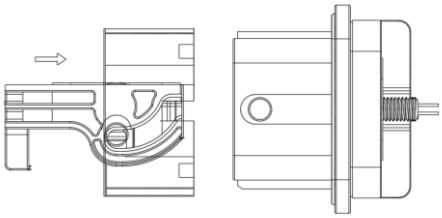
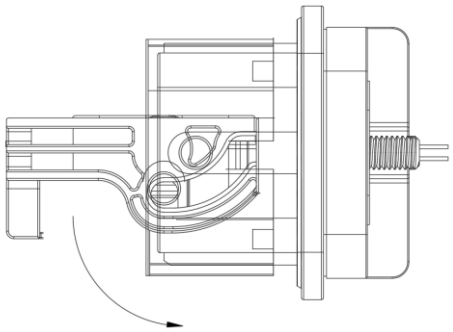
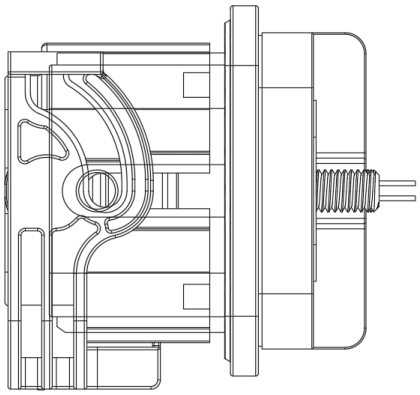
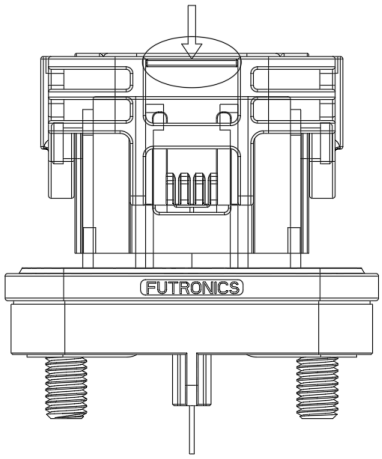


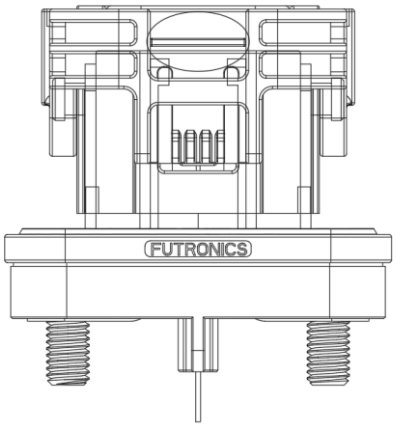
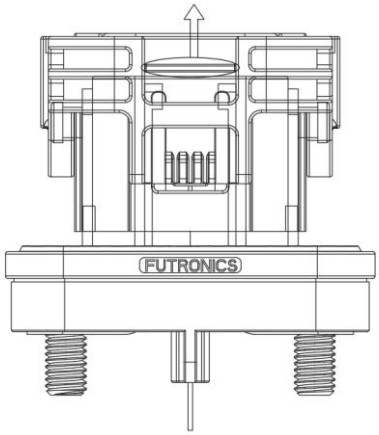
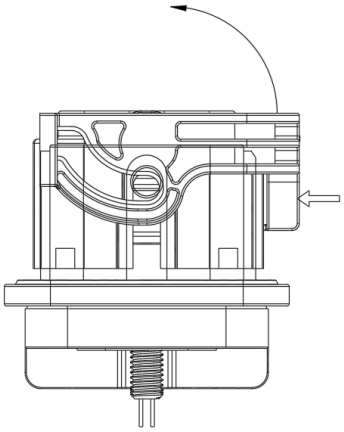
Figure 7-8 Maintenance switch position diagram

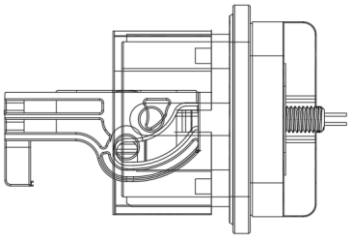
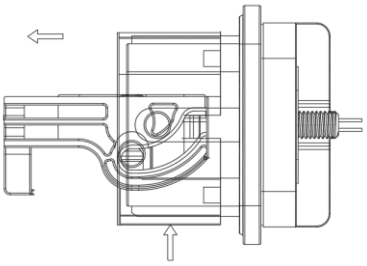
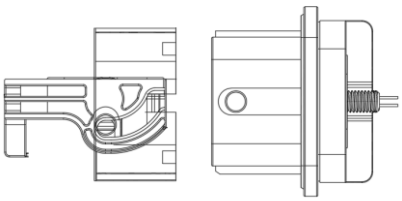
Attention: The following operations must be carried out with insulated gloves

Repair switch assembly and disassembly steps

Step 1: Pre-install		The plug and socket shells need to overlap with each other.

Step 2: Pre-installation		The socket rotating column needs to be fully inserted into the guide rail, and a clicking sound can be heard at this time.
Step 3: Rotate the push rod 90 °		A. Confirm that all the rotating columns have entered the guide rail before rotating the push rod, otherwise there is a risk of the rotating column breaking; B. Rotate the push rod to a horizontal position, at which point the push rod is parallel to the installation surface.
Step 4: Push in CPA		Gently push the red CPA with your hand.

Installed in place		As shown on the left figure.
Step 1: unlock		Pull the red CPA back.
Step 2: press the buckle push rod to unlock		Press the button and simultaneously rotate the push rod upwards.

Step 3: rotate the push rod towards the opposite insertion surface		When the hand feels a lag, it means the push rod has been pushed into place.
Step 4: unlock the button by pressing the plug		Press the unlocking buckle of the plug to the bottom while pulling out the plug with force.
Step 5: Separation completed		As shown on the left figure.

7.7 Precautions for disassembling energy storage connectors

During the process of disassembling and unplugging the energy storage connector, attention should be paid to waiting for the system to be powered off before proceeding with the operation.

When operating, insulated gloves must be worn, and their voltage level must be greater than the maximum voltage of the battery pack.

During the disassembly process, first press the connector lock switch, unlock it, and then pull out the energy storage connector, as shown in Figure 7-9.

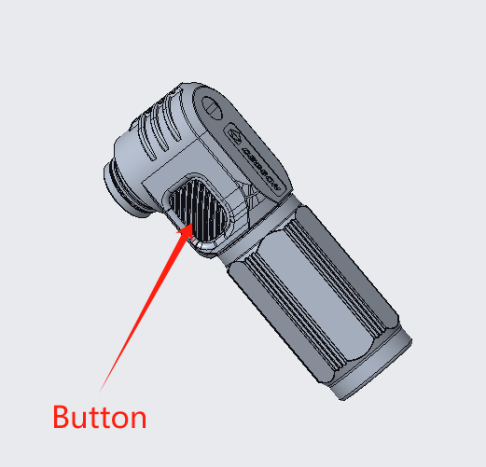


Figure 7-9 Schematic diagram of energy storage connector

8 Cable installation

8.1 Main circuit cable recommendation

8.1.1 Position of cabinet ground wire copper bar; The grounding wire has a hole diameter of M8.

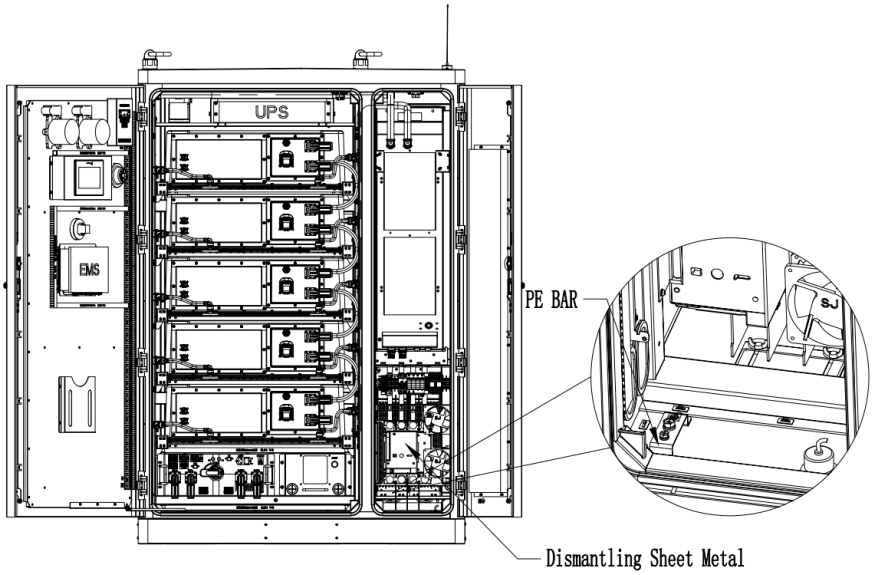


Figure 8-1 Schematic diagram of ground wire copper bar

8.1.2 Cabinet three-phase four wire wiring position; Wiring aperture M8.

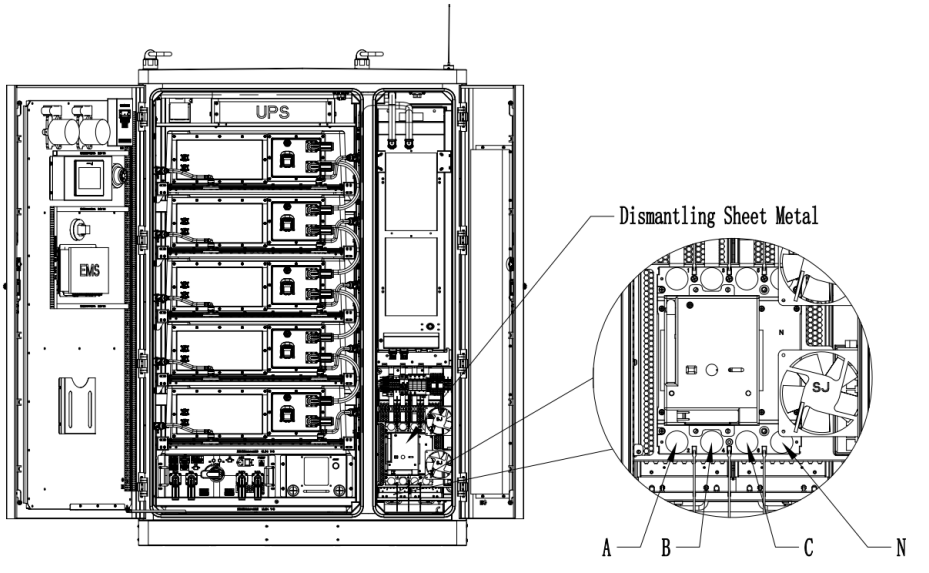


Figure 8-2 Schematic diagram of external wiring position

8.1.3 External communication wiring location; Wiring cable: Category 5e shielded network cable.

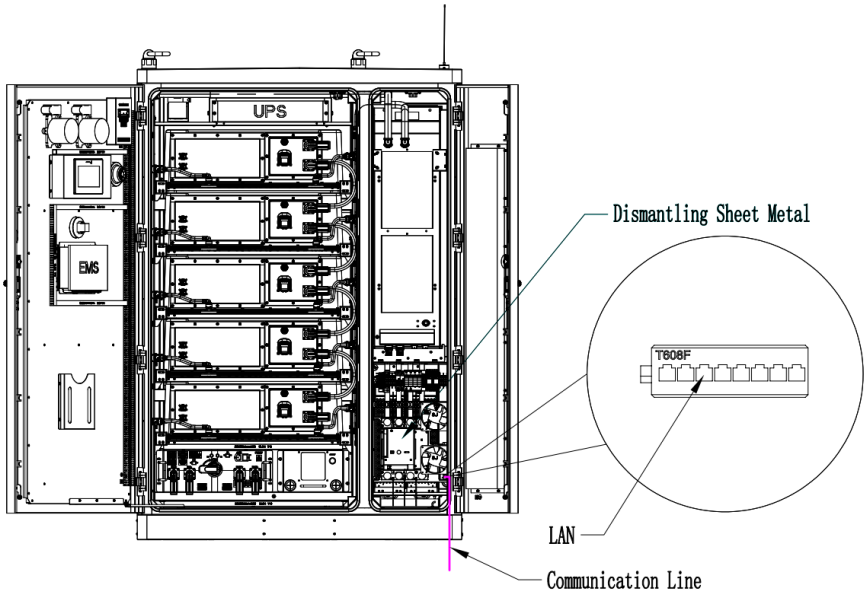


Figure 8-3 Schematic diagram of external communication wiring location

Recommended table for external cables of main circuit:

Table 8-1 Recommended external wiring for municipal power supply

Cable name	Start point	End point	Recommended cable	Note
QF1-A input line	Integrated cabinet-QF1	Phase A of electric supply	50mm²	SC terminal M8 torque 12N · m
QF1-B input line	Integrated cabinet-QF1	Phase B of electric supply	50mm²	SC terminal M8 torque 12N · m
QF1-C input line	Integrated cabinet-QF1	Phase C of electric supply	50mm²	SC terminal M8 torque 12N · m
QF1-N input line	Zero wire copper bar	Phase N of electric supply	25mm²	SC terminal M8 torque 12N · m
PE line	Grounding copper bar	PE	25mm²	SC terminal M8 torque 12N · m
Communication line	Switch network port	External controller	Ultra Category 5 Shielded Cable	

8.2 Main power terminal connection step

1. Wire stripping

Cable stripping size L2 and terminal copper tube size L1 as shown in the figure

Attention: When stripping the outer layer of the cable, it is necessary to prevent cutting of the core conductor.

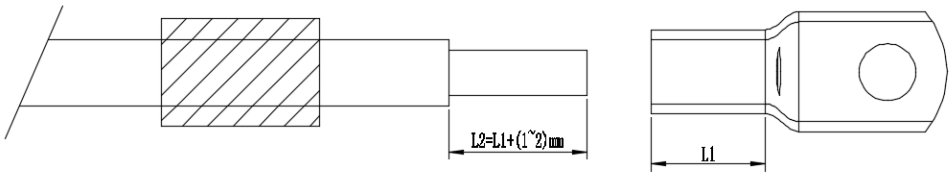


Figure 8-4 Cable stripping dimension drawing

2. Crimping

First, thread the heat shrink tubing into the cable

After ensuring that the wire core is plugged in place, use hydraulic pliers to press the terminal tightly.

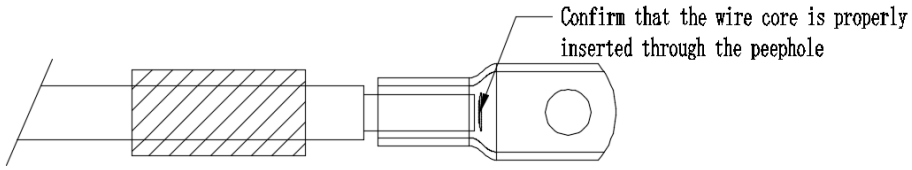


Figure 8-5 Terminal crimping diagram

3. Heat shrinkable tubing blow molding

After threading the sleeve into the copper tube terminal of the wire ear, blow mold it with a hot air gun.

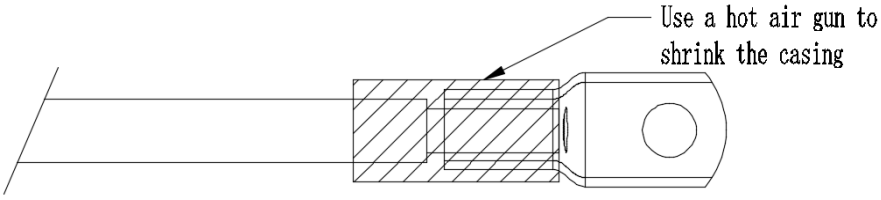


Figure 8-6 Blow molding diagram of heat shrink tubing

8.3 Communication cable connection

1. The wiring relationship of RJ45 crystal head is as follows

PIN	Color
1	Orange white
2	Orange
3	Green white
4	Blue
5	Blue white
6	Green
7	Brown white
8	Brown

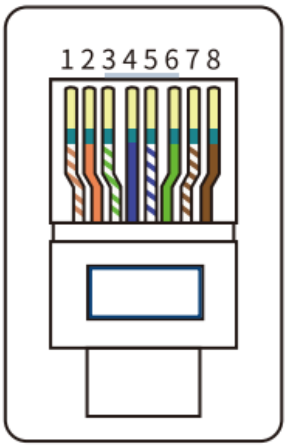


Figure 8-7 RJ45 pin color correspondence diagram

8.4 Block the wire hole

After connecting the wires, use fireproof mud to seal the power line inlet hole and communication line inlet hole. The correct sealing mud sealing construction standard is shown in the following figure.

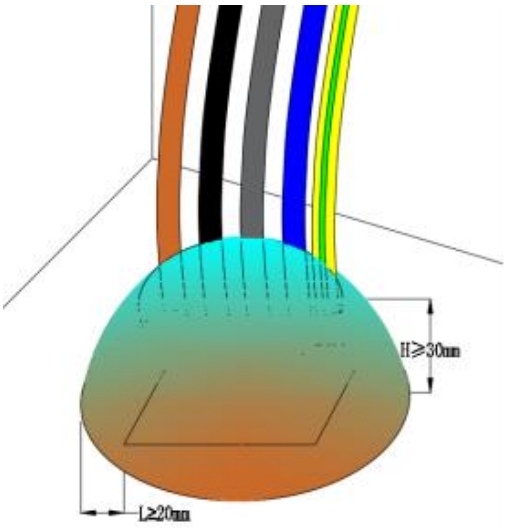


Figure 8-8 Construction drawing of fireproof mud

9 Power on/off operation of equipment

9.1 Power on detection

9.1.1 Routine Inspection

No.	Inspection item	Acceptance criteria
1	Equipment appearance	The appearance of the equipment is intact, without damage, rust, or paint peeling. If there is paint peeling, please perform touch up operation. The equipment labels are clear and visible, and damaged labels should be replaced in a timely manner.
2	Cable appearance	The cable protection layer is wrapped intact without obvious damage. The conduit cable and hose are intact.
3	Cable connection	The cable connection position is the same as the drawing design. The terminal connection is firm and reliable, and the specifications are consistent with the drawings. The labels on both ends of each cable are clear and oriented in the same direction.
4	Cable wiring	The wiring meets the principle of separating strong and weak electricity. The cables are neat and aesthetically pleasing. Cut the wire buckle joints neatly without any exposed spikes or other phenomena. Leave a margin as required at the turning point and do not tighten it. The wiring is straight and smooth, and there is no crossing of cables inside the cabinet.
5	Copper busbar for battery cabinet	The color of the heat shrink tubing corresponding to the copper bar is consistent with the drawing Copper bars are not deformed, and heat shrink tubing is not damaged.
6	Switch	All switches are on the OFF state

9.1.1 Electrical component testing

No.	Inspection item	Acceptance criteria
1	Circuit breaker	Circuit breaker in open state
2	Lightning arrester	Lightning protector status indication is green
3	Battery module	No damage to the appearance of the battery module

No.	Inspection item	Acceptance criteria
4	Grounding	The grounding conductor is reliably connected to the battery cabinet grounding terminal block or copper strip.
5	Entry and exit line blockage	Plugging of cable crossing holes completed
6	Cable	Cable mounting bolts or connectors are tightened and cables are stretched without looseness
7	Emergency stop	Check if the emergency stop button is in the released state

9.1.2 Pre power on inspection

No.	Inspection item	Testing content
1	Cable	Before powering on, check if the power cable wiring is secure and free of burrs
2	Circuit	Check the multimeter to ensure that there is no short circuit between phases A, B, and C, and between phases A, B, and C and N or PE

9.1.3 Insulation Test

1. After the installation of the module maintenance switch is completed, the insulation test method needs to be retested: adjust the voltage of the insulation meter to DC1000V, clip the red meter head to the control box BAT+/-, DC+/- respectively, clip the black meter head to the energy storage cabinet PE grounding terminal, and press the test button;
2. Judgment criteria: Insulation resistance ≥ 1M Ω;

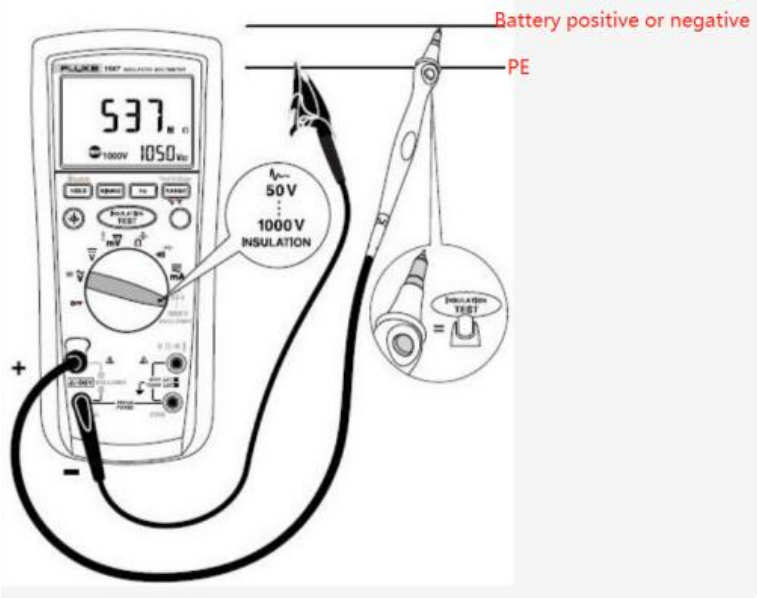


Figure 9-1 Insulation test diagram

9.2 System grid connection startup

Step 1: Pre start check: Confirm that all connections are made according to the installation instructions: AC circuit

breaker QF1 is in the OFF state, and the emergency stop button is in the released state; The DC circuit breaker and ship shaped switch of the energy storage cabinet control box are in the OFF state.

Step 2: Close the AC circuit breaker QF1 and then close the circuit breaker QF2;

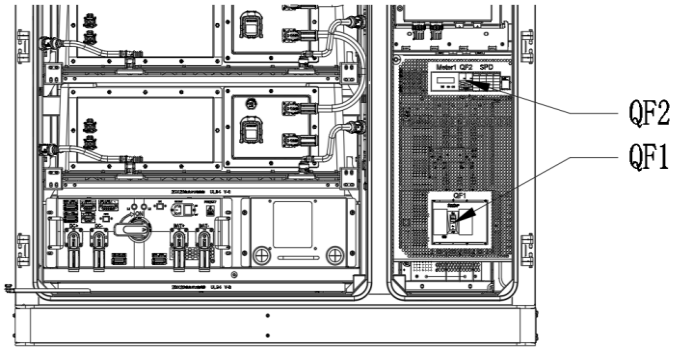


Figure 9-2 Circuit breaker operation position diagram

Step 3: Close the ship shaped switch on the front panel of the cluster control box and power on the energy storage cabinet system;

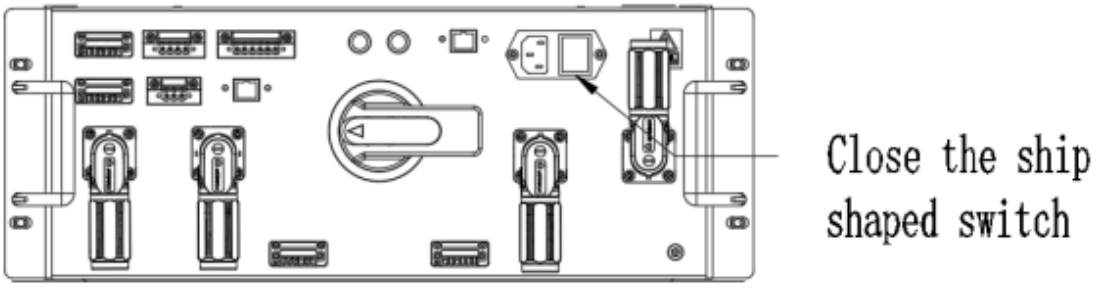


Figure 9-3 Schematic diagram of the ship type switch for the closed control box

Step 4: Check if the battery pack voltage on the display screen is normal. If there is no fault, close the control box circuit breaker QF of the energy storage cabinet;

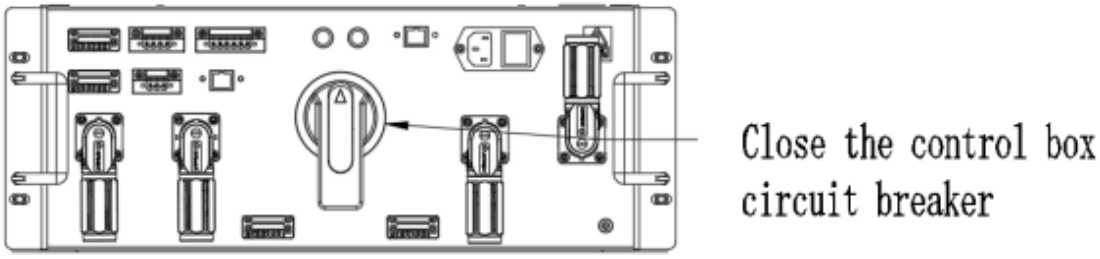


Figure 9-4 Schematic diagram of QF circuit breaker for closed control box

Step 5: Confirm whether there is protection information on the main page of the human-machine interface. If it displays "0", it indicates that the system auxiliary wiring is normal;

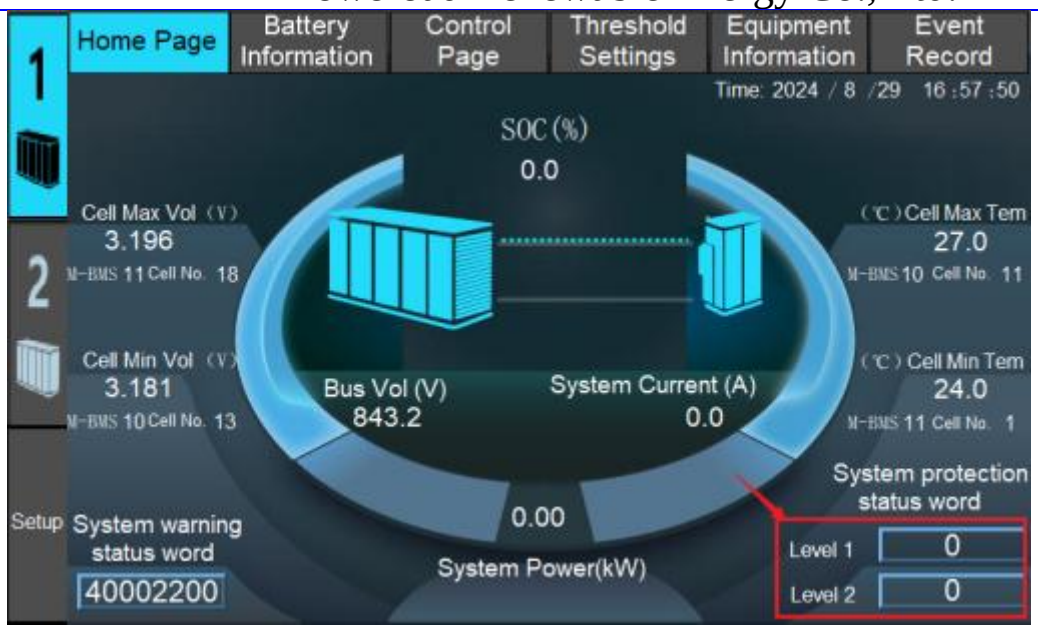


Figure 9-5 Confirm whether there is protective information on the homepage

Step 6: Select the current device on the touch screen of the energy storage cabinet and turn it on;

Please refer to section 10.2.5 for details of the closing operation instructions;

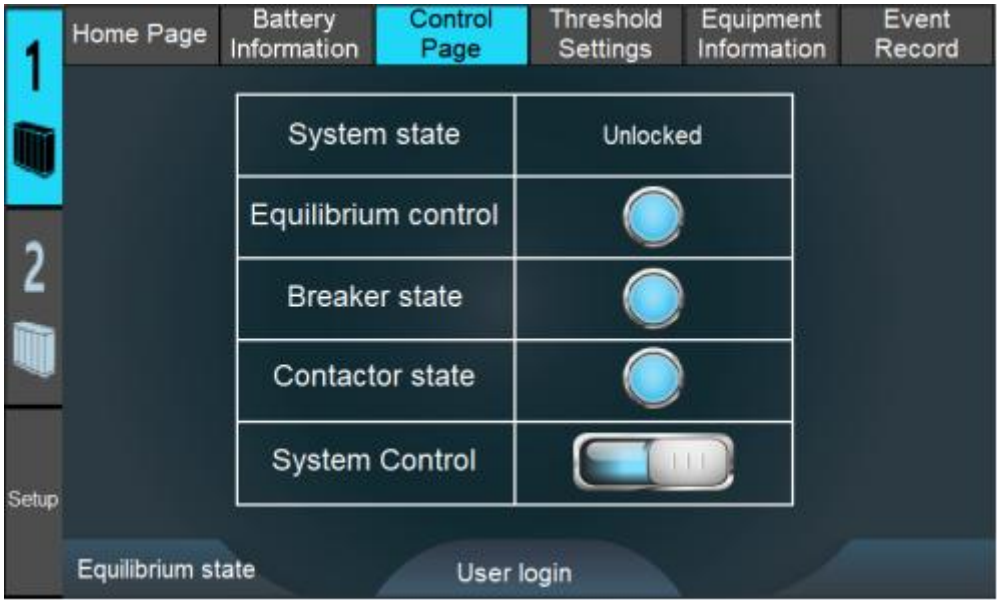


Figure 9-6 Confirmation of contactor engagement information

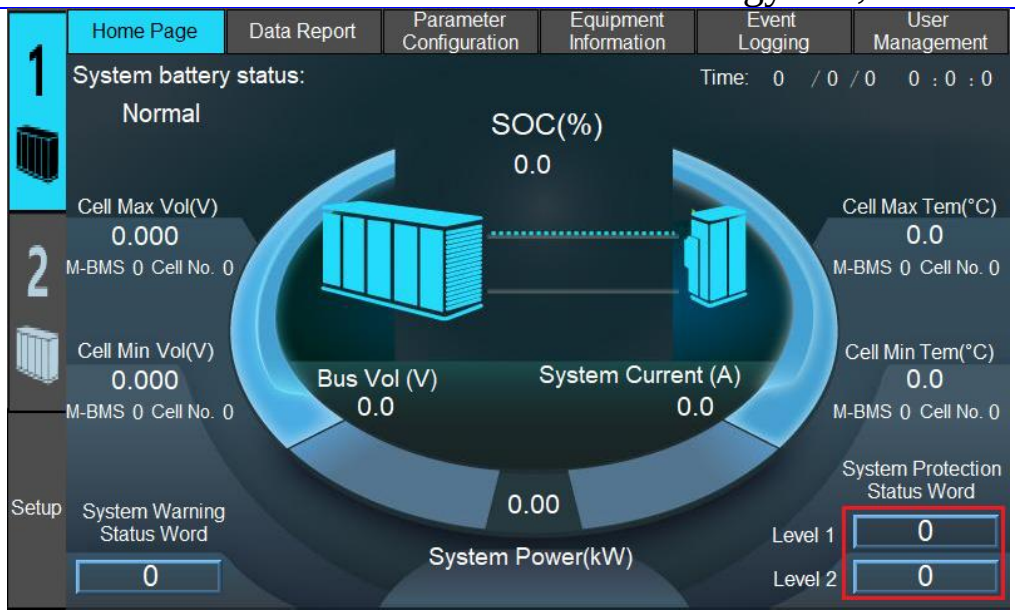


Figure 9-7 Confirming the presence of faults

Step 7: Check the reported data on the main page. If there are no faults, the user EMS can perform charging, discharging, and power scheduling on the system;

9.3 System emergency stop step

The system emergency stop button is located on the door of the battery cabinet. When there is an abnormality in the system operation, press the emergency stop button (as shown in the figure below), and the system will disconnect the DC circuit breaker inside the battery cabinet control box. Then, the software will control the disconnection of the DC contactor inside the control box, completely cutting off the external connection of the battery.

After troubleshooting, in order to restart the energy storage system, the emergency stop button must be rotated clockwise to release the locking state (see the figure below);

Clockwise rotation button

Figure 9-8 Schematic diagram of emergency stop reset

9.4 Cluster control box DC circuit breaker tripping recovery closing

When the first level protection occurs or the emergency stop button is pressed, the system will disconnect the circuit breaker for protection. After troubleshooting, it is necessary to manually restore the circuit breaker and restart the energy storage system.

Closing process:

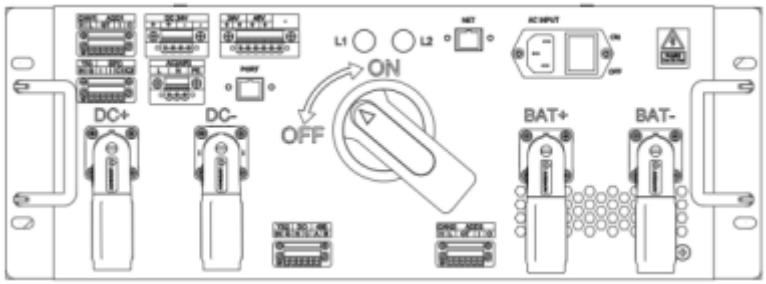


Figure 9-9 Circuit breaker tripping status

Step 1: Turn the release position to OFF and level at 15 ℃, and hear the sound of recovery

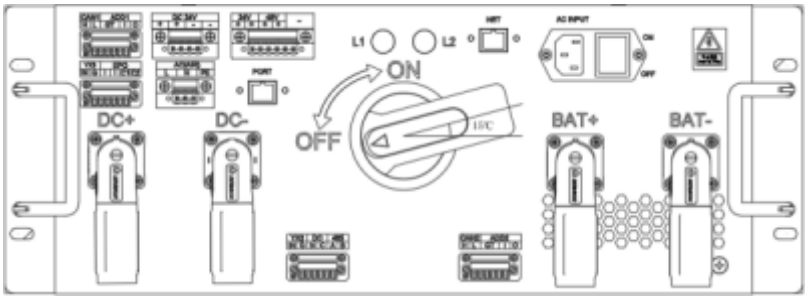


Figure 9-10 Schematic diagram of circuit breaker recovery trip

Step 2: Rotate the button clockwise to the ON position

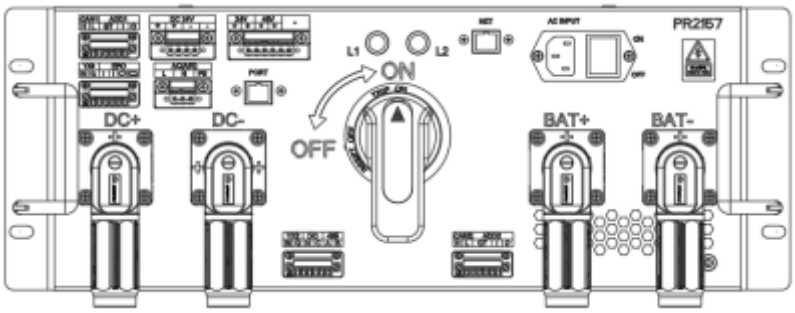


Figure 9-11 Close the circuit breaker again

10 HMI operation introduction

The LCD touch screen is located above the door of the integrated control cabinet, making it convenient for users to view data and perform related operations. The touch screen is designed with an ESS function module, which is used to display energy storage system related information and perform related controls.

Note: For the convenience of users to operate the touch screen, this document has provided a large number of touch screen interface images. The parameter values and other specific details in the images are for illustrative purposes only. Users should refer to the actual touch screen display of the received product. The account provided for users is as follows.

Account	USER
Password	6666

Warning

The touch screen contains a large number of parameters related to the operation of the energy storage system. All modifications and settings to parameters must be completed by designated professionals. Do not modify parameters with unclear meanings without authorization. Please refer to this manual or consult the relevant staff of our company.

10.1 Backlight function

If the user does not perform any click operation on HMI within a certain period of time,then:

If the not operated time reaches 5 minutes,HMI will enter the screensaver display;

If the not operated time reaches 10 minutes,HMI backlight will turn off;

When the user performs any click operation,HMI backlight lights up.

10.2 Battery cabinet system interface

10.2.1 IP address setting

When the energy storage system is powered on,HMI will start automatically,and after successful startup,it will enter the main page automatically,please prioritize the “system settings”for system connection.Please wait for the communication connection between HMI and the energy storage system to be successful before proceeding to the

next step.

1. HMI automatically enters the homepage when it is powered up.

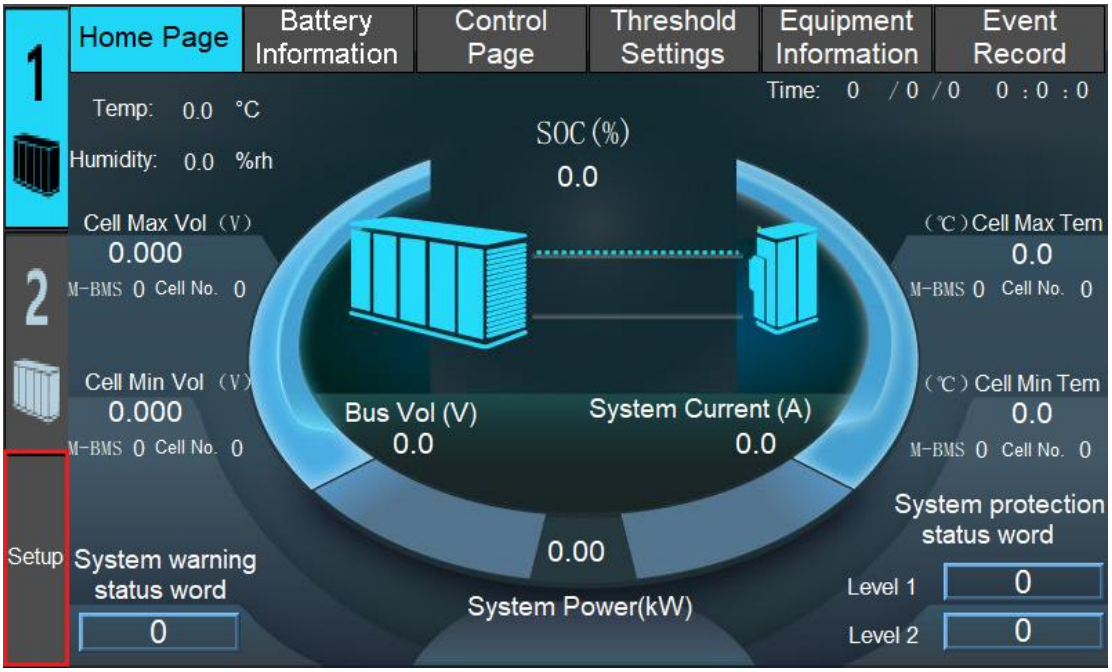


Figure 10-1 Homepage

2. Click the "Setup" button in the bottom left corner to bring up the interface shown in the following figure.

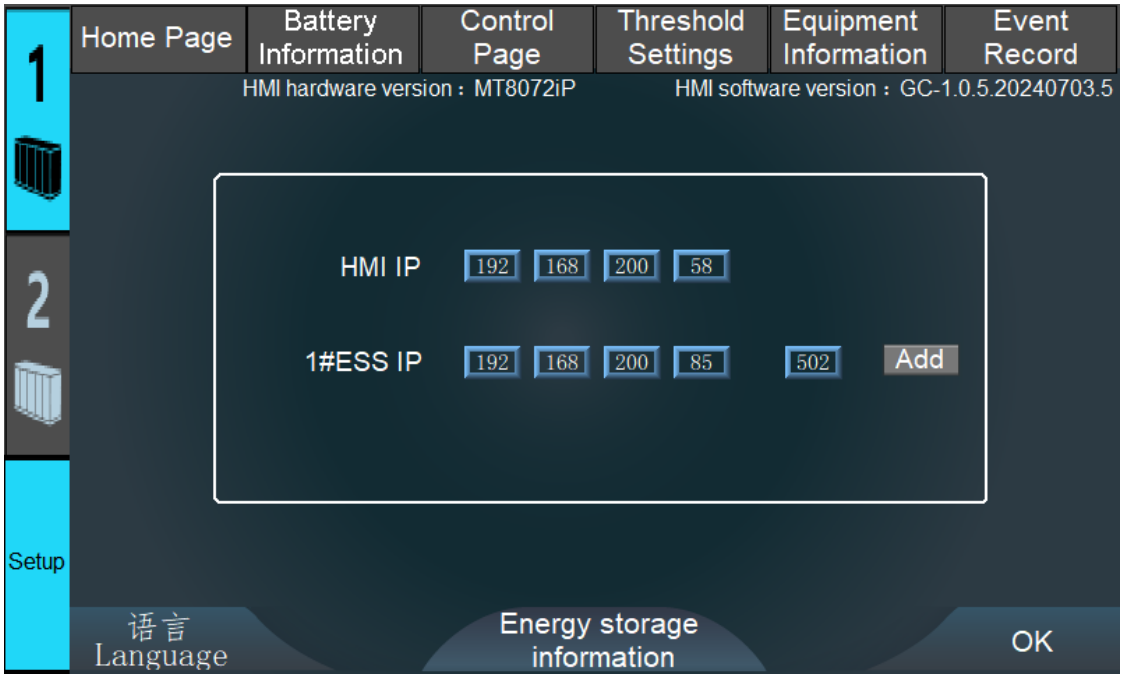


Figure 10-2 IP setting

3. This page is the settings page for connecting the touch screen to the energy storage system. Enter the corresponding IP to connect to the corresponding energy storage cabinet; '1 # ESS' is the first energy storage system. Clicking' Add 'will display' 2 # ESS'. Currently, 2 # ESS is a reserved item and has not been used yet.

4. As the screen of the battery cabinet is connected to the C-BMS, the default IP of the C-BMS is 192.168.1.60. While ensuring that the screen IP is on the same network segment as the default IP, select "1 # ESS", enter

"192.168.1.60", and click "Finish" to automatically return to the homepage. The connection is successful (note that if the IP of the C-BMS has been modified, the modified IP can be connected). Here, the modified IP is 192.168.200.85, and the default port number is 502.

5. Click the "Language" button in the bottom left corner to switch languages. Currently, only "Chinese" and "English" are supported.

Figure 10-3 Language setting

10.2.2 Energy storage page

（1）After setting the IP of "1 # ESS" in the settings interface, you can view the data related to the energy storage system. Click on the homepage to switch to the homepage interface, which will display important operational information in the energy storage system, as shown in the following figure.

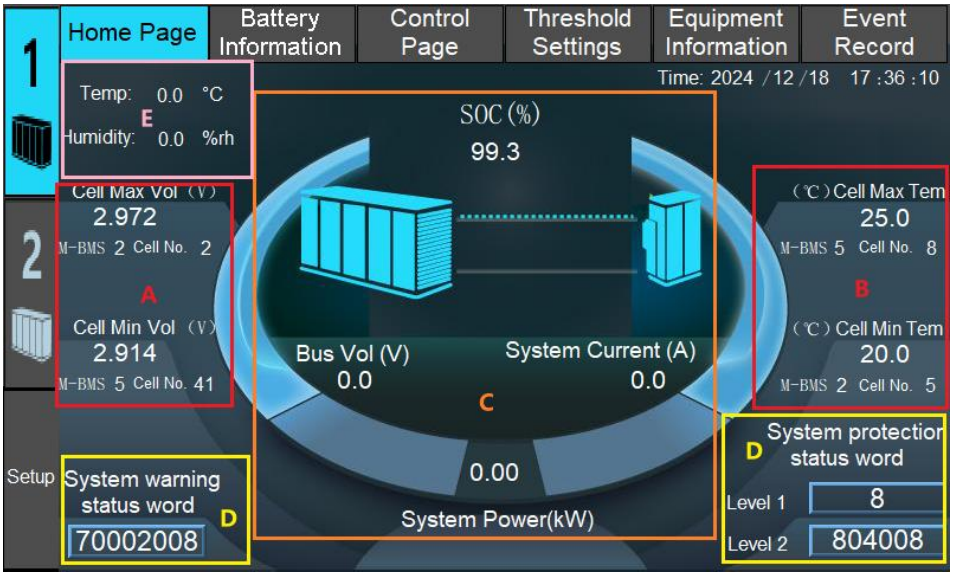


Figure 10-4 Energy storage homepage

1. A represents the "maximum voltage of the battery cell", "minimum voltage of the battery cell", and "position" in the current energy storage system.

2. B represents the "maximum temperature of the battery cell", "minimum temperature of the battery cell", and "position" in the current energy storage system

3. C represents the "SOC", "total voltage", "total current", and "total power" of the current energy storage system

4. D is whether there is an alarm or protection occurring in the current energy storage system. When there is no alarm or protection occurring, the system's alarm status word and protection status word default to 0. When there is a corresponding alarm or protection occurring, the value of the status word is not 0. Click on the relevant status word to view the corresponding status word analysis, as shown in the following figure.

5. E is the temperature and humidity data inside the cabinet.

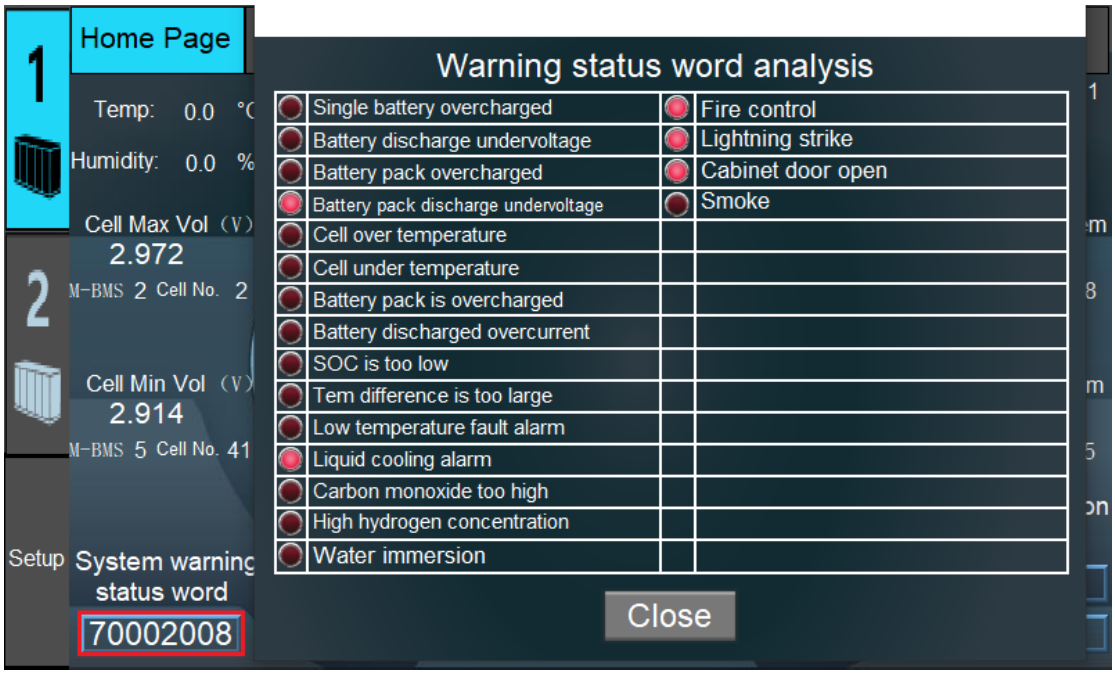


Figure 10-5 Status word analysis interface

10.2.3 Viewing battery pack information within the current battery cluster

1. Enter the “Energy Storage Homepage”

2. Click the "Battery Information" button above to enter the battery information interface, as shown in the following figure.

Figure 10-6 Battery pack information

① This page displays information about battery packs within the battery cluster. The data below  is for battery pack 1, the data below  is for battery pack 2, and so on.  indicates that the M-BMS is online, and  indicates that it is offline.

② The displayed data includes "pack voltage", "maximum and minimum voltage inside the battery pack", and "maximum and minimum temperature inside the battery pack".

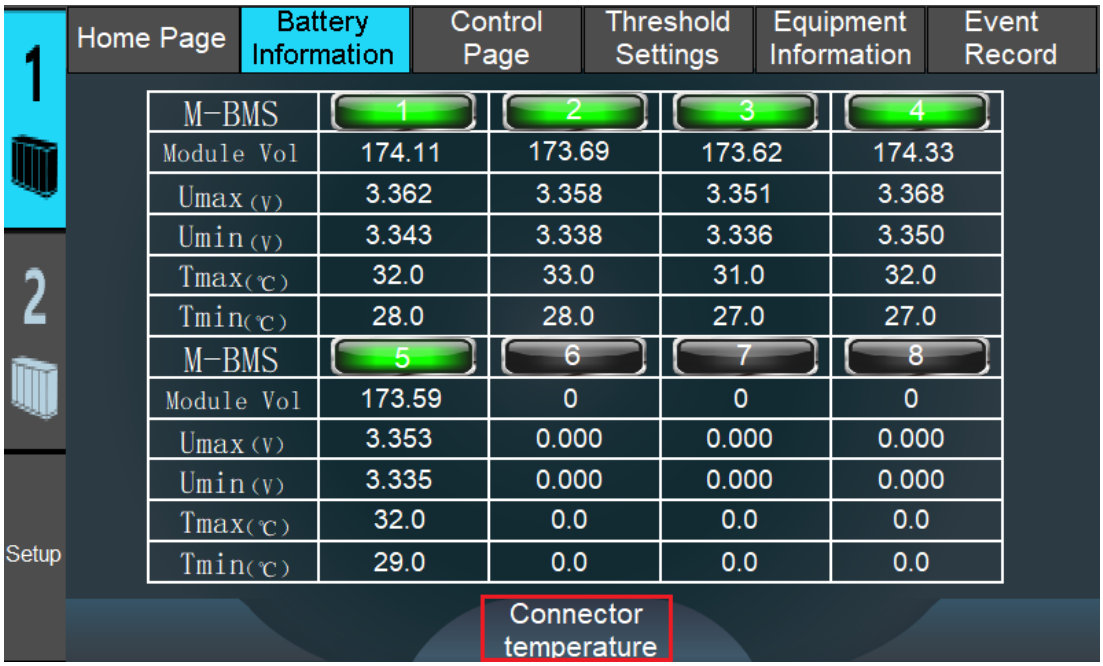
10.2.4 View individual cell information inside the battery pack

1. Click any "  " button to pop up the interface shown in the following figure.

Figure 10-7 Individual information of battery pack

2. This page displays information about the battery cells inside the battery pack. The displayed data includes "voltage of 1-52 individual cells" and "temperature". When the configured number of cells exceeds the maximum number that can be viewed on one page, the option for the next page will appear.

3. Click on the connector temperature at the bottom of the battery information interface to view the temperature of each individual package of positive and negative connectors. As shown in the following figure.



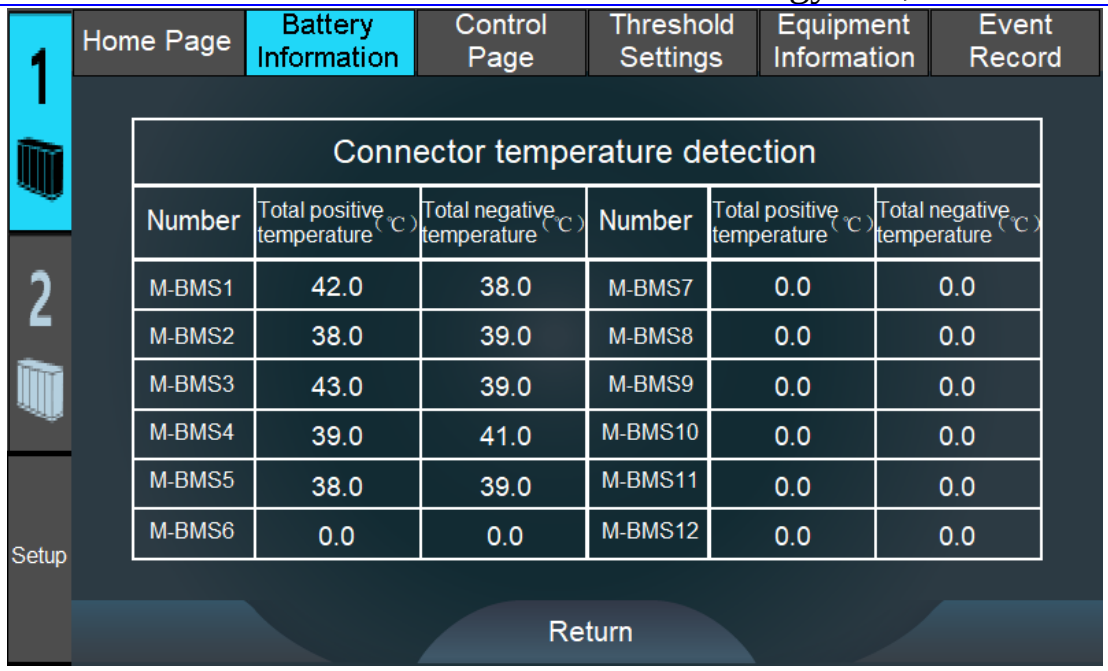


Figure 10-8 Connector temperature

10.2.5 Control page

1. Click on the control page to enter the interface shown below.

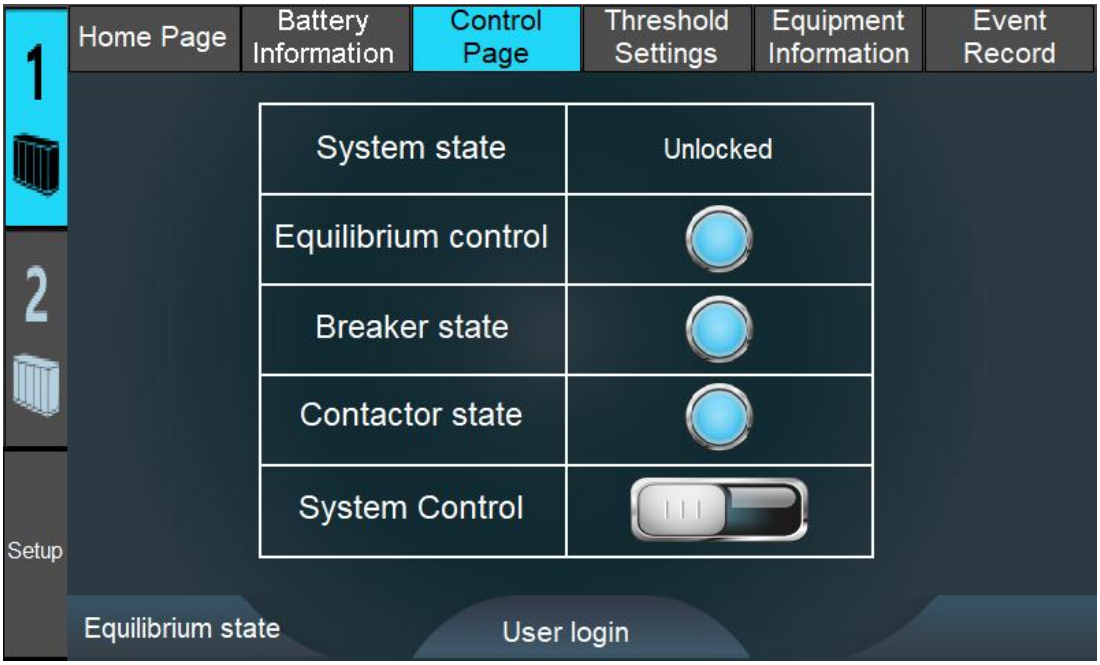


Figure 10-9 Control Page

2. This interface allows you to check whether the system status is locked. If the system is locked, it cannot be closed, charged or discharged. Secondly, you can check the status of the circuit breaker, contactor, and whether the balance is turned on. If the circuit breaker and contactor are all closed, the light will turn on; otherwise, the light will turn off. The same applies to equilibrium control. If the equilibrium control is turned

on, the light will turn on; otherwise, the light will turn off.

3. Click on User Login, select User Permissions Login, user name: user; Password: 6666. After logging in, click the  button next to the system control to enter the system control interface. As shown in the figure below, this interface can allocate addresses to system modules, enable balancing, and close contactors.

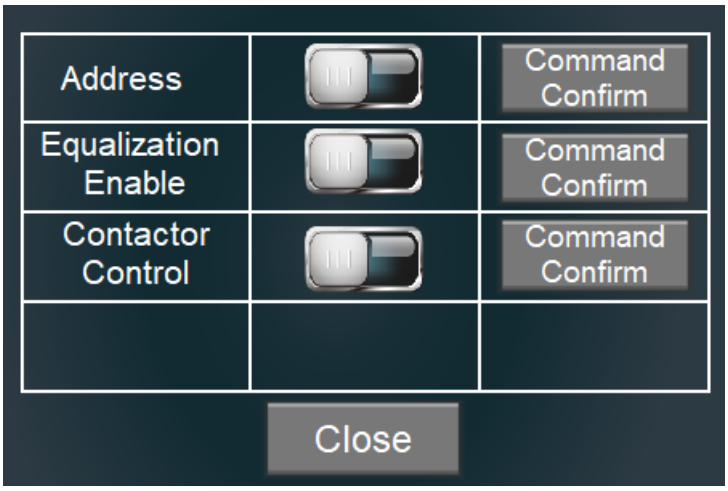


Figure 10-10 System control

4. Click on  shown in Figure 10-8, when the button switches to  , select the command to issue, and the corresponding sub address, open balance, and contactor control commands can be issued.

10.2.6 Viewing energy storage system operational threshold

1. Click on threshold settings to enter the threshold settings interface, where you can view threshold related information, as shown in the following figure.

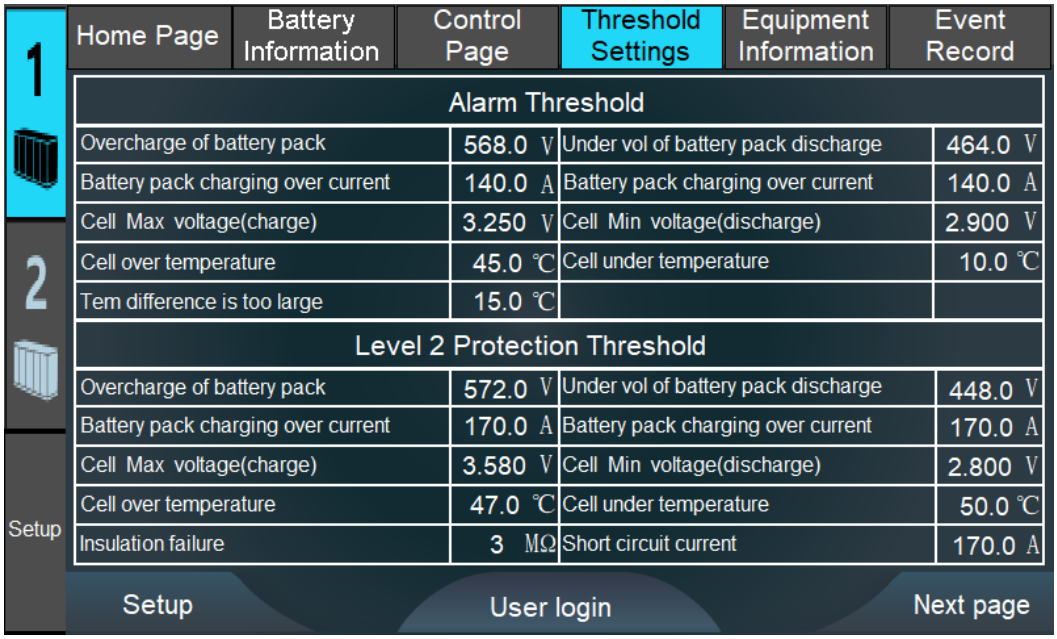


Figure 10-11 Threshold interface

10.2.7 Equipment information

1. Click on the device information to switch to the device information interface, as shown in the following figure. The device data that can be viewed on this interface now includes air conditioning, fire protection, dehumidifier, carbon monoxide, and hydrogen, with PCS data being a reserved item.

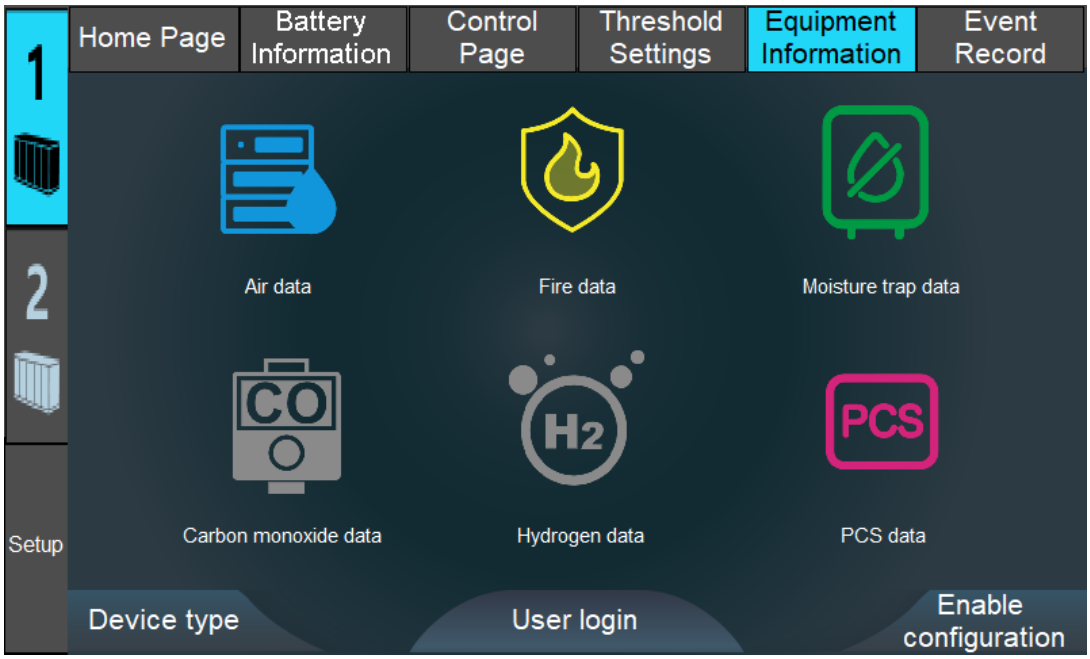


Figure 10-12 Equipment information interface

2. Click on the icon to jump to the liquid cooling machine data interface and view the relevant data of the liquid cooling machine, as shown in the following figure.

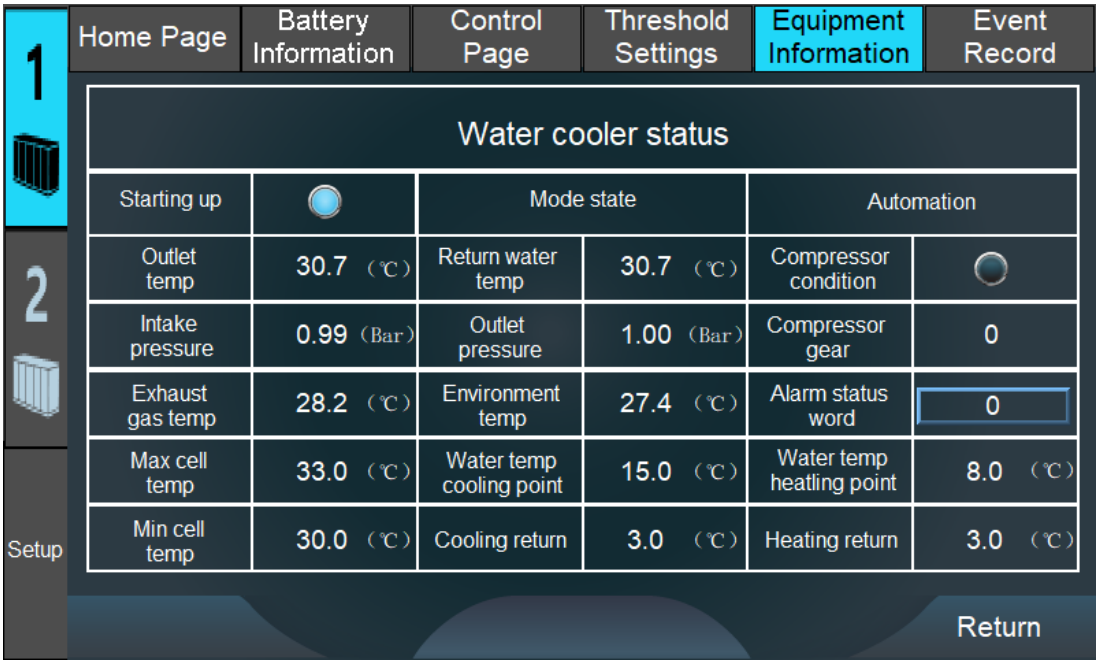


Figure 10-13 Liquid cooling data interface

① The indicator lights for the compressor status on the device information interface have three types of displays, namely standby, running, and fault. The indicator lights are in three states: not lit, blue, and red.

② There are five mode states: stop, internal circulation, cooling, heating, and fully automatic (based on water temperature).

③ The compressor has one, two, and three gears.

3. If the system is configured with fire protection, as shown in the following figure.

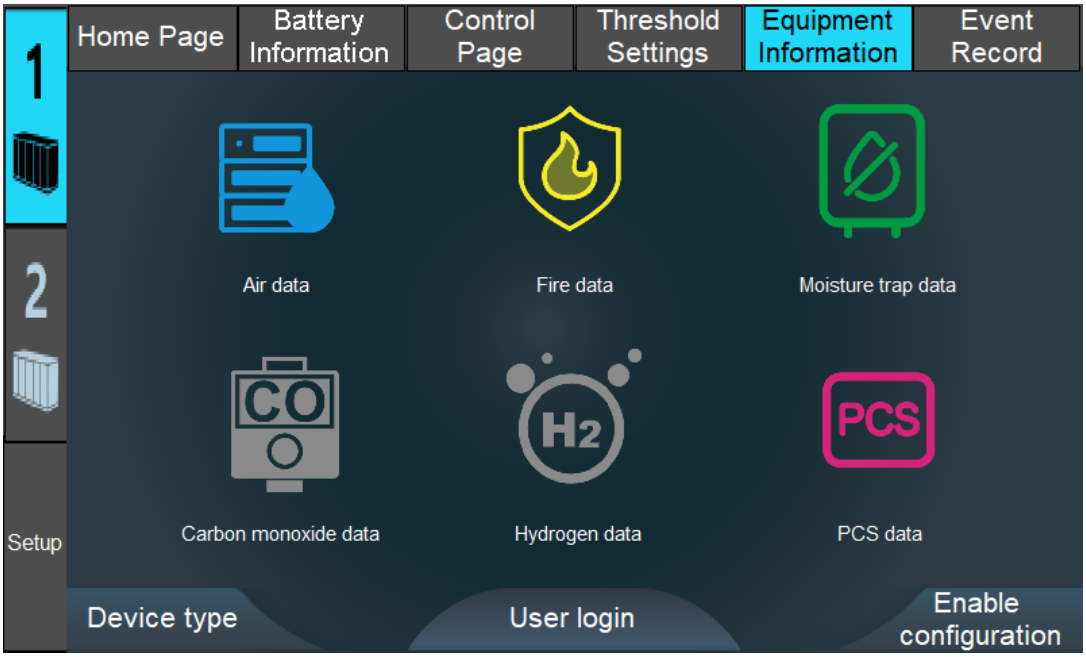
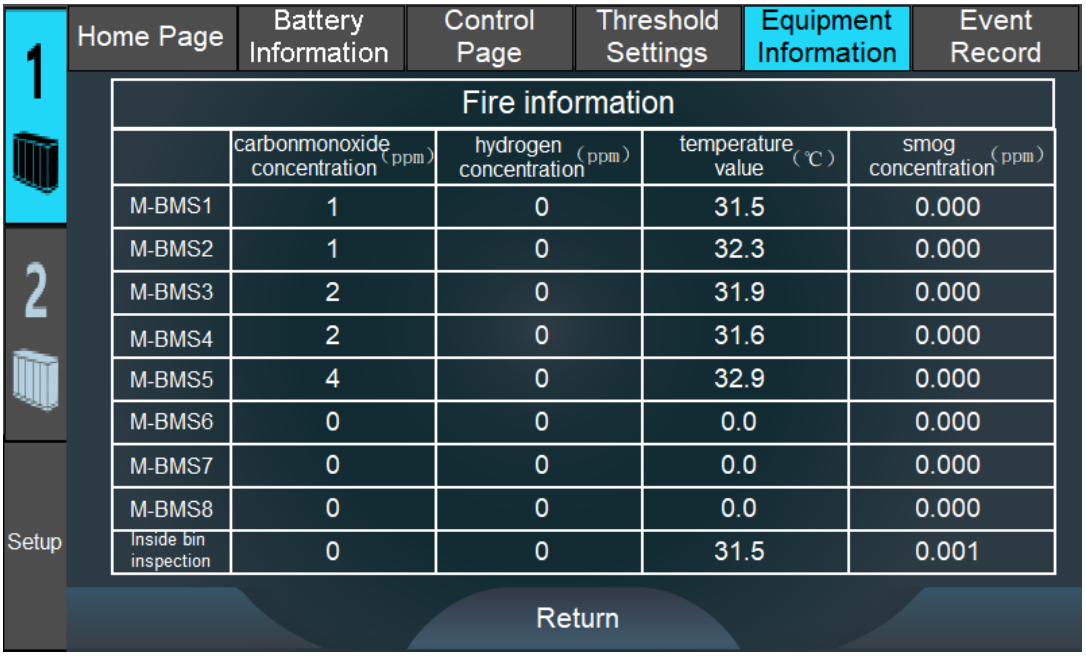


Figure 10-14 Configuration of fire protection

4. Click on the fire icon to switch to the fire interface and view fire related data information, as shown in the following figure.



	carbonmonoxide concentration (ppm)	hydrogen concentration (ppm)	temperature value (℃)	smog concentration (ppm)
M-BMS1	1	0	31.5	0.000
M-BMS2	1	0	32.3	0.000
M-BMS3	2	0	31.9	0.000
M-BMS4	2	0	31.6	0.000
M-BMS5	4	0	32.9	0.000
M-BMS6	0	0	0.0	0.000
M-BMS7	0	0	0.0	0.000
M-BMS8	0	0	0.0	0.000
Inside bin inspection	0	0	31.5	0.001

Figure 10-15 Fire alarm data

5. If the system is configured with a dehumidifier, clicking on the icon can view the dehumidifier related data, as shown in the following figure.

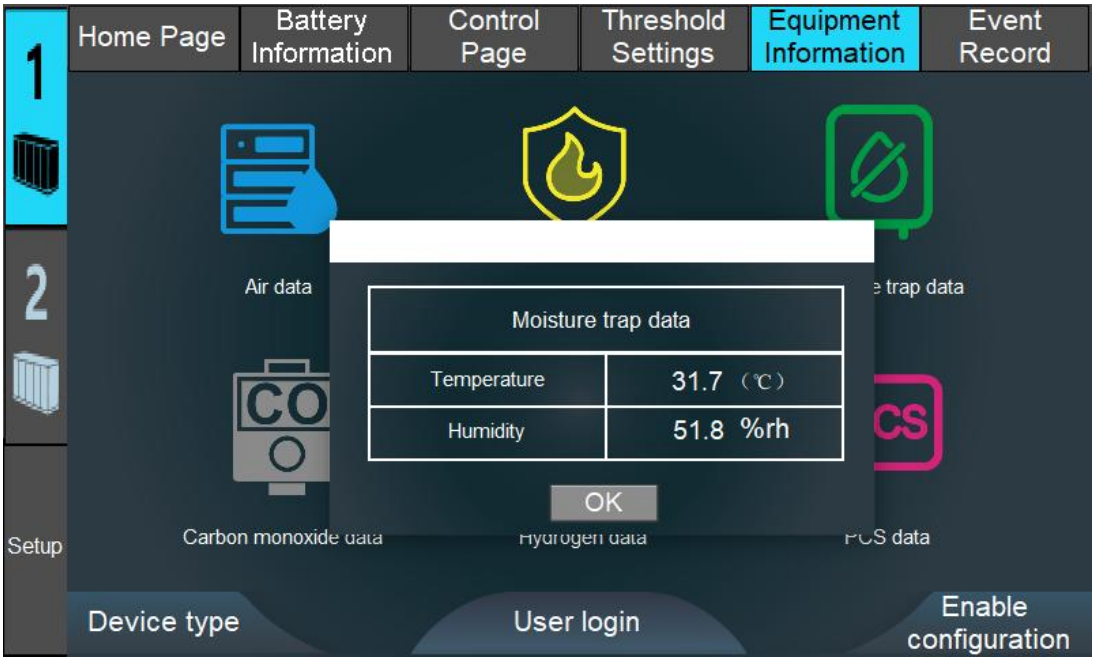


Figure 10-16 Dehumidifier data

10.2.8 Event viewing

1. Click on the event record to enter the event record interface, as shown in the following figure.

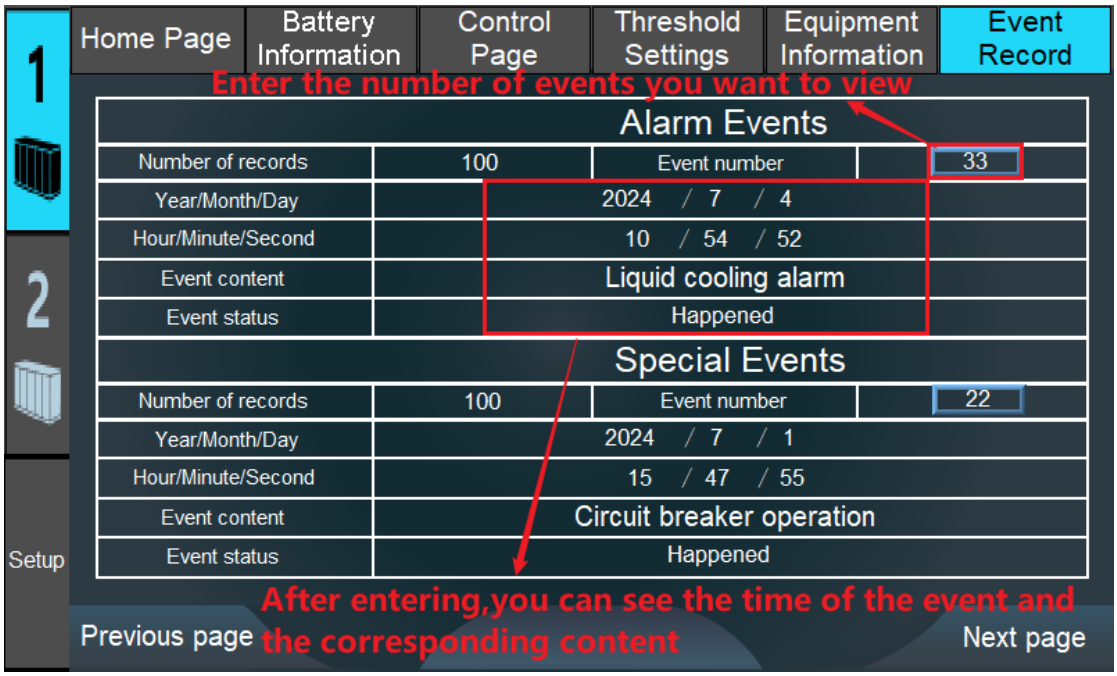


Figure 10-17 Event record

2. On this interface, you can view the total number of events that have occurred. Only 100 event records can be retained (the latest one will be saved), and the corresponding event number can be viewed through the time sequence on the right. After selection, the time, content, and status of the event will appear below.

11 Failure analysis and handling

11.1 Failure alarm content and response action

No.	Fault alarm content	Response action
1	Insulation fault	1. Cut off the contactor, the control box cannot be closed
2	Cell over voltage	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class I protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
3	Cell under voltage	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
4	Over temperature	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
5	Under temperature	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
6	Cluster total voltage over-voltage	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
7	Cluster total voltage under-voltage	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
8	Current charging over current	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker

9	Cluster current discharging over current	Alarm: The system will feedback the alarm signal to the superior, and it is recommended to stop the (PCS) power Class II protection: Disconnect cluster contactor Class I protection:Disconnect cluster breaker
10	Communication failure	1. System power outage 2. Cut off the cluster contactor
11	Contactor malfunction	1. System power outage
12	Short-circuit fault	1. System power outage 2.Disconnect the control box contactor after disconnecting the DC side circuit breaker
13	Emergency stop malfunction	1. Cut off all cluster contactors 2. Cut off the DC side circuit breaker
14	Lightning arrester malfunction	1. Cut off all cluster contactors 2. Cut off the circuit breaker
15	Water immersion	The system will feedback the alarm signal to the superior
16	Fire fighting	The system will feedback the alarm signal to the superior

11.2 Common failure analysis and handling

No.	Fault alarm status	Reason analysis	Troubleshooting
1	Insulation fault	1. Damage or aging of cable insulation skin leads to a decrease in insulation strength; 2. There are foreign objects that make contact between the power circuit and the conductive parts of the cabinet.	1. Check if the insulation of the power cable is normal 2. Check for foreign objects in the power circuit 3. Replace the power cable
2	Cell over voltage	1. Overcharging; 2. Abnormal sampling.	1. Stop charging 2. Check the wire harness
3	Cell under voltage	1. Excessive discharge; 2. The system is idle for a long time, and the battery is in power shortage due to self consumption; 3. Abnormal sampling.	1. Stop discharging 2. Trickle charging 3. Check the wire harness

No.	Fault alarm status	Reason analysis	Troubleshooting
4	Over temperature	1. Air conditioner fault; 2. Fan fault; 3. The air inlet or outlet of the cabinet is blocked; 4. Abnormal sampling line.	1. Check the refrigeration function of the air conditioner 2. Check whether the fan rotates normally 3. Clean the air inlet and outlet of the cabinet 4. Check the wire harness 5. After the system has stood for 24 hours, wait for the temperature to return to normal and restart
5	Under temperature	1. Air conditioner fault; 2. Abnormal sampling line.	1. Check the heating function of the air conditioner 2. Check the wire harness
6	Cluster total Voltage over-voltage	1. Overcharging	1.Stop charging
7	Cluster total Voltage under-voltage	1.Excessive discharge 2.Abnormal sampling line	1.Stop discharging 2.Check the wiring harness
8	Cluster current charging Over-current	1. The system charging power is set high	1.Reset the system power
9	Cluster current discharging Over-current	1.The system discharging power is set high	1.Reset the system power
10	Communication failure	1.Loose communication or power cables 2.BMS fault	1. Check communication and power supply cables 2. Replace the BMS
11	Short circuit fault	1. Short circuit occurs outside	1. Check whether there is a short circuit outside and eliminate the short circuit point
12	Circuit breaker fault	1. Breaker failure 2. Circuit breaker control and wire looseness	1. Check the circuit breaker cable 2. Replace the circuit breaker

No.	Fault alarm status	Reason analysis	Troubleshooting
13	Emergency stop fault	1. Press the emergency stop switch 2. Emergency stop switch failure	1. Check whether the emergency stop switch is pressed 2. Check whether the wiring of the emergency stop switch is loose 3. Replace the emergency stop switch

12 System maintenance instruction

12.1 Routine inspection

System routine inspection items and cycles:

Inspection content	Cycle	Measures to address the problem
Complete cabinet and environmental inspection	Every 3 months	Clean and replace problematic parts
Maintenance and inspection of liquid cooling machine	Every 3 months	Cleaning and maintenance
Fire system inspection	Every 3 months	Replace or repair
Power circuit and circuit main switch check	Every 6 months	Fastening
System cleaning	Every 3 months	Cleaning
Static return pressure of liquid cooling machine ≥ 0.8Bar	Every 6 months	System fluid replacement
Coolant concentration, pH, and dirt impurities	Every 6 months	Replacement of coolant

- Complete cabinet and environmental inspection

The main contents of the inspection of the whole machine cabinet and environment are as follows:

1. Cabinet door tightness.
2. Does the fan impeller sound strange.
3. Dust and dirt inside the fan.
4. Dust and dirt on the dust screen.
5. Is the cabinet inlet well sealed.
6. Check structural components for damage, deformation;

- Maintenance and inspection of liquid cooling machine

The maintenance and inspection of liquid cooling machine mainly include the following:

1. Check the heating and cooling functions of the liquid cooling machine.
2. Check for dirt on the radiator fins of the liquid cooling machine.

- Fire system inspection

The main contents of the fire protection system inspection are as follows:

1. Check if the fire tank is deformed or damaged.

2. Check the feedback signal of the fire tank.

- Inspection of power circuit and circuit main switch

The inspection contents of power circuit and circuit main switch are as follows:

1. Tighten the bolts connecting the power grid and battery cables.

2. Secure the ground wire (PE) and other ground wires of the cabinet.

3. Check various switches of the main circuit, including the main circuit breaker and main contactor.

4. Check the insulation condition (with a meter).

- Control circuit inspection

The inspection contents of control circuit and software are as follows:

1. Check whether the control circuit board and components are loose, and clean them if necessary.

2. Check if the control software is functioning properly.

- Fan inspection

The inspection contents of the components are as follows:

1. Check if the fan is running properly.

2. Is there any looseness, shaking, or severe vibration of the fan.

- Signal circuit inspection

The inspection contents of the signal circuit are as follows:

1. The installation of terminals, plug-in connections, and internal cables of the device must be tightened once a year.

- The process of detecting the pH value of coolant

The inspection contents of the components are as follows:

Prepare tools:

1. pH test paper.

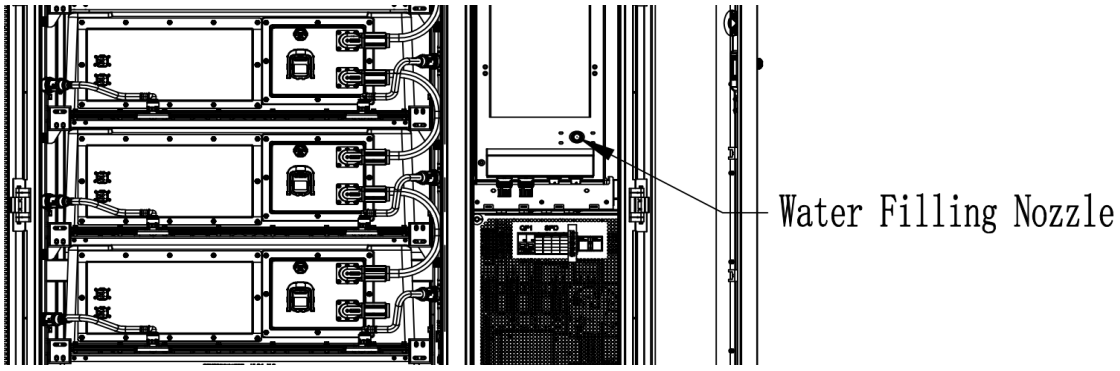
2. Coolant sampling bottle: Ensure that the bottle is clean and free of impurities.

3. Protective gloves and glasses: to prevent coolant from splashing onto the skin or eyes.

Sampling:

1. Open the battery cabinet and locate the coolant injection port.

2. Open the front panel of the chiller, find the valve for the water injection port, and slightly unscrew it (as shown in the figure below)



3. Use a clean sampling bottle to take a certain amount of coolant sample from the water injection port.

4. Ensure that no other liquids or impurities are mixed in during the sampling process.

Testing:

1. Use pH test paper: Take out a pH test paper and ensure that it is dry and not damp.

Drop a drop of coolant sample onto the test paper.

2. After standing still for 10 seconds, observe the color of the test paper

Result:

Compare the color change of the test paper with the standard color chart to determine the pH range of the coolant.

Result analysis: Determine whether the coolant is within the normal range based on the pH value read.

The normal pH range is 7.0~10. If the test exceeds the normal range, it is necessary to replace the coolant as soon as possible for adjustment.

Cleaning and organization:

1. After the inspection is completed, clean the tools and instruments used to ensure they are in good condition for the next use.

2. Return the coolant sampling bottle and pH test paper to their original positions for future use.

Attention:

1. During the sampling and testing process, avoid splashing the coolant onto the skin or eyes. If it does splash, immediately rinse with water and seek medical attention.

2. When using pH test strips, ensure that they are not damp, undamaged, and within their expiration date.

12.2 Regular maintenance

During the operation of the energy storage system, dust will cover the air inlet of the cabinet, causing thermal resistance and affecting air convection in the cabinet. In severe cases, it may cause system shutdown. It is recommended to clean and maintain the air inlet of the cabinet every 3-6 months. The maintenance interval depends on the degree of air pollution and operating time in different regions. Do not use organic solvents such as hot water or gasoline for cleaning.

13 Disclaimer

The use of this product must strictly comply with the precautions and safety instructions provided by the company. The company shall not be liable for any injury or loss caused by violation of safety operation requirements. Operators shall comply with local safety regulations, and the manufacturer of energy storage system shall not be responsible for any loss that may be caused by equipment failure.

See the following disclaimers.

- Transport damage
- Incorrect installation, use, transformation and other operations
- Operation beyond the environment specified in this manual
- Ignore safety warnings and warnings for use
- Experiencing force majeure (e.g., lightning, heavy rain, floods, fires, earthquakes, etc.)

14 About Xiamen Poweroad

If you have any questions about this product, please contact us. Thank you for your use!

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