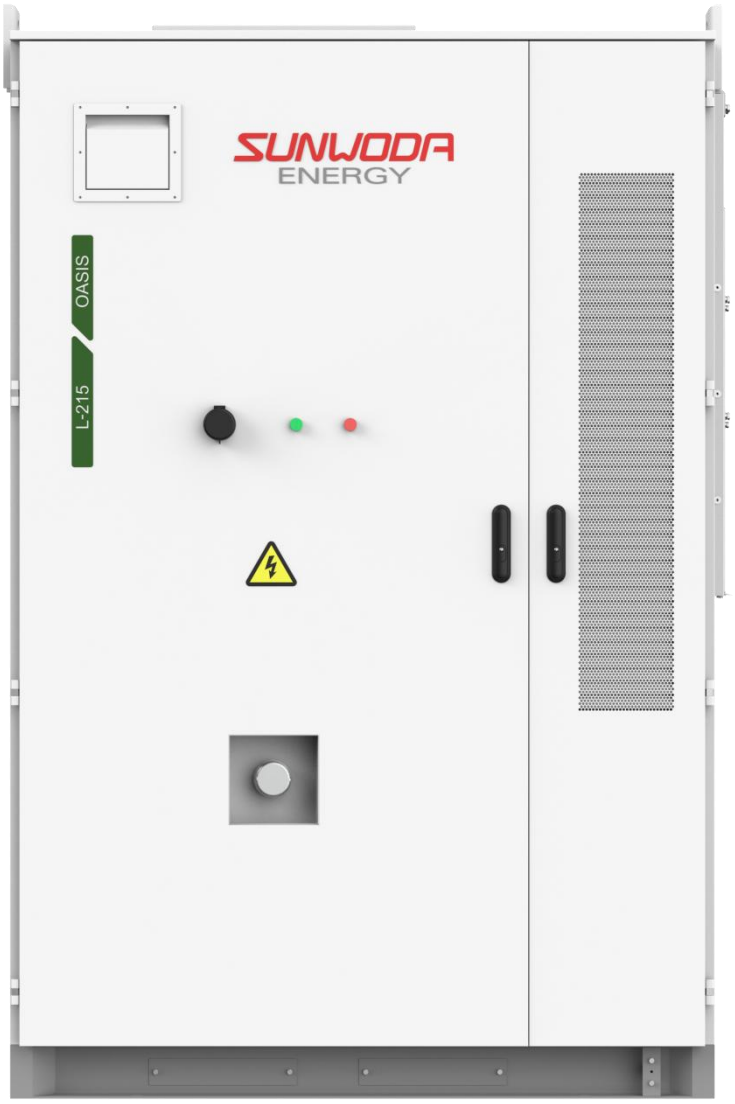
SUNWODA ENERGY



User Manual

Oasis L215

Battery Cabinet System

Preface

Thank you sincerely for purchasing and exploring products developed and manufactured by Shenzhen Sunwoda Energy Technology Co., Ltd. (hereinafter referred to as "Sunwoda"). We genuinely hope that our products and this manual will meet your needs. Your valuable feedback is warmly welcomed, and we will continuously improve and enhance our offerings.

 The content is subject to change based on the latest physical product, and revisions may be made without prior notice.

Due to product version upgrades or other reasons, this document may be updated periodically. Unless otherwise agreed, this document serves solely as a product guide. All statements, information, and recommendations provided herein do not constitute any express or implied warranties.

Content

I. Safety Precaution

1.1 Instruction

The battery cabinet is a professional energy storage device. To ensure correct and safe installation, operation, and usage, please thoroughly read this manual before proceeding. Installation personnel must be professionally trained, possess electrical technical expertise, and fully understand local grid regulations and relevant requirements. The company shall not be held legally liable for any losses or injuries resulting from failure to comply with the operational guidelines emphasized in this manual.

This manual provides detailed information on the Oasis L344 Series, including product features, installation specifications, usage guidelines, troubleshooting, and routine maintenance. Due to ongoing product iterations, the manual content may be periodically updated. The actual product received shall prevail in terms of specific details.

Finally, we hope this product fully meets your needs. We welcome your valuable feedback and suggestions. For any inquiries or requests, please contact us promptly.

1.2 Operational Safety

No.	Item
1	Before using the device, carefully read the "Safety Precautions" to ensure correct and safe operation. Retain the manual for future reference.
2	During operation, observe all warning labels and follow the specified procedures.

1.3 Electrical Safety

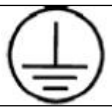
No.	Item
1	Before powering on the device, confirm that the power cables are properly connected and grounded.
2	If re-wiring is required, shut down the device, disconnect both the power supply and battery switches, and ensure the system is fully powered down. Failure to do so may result in live electrical output, posing an electrocution hazard.

1.4 Battery Safety

No.	Item
1	Battery lifespan decreases with elevated ambient temperatures. Regular maintenance

	ensures normal operation and sufficient backup time.
2	Lithium battery maintenance must be performed by personnel with specialized battery expertise.
3	Batteries pose risks of electric shock and short circuit. To prevent injury during maintenance, adhere to the following warnings: A、Do not wear watches, rings, or other metallic objects. B、Use insulated tools. C、Wear rubber-soled shoes and gloves. D、Never place metal tools or similar conductive materials on batteries. E、Before disconnecting battery terminals, always remove the load connected to the batteries.
4	Do not expose batteries to fire, as this may cause explosions endangering personnel.
5	Avoid short-circuiting the battery terminals(positive and negative), as this may lead to electric shock or fire.

1.5 Symbol Description

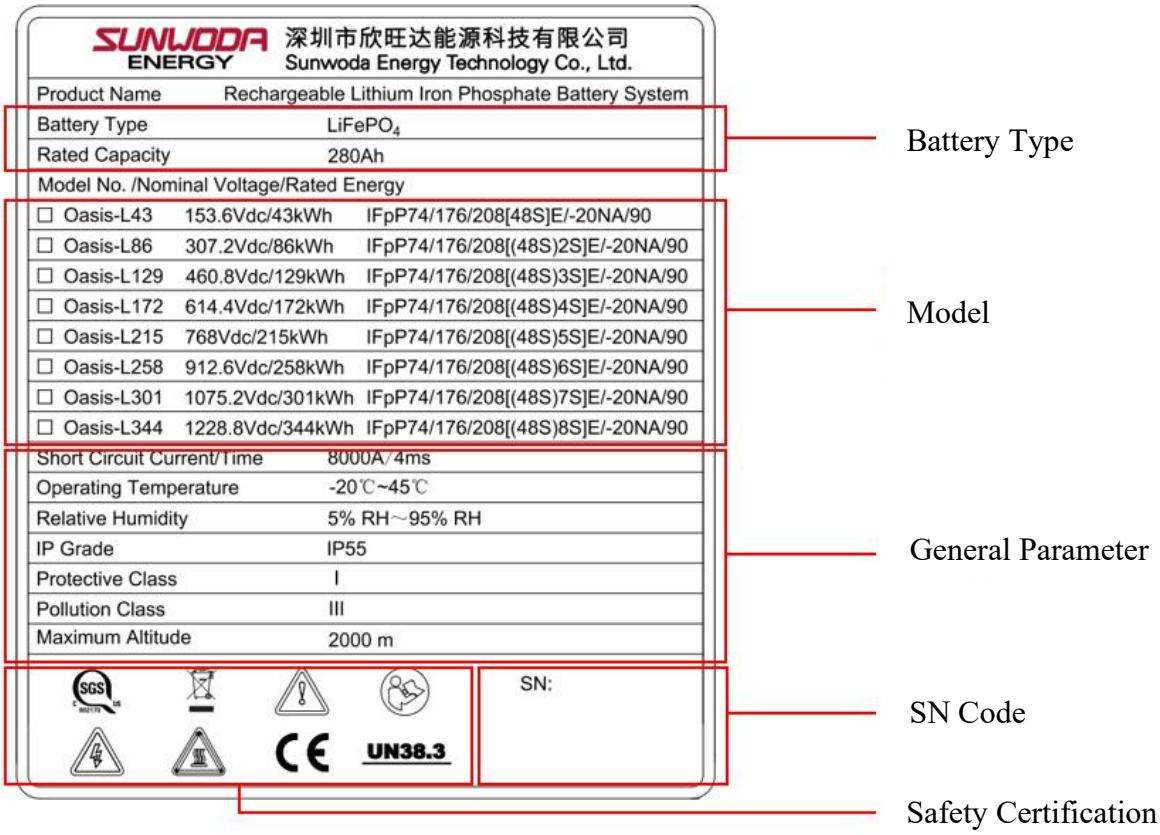
Symbol	Description
	Read the user manual before operation or maintenance!
	High voltage hazard! Do not touch!
	Caution! Potential danger!
	Warning: Dangerous arc!
	High temperature! Do not touch!
	Risk of corrosion!
	AC (Sinusoidal waveform)!
	DC power!
	Protective grounding!

	Wear protective gloves!
	No open flames or sparks!
	Do not step on!
	Recyclable!
	When this product reaches end-of-life, ensure it is delivered to your country's designated Waste Electrical and Electronic Equipment (WEEE) collection point. This guarantees proper disposal and prevents environmental release of hazardous substances.
	When the battery/battery pack reaches end-of-life, ensure it is delivered to your country's designated battery recycling station.
	Danger! Do not touch! Access restricted to authorized personnel only!

II. Product Introduction

The Oasis L215 Liquid-Cooled Outdoor Battery Cabinet leverages Sunwoda's full lifecycle management capabilities and deep technical expertise in lithium battery technology. Integrating high-performance long-life cells, intelligent battery balancing management, multi-dimensional data monitoring, massive data storage, optimized power electronics control, and a high-efficiency liquid cooling thermal management system, it delivers a technologically advanced, reliable, and high-performance energy management solution designed for high-power applications in grid-side and industrial/commercial scenarios. Key features include proactive safety protection, simplified maintenance, and full-scenario adaptability.

2.1 Nameplate Information



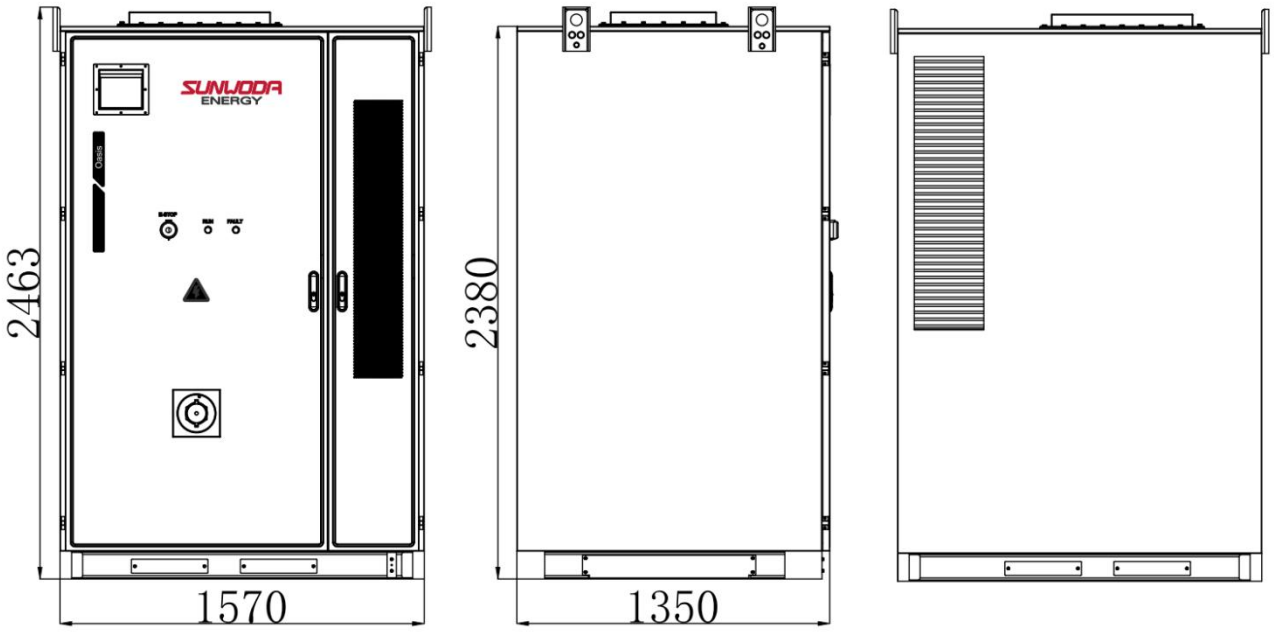
Note: The above nameplate is for reference only. Actual specifications are subject to the physical product.

2.2 System Parameter

Parameter		Oasis L215
Nominal Capacity		215kWh
Rated Charge/Discharge Power		107kW(0.5C)
Max Charge/Discharge Power		215kW
DC Voltage Range		624VDC~876VDC
Ambient Temperature		-30℃～55℃
Humidity		5～95%
Altitude		2000m
Protection Grade		IP55
Dimensions (W × D × H)		1570*1350*2380mm
Weight		2655±100kg
Port	Power Port	CAN/Modbus-TCP
	External Power Port	2 ports (Liquid cooling & monitoring)
	Grounding Port	1 port
	Communication Port	2 ports (CAN & TCP)
Transportation		Sea / Road

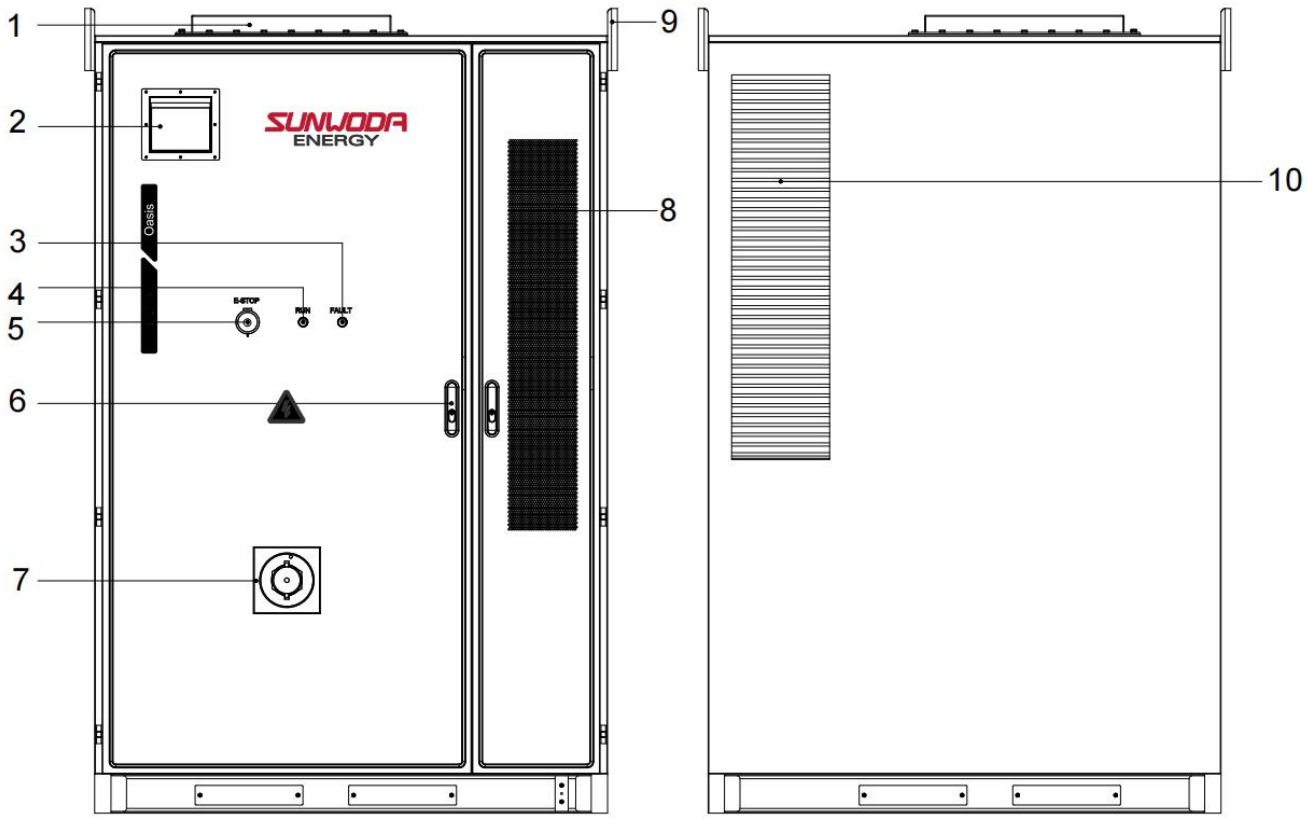
2.3 Structural Layout

2.3.1 External Dimension



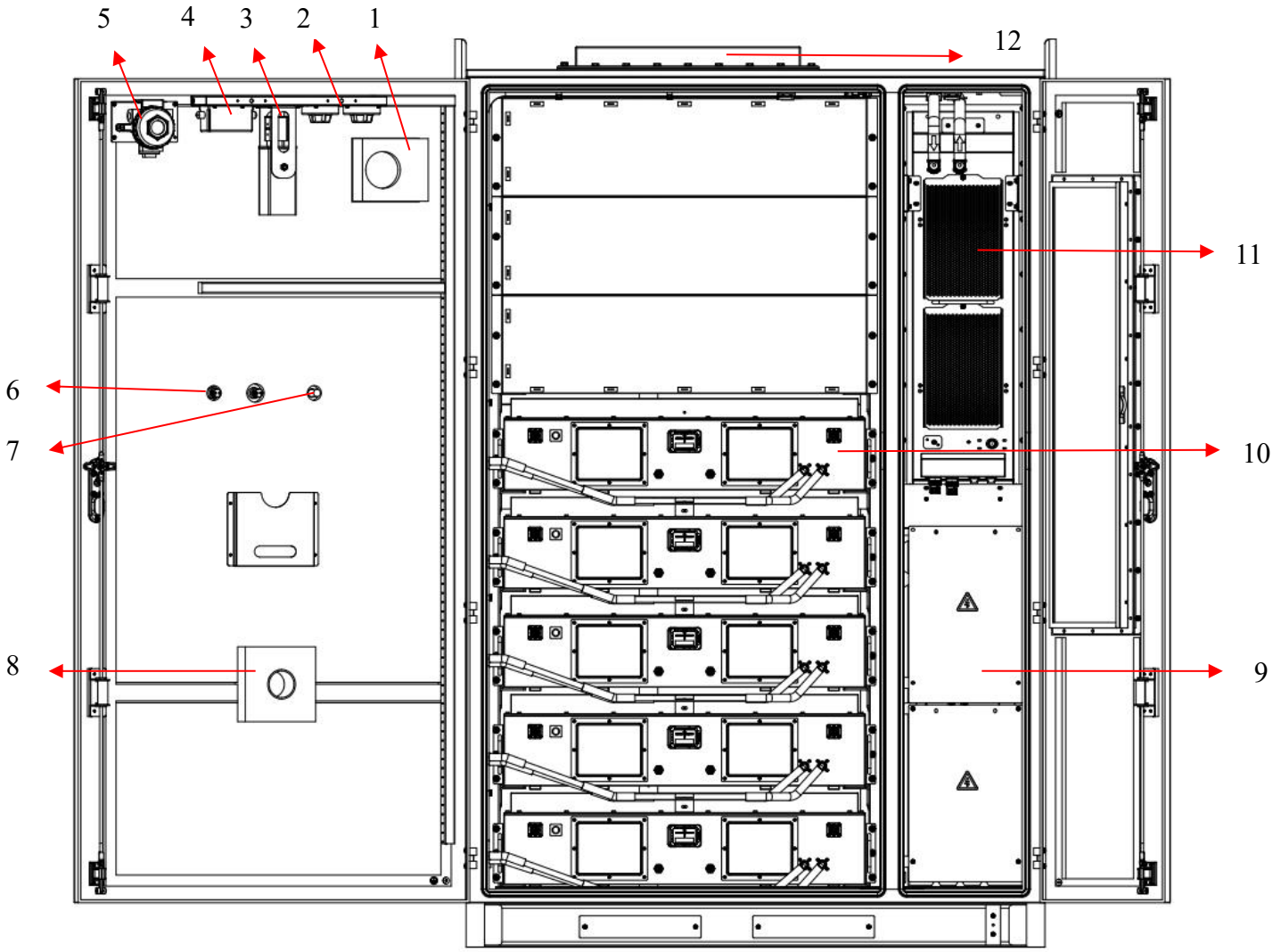
2.3.2 Product Structure

(1) External Structure



No.	Name	No.	Name
1	Explosion vent panel	2	Flammable gas exhaust fan
3	Emergency stop button	4	Operation indicator
5	Alarm indicator	6	Door lock
7	Water fire suppression port	8	Air intake vent
9	Lifting lug	10	Air exhaust vent

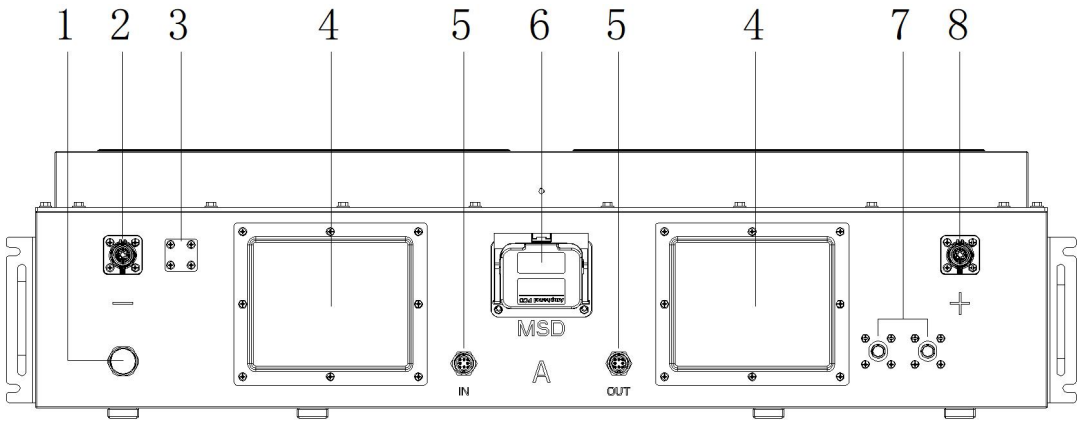
(2) Internal Structure



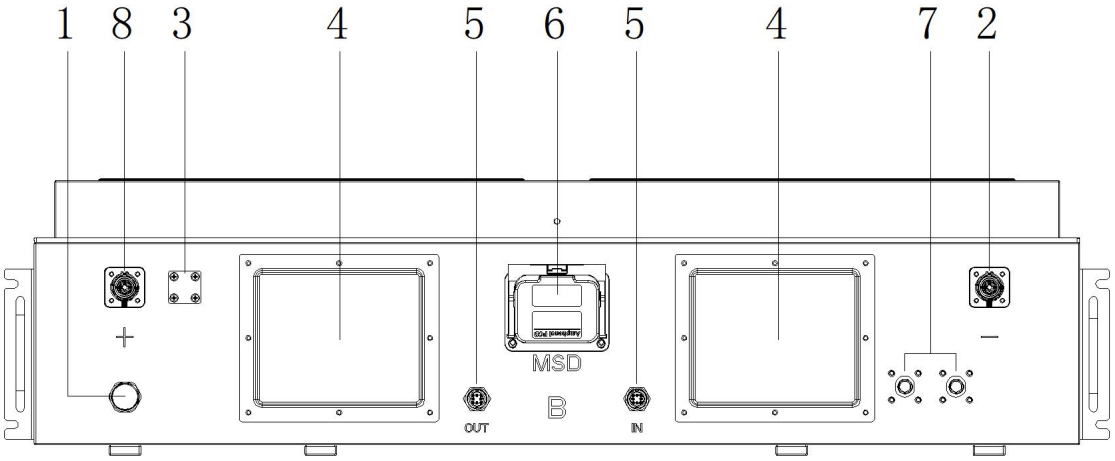
No.	Name	No.	Name
1	Combustible Gas Exhaust Fan	7	Emergency Stop Switch
2	Temperature&Smoke Sensor	8	Water Fire Suppression Interface
3	Aerosol Fire Suppression	9	Control Box
4	Fire Suppression Controller	10	Battery PACK
5	Combustible Gas Detector	11	Liquid-cooled Unit
6	Display Light	12	Intended breaking Point for Explosions

2.3.3 Battery box structure

Battery modules are categorized into Type A and Type B based on the positions of the positive/negative power cable interfaces. Details are as follows:



Panel Diagram of Type A



Panel Diagram of Type B

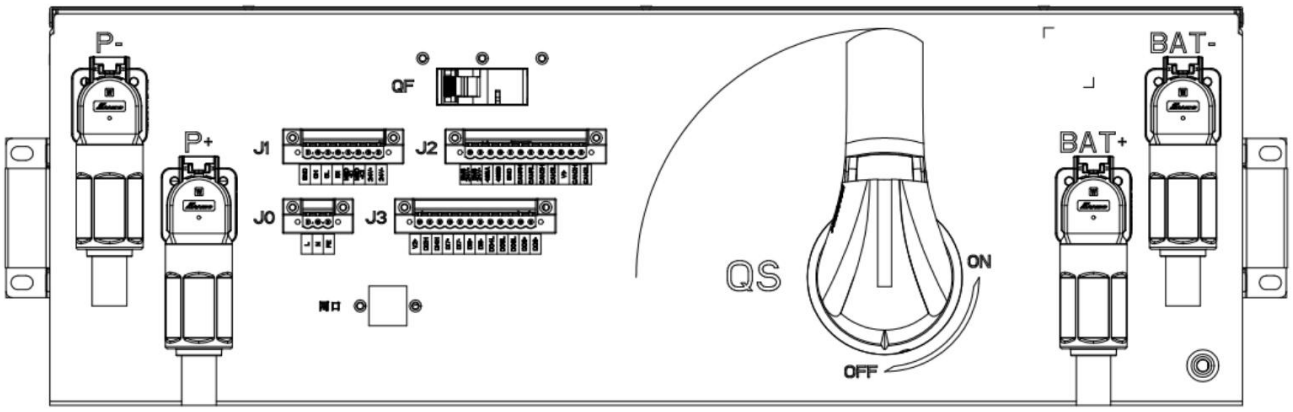
No.	Description	Specification
1	Pressure relief valve	VE-M582-00-111 Voir
2	Negative terminal	ES103-01M8-1SYW-07
3	Fire plug	Reserved internal fire protection interface
4	BMU maintenance panel (L*W*H)	207*172*12mm
5	CAN communication connector (IN/OUT)	8-pin aviation socket (IN/OUT)
6	MSD manual maintenance switch	GCMSDP000/GCMSDRFS 1500VDC 350A
7	Coolant inlet/outlet	\
8	Positive terminal	ES103-01M8-2SYX-07

Usage Instructions:

The battery system consists of 5 packs connected in series. These packs are arranged from top to bottom and sequentially connected in series. The system's total positive (B+) and total negative (B-) terminals are connected to the B+ and B- terminals of the high-voltage box, respectively. The DC output connector P+ and P- of the high voltage control box is connected to the DC input

connector DC+ and DC- of the PCS.

2.3.4 Control Box Structure



No.	Description	Function
1	BAT1-	Connects to the negative terminal of the battery box
2	BAT1+	Connects to the positive terminal of the battery box
3	P+	Positive output terminal of the battery cluster
4	P-	Negative output terminal of the battery cluster
5	J1	Internal communication for the battery cluster
6	J0	AC power supply for BMS
7	J2	External communication for the battery cluster
8	J3	DODI signal interface
9	QF	Power supply switch for main control box
10	QS	Battery cluster output circuit breaker
11	网口（Ethernet Port）	Modbus-TCP communication or Ethernet communication

2.4 Module Overview

The Oasis L215 Outdoor Battery Cabinet consists of lithium-ion battery packs, a Battery Management System (BMS), and auxiliary components such as fire protection modules, smoke/temperature sensors, water immersion detectors, and liquid cooling units. Key specifications are as follows.

2.4.1 Battery Box

The battery enclosure uses Lithium Iron Phosphate (LFP) cells, characterized by high energy density, long cycle life, high charge/discharge rates, and safety. Each 43 kWh battery module is formed by connecting 280Ah cells in a 48S1P configuration. These modules are then connected in series via 5S1P configurations to form a battery cluster.

(1) Cell Module

Cell Type:

Prismatic aluminum-shell LFP ($LiFePO_4$) cell.

Safety Design:

- Explosion-proof vents on cells release internal pressure during overcharge, over-discharge, short circuit, or thermal runaway.
- Robust mechanical structure protects against physical damage.

Specification:

Parameter	Specification
Cell Type	Lithium Iron Phosphate ($LiFePO_4$)
Rated Capacity	280Ah
Rated Voltage	3.2V
Rated Energy	896Wh
Operating Voltage Range	2.5~3.65V
Rated Charge/Discharge Rate	0.5C
Max. Continuous Charge/Discharge Rate	1C
Storage Temperature	-30℃～60℃
Charge Temperature	0℃～60℃
Discharge Temperature	-30℃～60℃
Dimensions (W*D*H)	174*72*207mm
Weight	5.4kg
Energy Density	166Wh/kg

(2) PACK Module

Key Feature:

- Modular design for rapid installation and maintenance.
- Laser welding ensures low impedance and high reliability.
- Passive balancing (BMS) with proven market performance.
- Liquid cooling system with integrated cooling plates for efficient heat dissipation.
- Safety space above cell vents to prevent pressure-induced explosions.

Specifications:

Parameter	Specification
Model	B1F-154/43-CN
Configuration	1P48S
Rated Voltage	153.6V
Rated Energy	43.008kWh
Rated Charge/Discharge Current	140A
Max. Charge/Discharge Current	280A
Voltage Range	134.4~172.8V
Cooling Method	Liquid Cooling
Dimensions (W*D*H)	980*864*260mm 1036 * 876 * 258mm(Maximum contour)
Weight	326±5kg

(3) Battery Cluster

Configuration:

- 1 cluster = 5 PACK modules (215kWh total).
- Series connection for high-voltage output with no circulating currents.

Key Features:

- Frame structure with high/low-voltage harnesses meeting electrical isolation requirements.
- Robust mechanical strength to prevent deformation.
- Compliant electrical clearance and creepage distance design.

Specification:

Model	Oasis L215
Configuration	5 modules in series
Cell Connections	1P240S
Rated Charge/Discharge rate	0.5C
Maximum Continuous Charge/Discharge Rate	1C
Rated Energy	215.04 kWh
Rated Voltage	768V
Operating Voltage Range	624V~876V
Communication Mode	CAN\Modbus
Equalisation Method	Passive

2.4.2 Control Box

Function:

Power control unit integrating BCM, relays, contactors, fuses, Hall sensors, and circuit breakers.

Specification:

Rated Voltage	1500Vdc
Max Current	400A
Communication	CAN、RS485
Protocol	CAN/MODBUS-TCP
Dimension	600*700*200mm
Weight	33.2±3kg

2.4.3 BMS System

The BMS is designed to monitor battery status, control operational states, perform insulation monitoring, manage cell balancing, trigger protection alarms, and enable communication. Through real-time supervision of the battery system, it ensures normal, stable, and safe operation. The BMS comprises two hierarchical layers:

(1) Battery Module Manager (BMM):

- Monitors cell voltage and temperature within each module.
- Implements balancing.
- Communicates with BCM via CAN bus.

(2) Battery Cluster Manager (BCM):

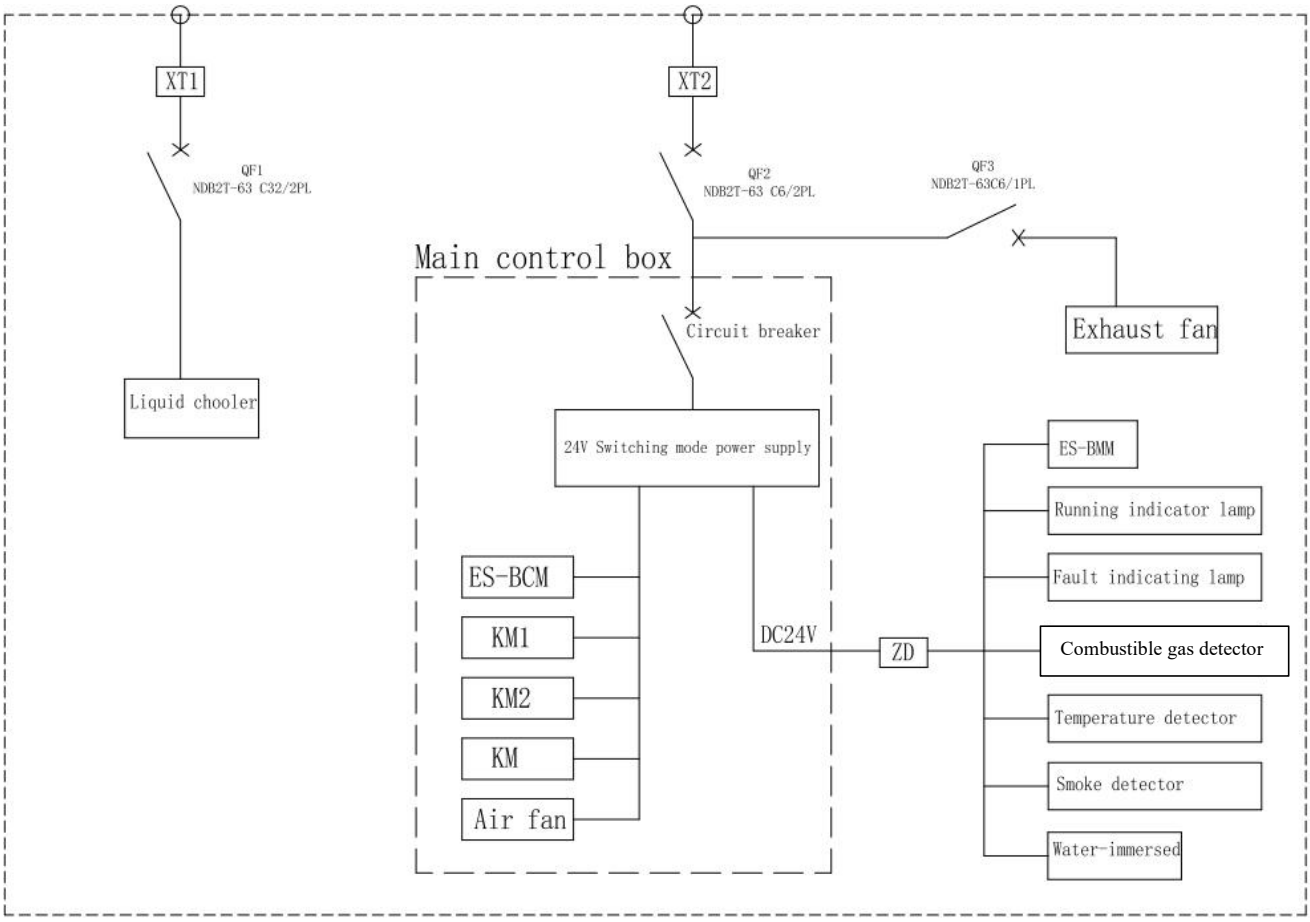
- Aggregates data from BMM.
- Manages cluster voltage/current, insulation monitoring, alarms, and protection.
- Interfaces with upper-level systems via CAN.

2.4.4 Power Distribution System

The power distribution system consists of circuit breakers, terminals, water leak sensors, and other components. The system's AC power supply is divided into two circuits:

Circuit 1: The water cooling unit is directly powered by mains power.

Circuit 2: The second AC power source is supplied by an external UPS and feeds into the cabinet to provide auxiliary power to the ventilation fans and high-voltage control box. The high-voltage control box outputs DC24V power to the terminal strip on the cabinet’s distribution panel.



2.4.5 Temperature Control System

The outdoor cabinet's temperature control system comprises a liquid cooling unit, coolant pipelines, liquid cooling plates, and related components. The Battery Management System (BMS) activates cooling or heating functions based on real-time cell temperature monitoring. Default temperature settings:

Cooling: Activated at 28°C, deactivated at 22°C.

Heating: Activated at 10°C, deactivated at 15°C.

2.4.6 Fire Protection System

(1) Temperature + Smoke Sensors

Built-in temperature sensor and smoke sensor, when the detected temperature and smoke synchronously reaches a certain threshold, trigger the system alarm.

(2) Gas Detector + Exhaust Fan

The gas detector monitors hydrogen (H_2) concentration. When the H_2 level reaches 25% LEL (Lower Explosive Limit), the exhaust fan is activated. If the concentration further rises to 50% LEL, the exhaust fan shuts down, and the next-stage fire suppression protocols are initiated.

(3) Aerosol Fire Suppression

When the aerosol temperature detector detects a temperature exceeding 70°C, it triggers the suppression system to release fire-extinguishing aerosol.

(4) Pressure Relief Panel + Fire Suppression Port

To ensure fire safety reliability, the system includes dual protection mechanisms:

Roof-mounted Pressure Relief Panel:

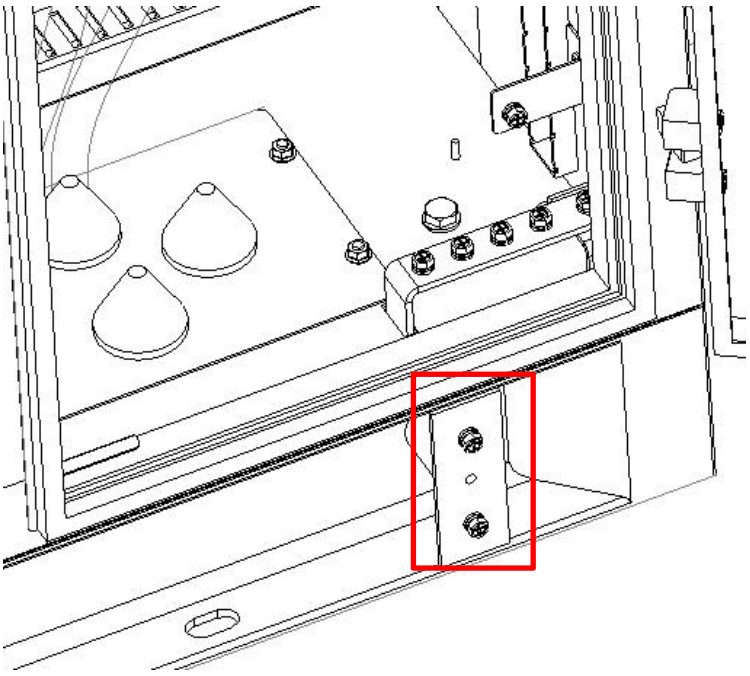
Responds immediately during explosions caused by overcharge, over-discharge, short circuit, or thermal runaway. It rapidly releases pressure to maintain cabinet pressure balance and prevent catastrophic explosions.

Fire Suppression Port (on Cabinet Door):

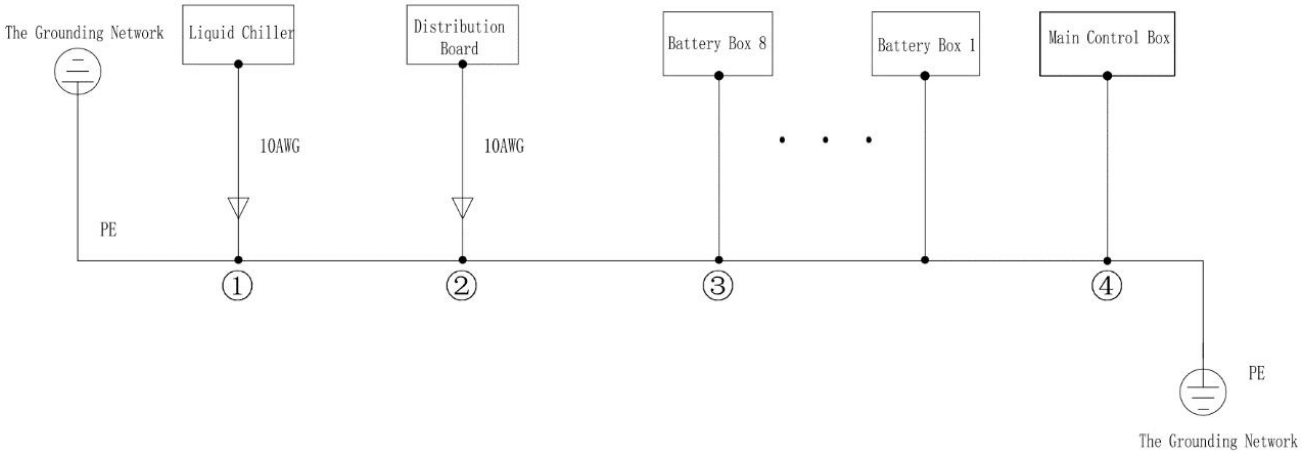
Allows injection of cooling water during controllable fires to lower the cabinet's internal temperature in minimal time.

2.4.7 Grounding System

(1) Grounding Locations



(2) Grounding Principles



III. Installation Guide

3.1 Storage and Transportation

3.1.1 Storage

No.	Items
1	To prevent internal condensation, store the outdoor cabinet in a dry warehouse. If unavailable, use heaters to maintain the internal temperature above the ambient temperature.
2	Protect the cabinet from rainwater and dust by covering air inlets/outlets with protective caps. Avoid opening the cabinet during storage unless necessary.
3	Place the cabinet on a solid, flat, dry, and spacious surface that can support its weight. The surface must remain level to prevent cabinet distortion or compression. Don't place the cabinet directly on bare ground, as this may cause scratches or corrosion.

3.1.2 Transportation

No.	Items
1	The outdoor cabinet is designed as a cubic structure and can be transported using standard container handling systems on dedicated container trailers.
2	If a dedicated container trailer is unavailable: ● Secure the cabinet on a low-bed transport vehicle to minimize height and prevent sliding. ● Place anti-slip mats (max. thickness: 3 cm) beneath the cabinet to enhance friction. ● Fix the cabinet to the vehicle using heavy-duty straps.

3.1.3 Unboxing Inspection

(1) Visual Integrity Check

When the outdoor cabinet arrives at the project site, conduct a comprehensive system integrity inspection, including:

External Inspection: Perform a six-sided visual check of the cabinet exterior. Inspect for damage, deformation, cracks, or abnormalities. If any issues are found, mark the affected areas for repair demand.

Internal Inspection: Conduct a six-sided visual check of the cabinet interior. Verify the absence of water leakage, light penetration, stains, or moisture traces.

Equipment Check: Inspect the alignment of installed components, including the fire protection system, monitoring cabinet, battery racks, battery modules, and AC distribution cabinet, to ensure no misalignment or displacement.

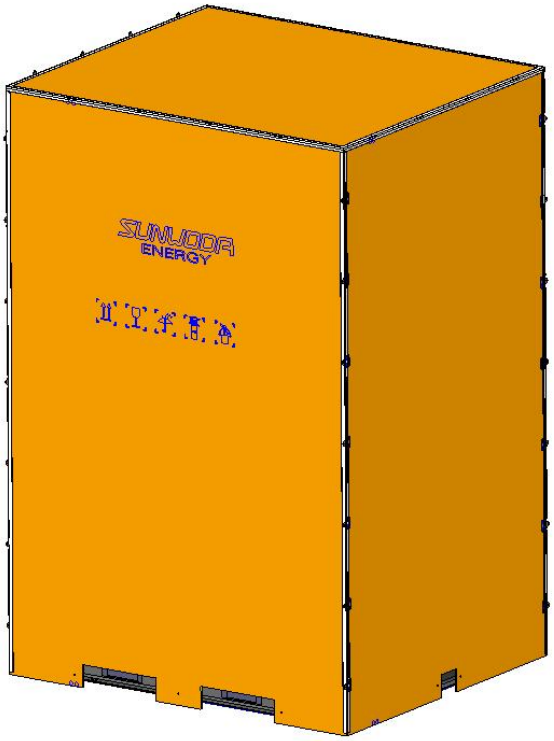


Figure 3.1.3.1 Diagram of cabinet outer packaging

Figure 3.1.3.2 Cabinet view

（2）Accessory inspection

No.	Name	Quantity	Remark
1	Battery cluster	1cluster	5 battery boxes for 1 cluster, total capacity 215kWh
2	High voltage box	1pcs	Containing isolation switch, fuse, relay, etc.
3	Liquid cooler	1pcs	with piping
5	Fire-fighting system	1set	Aerosol, detector, exhaust fan, explosion venting panel
6	Wiring harness	1set	battery cluster power harness, communication wiring harness(in-cabinet)
7	Outdoor cabinet	1pcs	\
8	Power cable connector	1set	BAT+\-Powerline Connectors ($95mm^2$)

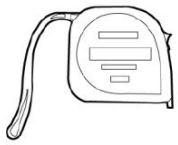
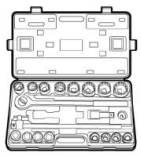
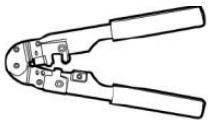
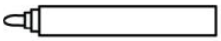
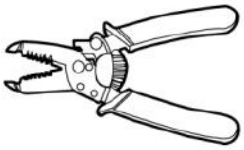
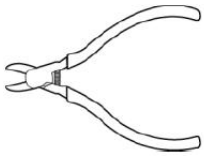
3.2 Mechanical Installation

3.2.1 General requirements

(1) Tool preparation

Table 3.2.1.1 Table of installation tools

Lifting trolley	Phillips screwdriver	Flathead screwdriver	Insulated adjustable wrench
			
Multimeter	Insulated safety shoes	Insulation tape	Insulated gloves
			
Steel tape measure	Socket wrench set	RJ45 crimping tool	Marker pen

			
Wire stripper	Diagonal cutting pliers	Utility knife	Crimping tool
			

(2) Environmental Requirements

Table 3.2.1.2 Installation Conditions

No.	Details
1	The equipment shall be statically fixed during installation, and the mounting surface must be sturdy and even.
2	It is recommended to install the equipment on an outdoor concrete foundation or a similar base platform capable of providing sufficient load-bearing capacity.
3	The installation process should be kept as stable as possible, avoiding significant impact or vibration.
4	Free-fall incidents are strictly prohibited during installation.

3.2.2 Foundation Construction

Requirements for the Foundation Construction of Energy Storage System:

The load-bearing capacity of the foundation must be no less than 5 tons. The design and construction of the foundation for outdoor energy storage cabinets at the customer site must comply with our company's foundation layout diagrams.

Notes:

- During foundation construction, ensure the embedment of Q235 steel connection plates, reserve space for air ducts for the chiller unit, and embedment of steel ladders.
- During construction, positioning lines for the outdoor cabinets should be marked on the upper surface of the foundation, clearly indicating the directional labels for the battery compartment and PCS compartment.

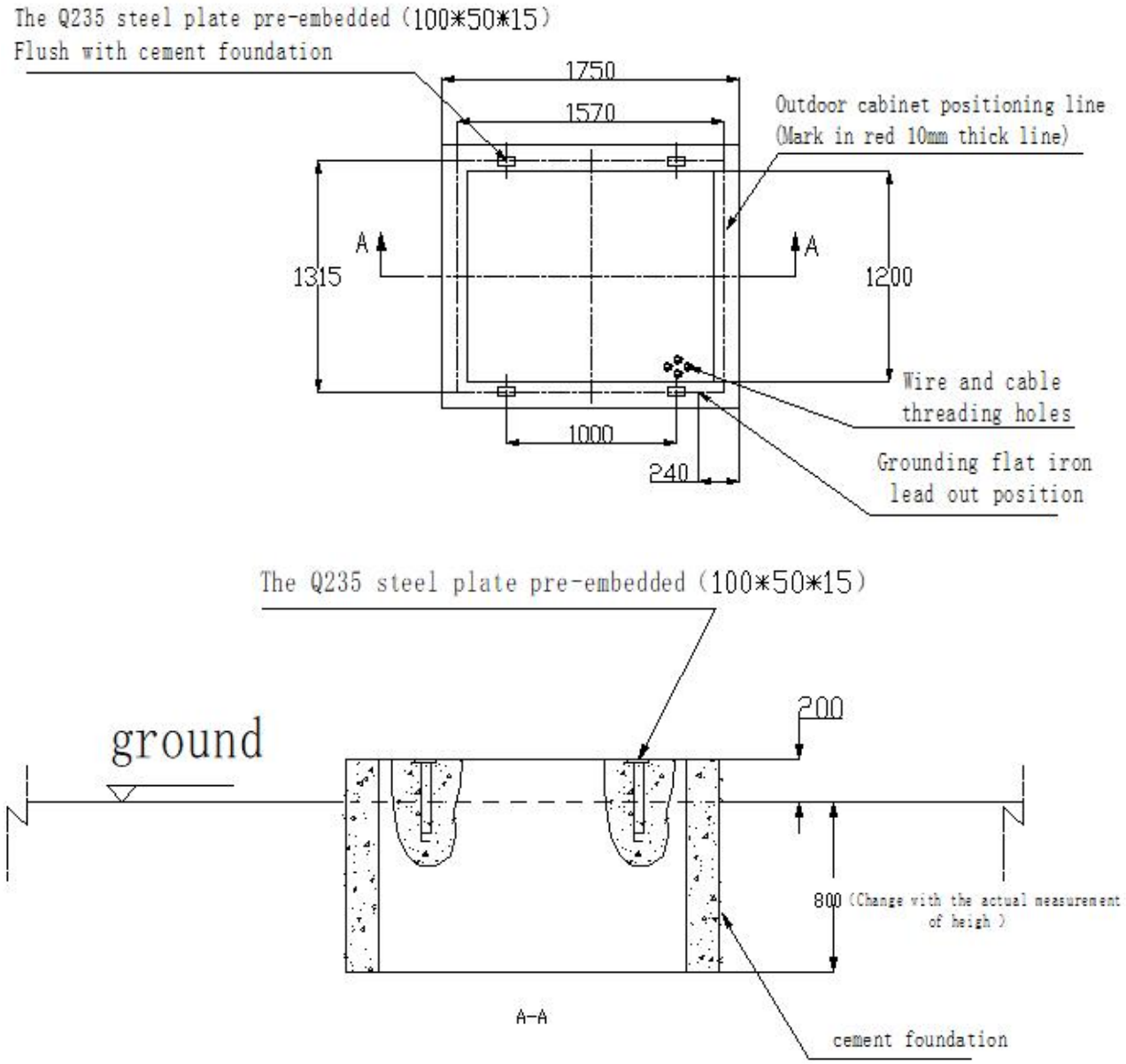


Figure 3.2.2.1 Schematic diagram of concrete foundation

3.2.3 Battery Cabinet Placement

Align the battery cabinet with the outdoor cabinet positioning lines and lower it into place. Weld the energy storage cabinet base beam to the embedded Q235 connection plate.

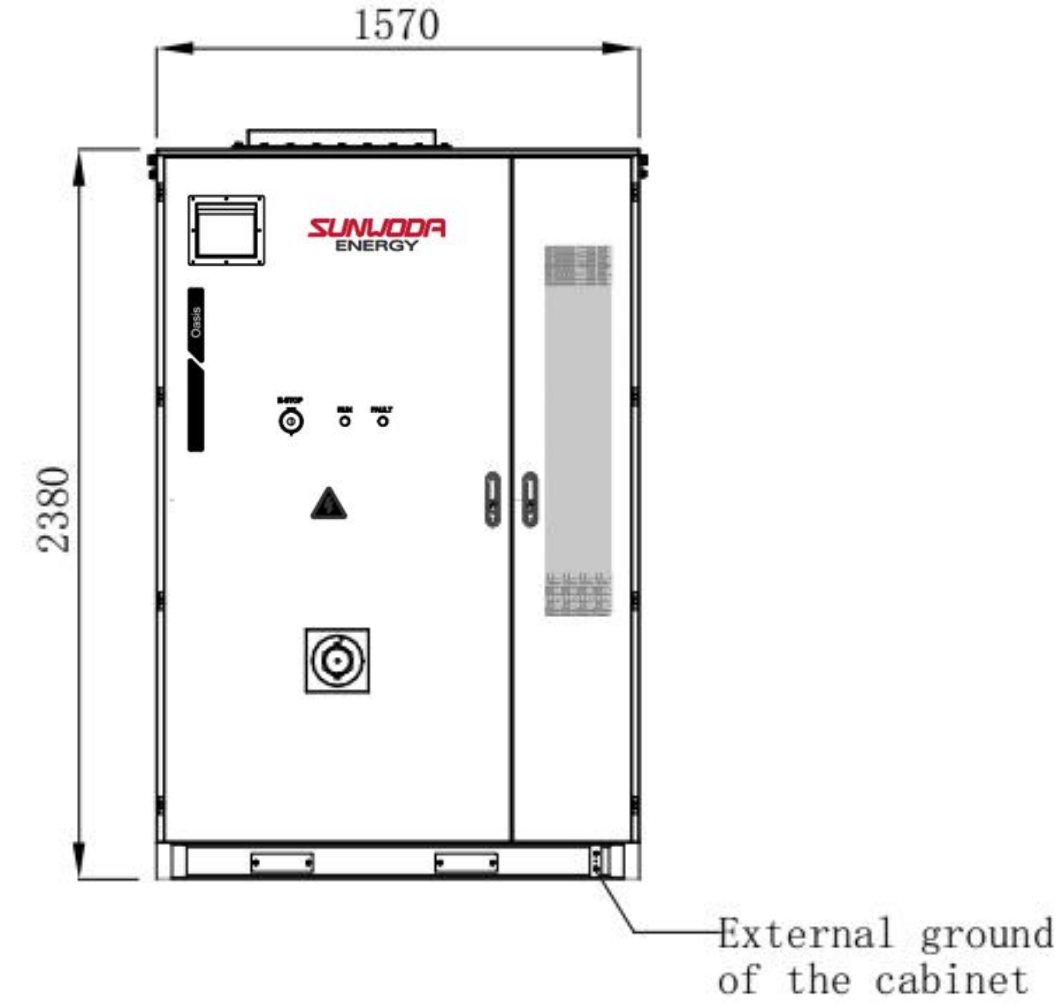


Figure 3.2.3.1 Front View

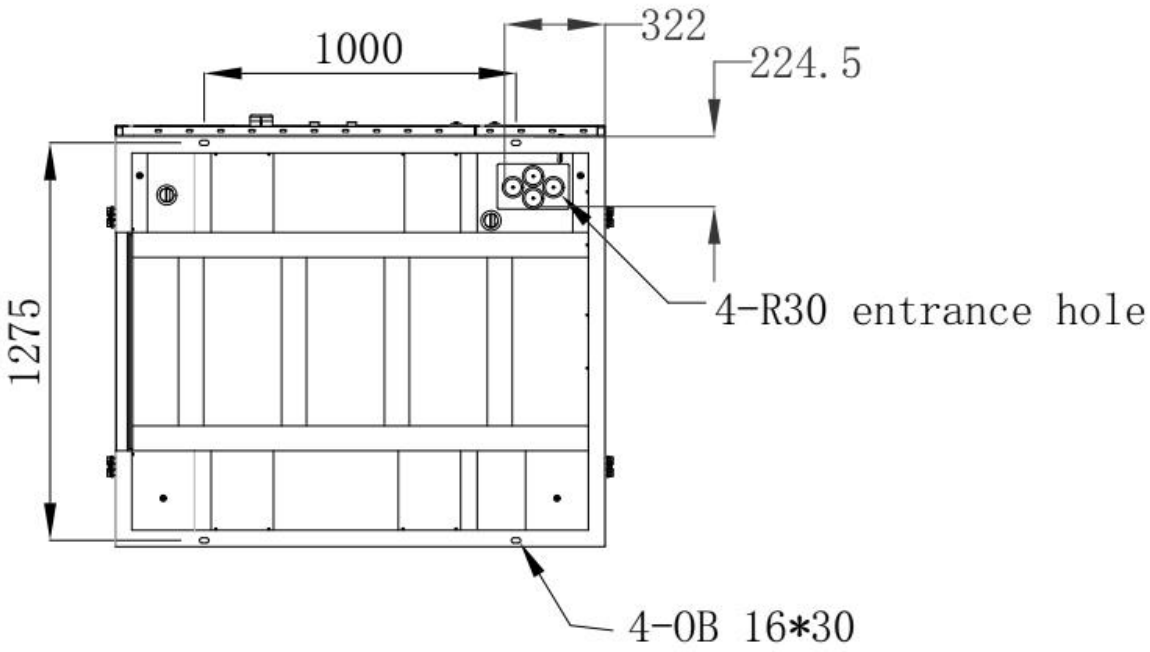


Figure 3.2.3.2 Battery Cabinet Bottom Structure Distribution (Bottom View)

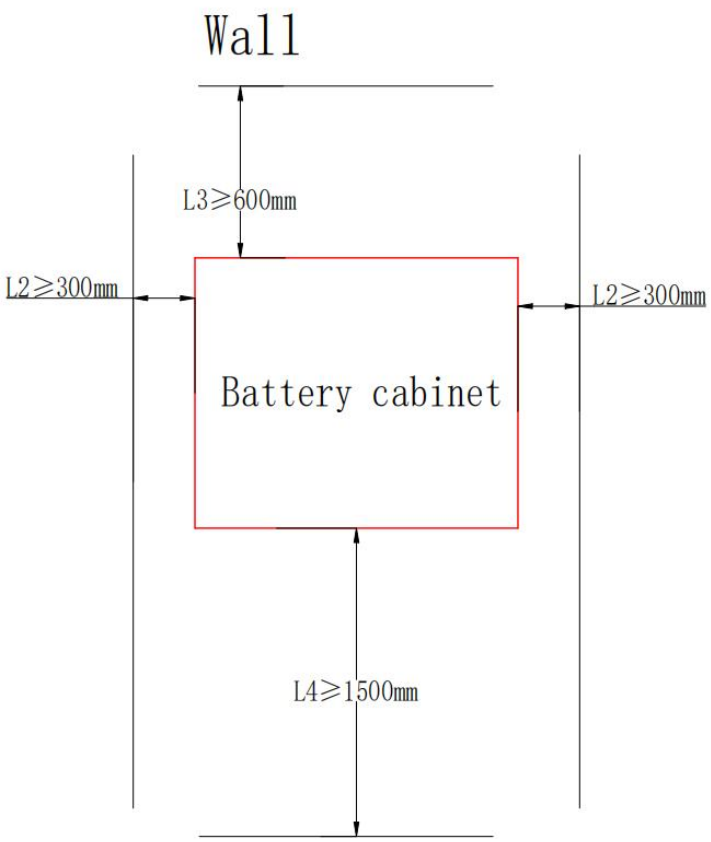


Figure 3.2.3.3 Layout Spacing Diagram

3.3 Electrical Installation

3.3.1 Installation Precaution

To ensure the safety of personnel during electrical installation, the following rules must be observed:

No.	Items
1	All power sources connected to the outdoor cabinet must be disconnected to ensure that the outdoor cabinet is unpowered.
2	A warning sign must be left in the disconnected position to prevent it from being re-energized during installation.
3	Perform necessary grounding and short-circuit connections.
4	Insulate live components with appropriate materials to prevent electric shock.
5	After disconnecting PACK wiring, cover unused terminals with plastic terminal caps until reconnection.
6	Only qualified professionals may perform installation, strictly following the user manual.
7	Comply with local electrical safety regulations in the country/region.

3.3.2 Cable Routing Requirements

No.	Items
1	Separate communication cables from power cables.
2	Separate DC circuits from AC circuits, maintaining a minimum distance of 300mm between them.
3	If control cables must cross power cables, ensure the angle between them is as close to 90° as possible.

3.3.3 Cable Fixing and Protection

(1) Cable Fixing

- Tighten terminal screws to the specified torque (Table 3.3.3.1) to prevent loosening or overheating.
- Relieve stress on cable connections at appropriate points.

Table 3.3.3.1 Torque Specifications (Unit: N·m)

Bolt	Torque	Bolt	Torque
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

(2) Cable Protection

Power Cables: Avoid insulation damage during installation. Secure cables after routing to prevent short circuits.

Communication Cables: Route via wire trays or secure with cable ties. Avoid proximity to heat sources or high-voltage cables.

3.3.4 Outdoor Cabinet Wiring

The wiring of the outdoor cabinet is divided into four parts: DC power cable wiring, AC power cable wiring, communication cable wiring, and grounding. For safety, all live components in the outdoor cabinet are shielded by protective panels to prevent accidental contact. Before wiring, use tools to remove the protective panels, exposing the terminals and copper busbars. Follow the labels and specifications to connect the cables properly.

（1）DC Power Cable Wiring Inside the Outdoor Cabinet

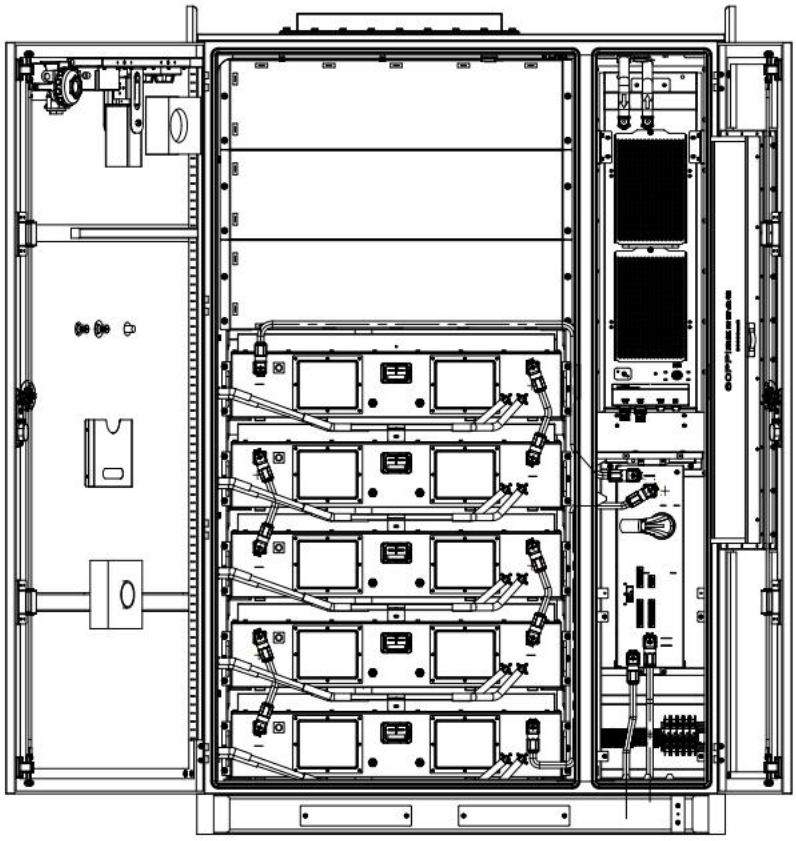


Figure 3.3.4.1 Internal Schematic of Cabinet

Step 1:

- Battery cabinets are numbered 1 to 5 from top to bottom.
- Connect the DC power cables sequentially:

Start from the negative terminal (B-) of the main control box to the negative terminal of battery box 1.Connect the positive terminal of battery box 1 to the negative terminal of Battery box 2, continuing this pattern until the positive terminal of Battery box 5.

Finally, connect the positive terminal of battery box 5 to the positive terminal (B+) of the main control box.

Note: Only connect one cable at a time to avoid accidental short circuits during operation.

Step 2:

- On the left side of the main control box panel:

Connect the positive cable between the PCS positive terminal and the main control box output positive terminal (P+).

Connect the negative cable between the PCS negative terminal and the main control box output negative terminal (P-).

Step3:

- After completing the connections, verify that all quick-connect plugs for power cables are securely locked in place.

Notes:

① All power connectors in the outdoor cabinet use quick-connect technology. When inserting a plug, a distinct click will confirm proper locking. Visually inspect the lock key on the plug's side to ensure it returns to a horizontal position.

② Battery connections must follow the sequence from positive to negative . Do not start from both ends and connect the middle last.

(2) Grounding

The outdoor cabinet is pre-equipped with a 2 AWG grounding cable. Grounding holes are located at the bottom of each cabinet. Connect the cabinet to the electrical cabinet's grounding busbar, then to the grounding system.

No.	Material	Specification	Quantity
1	M6×16 Grounding Screw	Cross-recessed combo screw, GB/T9074.13-M6×16, 304 stainless steel	2pcs

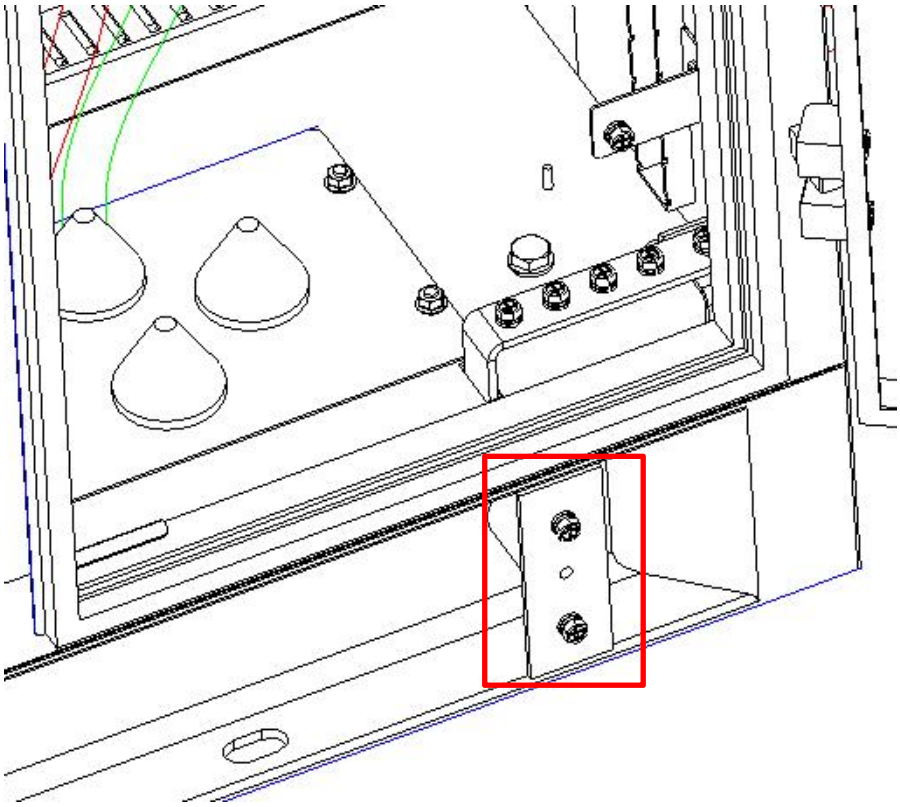


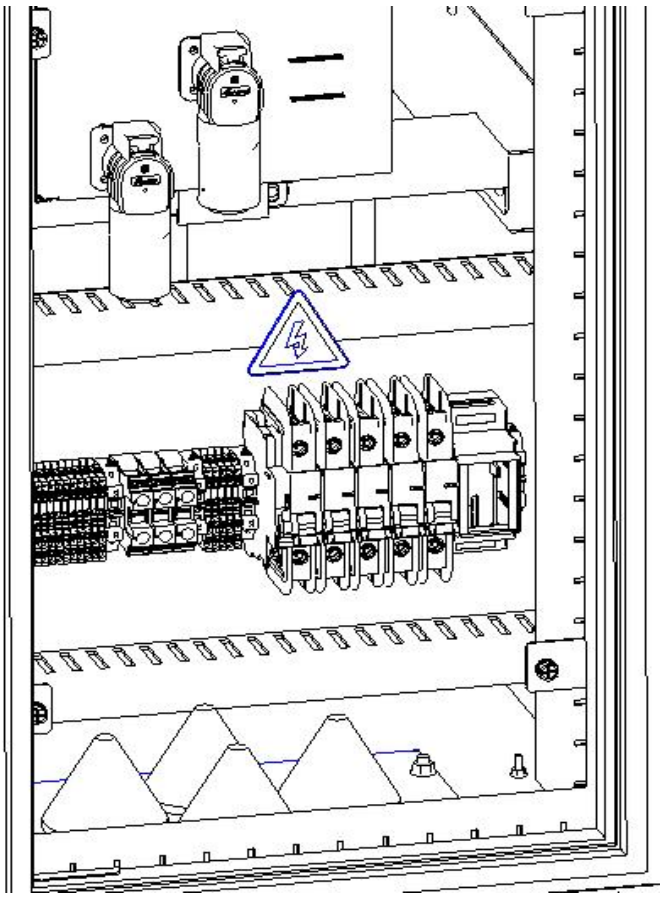
Figure 3.3.4.2 External Grounding Busbar Location

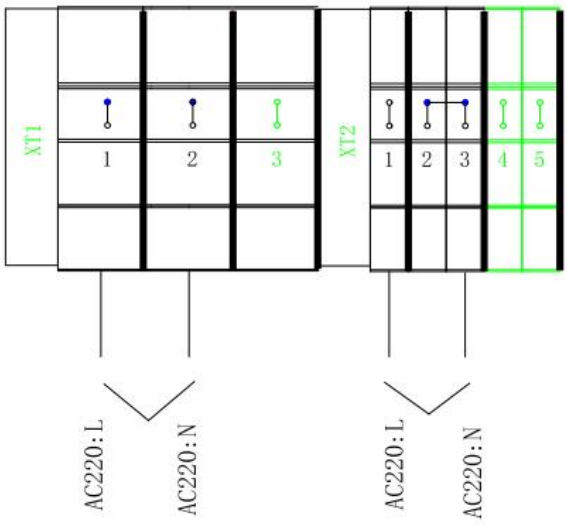
⚠ WARNING:
Improper grounding poses severe risks: ① Fatal electric shock during equipment faults. ② Lightning-induced damage to equipment. ③ System malfunction due to poor grounding.
⚠ Requirements:
① Grounding must comply with local/national electrical codes. ② Ensure secure connections between the cabinet, grounding busbar, and grounding electrodes. ③ Measure grounding resistance after installation: Resistance from the outdoor cabinet's grounding busbar to the grounding electrode must not exceed 0.1Ω. ④ All internal devices are pre-connected to the cabinet's main grounding busbar.

(3) AC Power Cable Wiring

The AC auxiliary power cable channel is located at the lower part of the outdoor cabinet:

- External single-phase AC power（≥5kW） enters the cabinet and connects to the XT1 terminal block to power the liquid cooling unit.
- External single-phase AC power（≥1kW，UPS power is best） connects to the XT2 distribution terminal block to power monitoring devices (e.g., high-voltage cabinet, exhaust fans).





Terminal Block Connections:

No.	Terminal	Definition	Wiring Instructions
1	XT1:1-2	L	Connect to external AC220V L
2	XT1:2-2	N	Connect to external AC220V N
3	XT2:1-2	L	Connect to external AC220V output L
4	XT2:2-2/3-2	N	Connect to external AC220V output N

（4）Communication Cable Wiring

Communication between the outdoor cabinet and electrical cabinet uses RVSP shielded twisted pair (STP) cable. The signal terminal block in the outdoor cabinet is defined as follows:

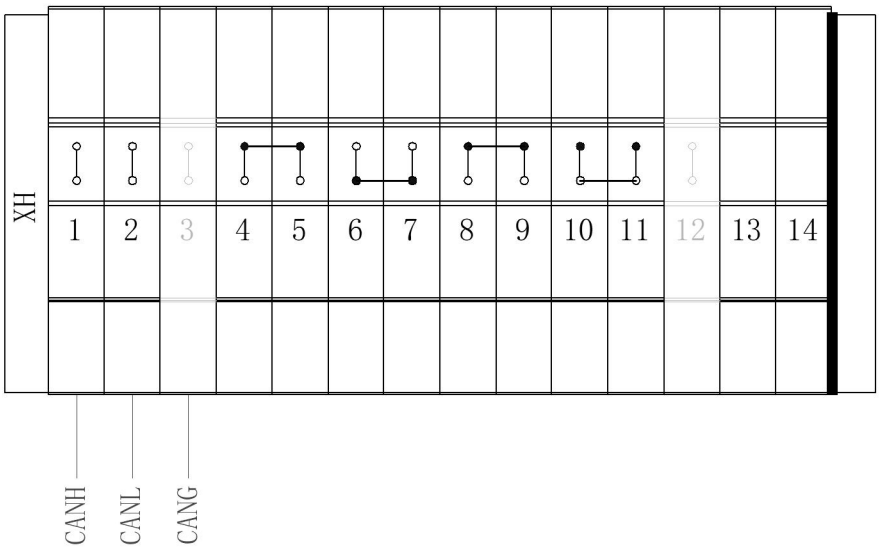


Figure 3.3.4.3 External Communication Terminal Block

No.	Terminal	Definition	Wiring Instructions
1	XH:1-2	CANH	Connect to CANH of external EMS (display/control unit).
2	XH:2-2	CANL	Connect to CANL of external EMS (display/control unit).
3	XH:3-2	CANG	Connect to the shield layer of the STP cable.

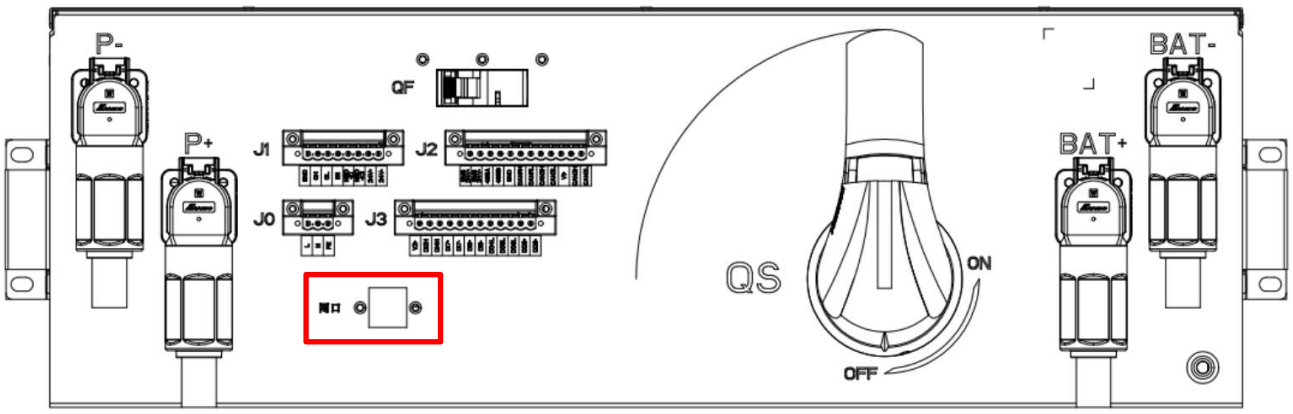
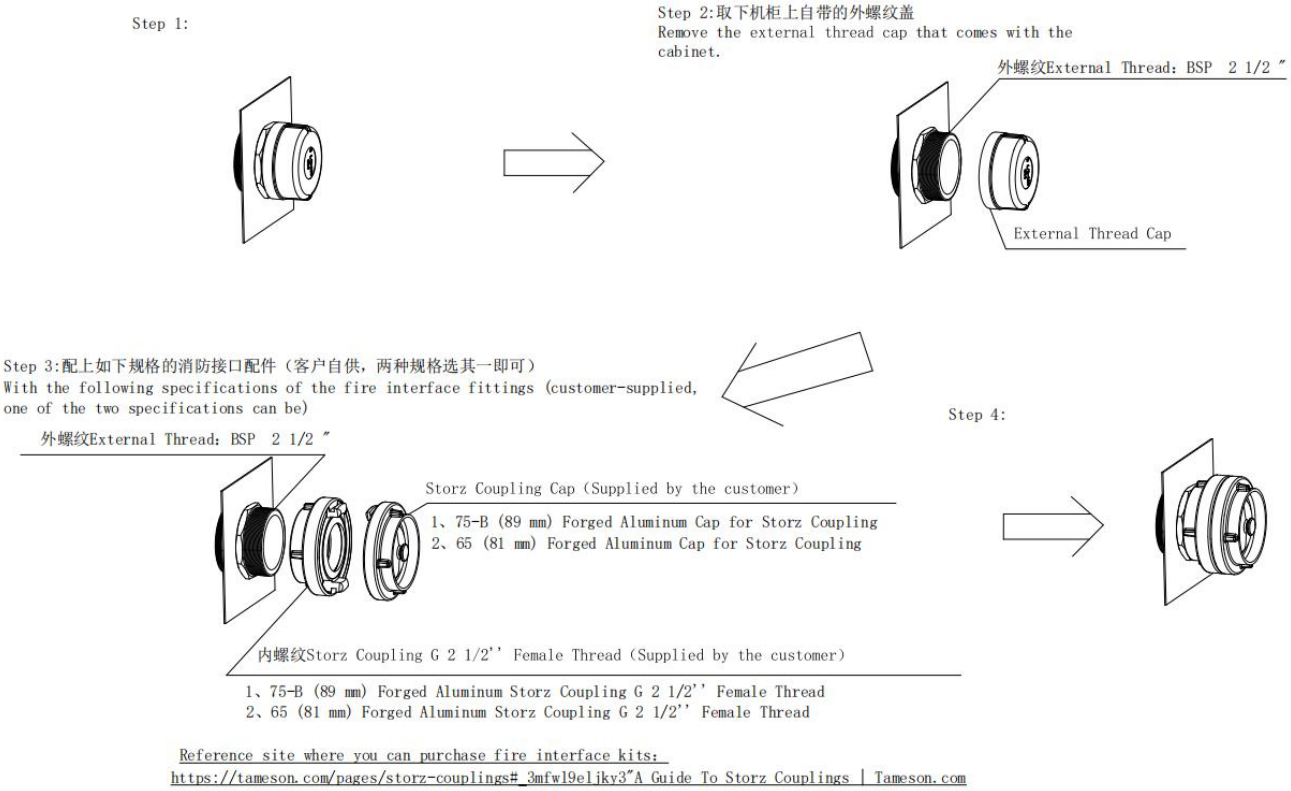


Figure 3.3.4.4 Modbus-TCP communication interface or Ethernet communication interface diagram

If Modbus-TCP communication or Ethernet communication is used in the field, the interface is at the Ethernet port of the control box.

3.3.5 Fire Interface Connection (If Necessary)

The fire interfaces are connected according to the needs of the site, and the connection guide is shown below:



Note: Because the fire interface is not completely uniform in each country and region, Storz's specifications can be selected by the customer according to the actual commonly used local fire interface specifications (65, 75-B or other specifications), and only need its fittings to have a female thread size of BSP G 2 1/2".

3.4 Installation Inspection

3.4.1 Electrical Installation Inspection

After installation, perform the following checks to prevent equipment damage or safety hazards:

No.	Items
1	Ensure all circuit breakers in the battery cabinet are in the OFF position before inspection.
2	Verify correct polarity of DC battery array connections. Measure resistance between DC terminals: Normal resistance: megohm-level. If resistance is kilohm-level or lower, inspect wiring.
3	Confirm all grounding and communication cables are securely fastened.

4	Verify grounding resistance < 0.1Ω.
5	Ensure all protective panels removed during wiring are reinstalled.

⚠ WARNING:
① Reinstall the lower protective panel to prevent foreign objects from entering the cabinet. Failure to do so risks equipment damage. ② Never power on the cabinet without reinstalling protective panels.

3.4.2 Mechanical Installation Inspection

No.	Items
1	Confirm equipment is intact, free of damage, rust, or paint peeling.
2	Ensure labels are legible and undamaged.
3	Verify equipment is securely installed with adequate surrounding space.
4	Clean the installation area; remove debris from the inverter cabinet.
5	Reinstall all protective covers/panels removed during wiring.
6	After final checks: ● Adjust cables to proper positions. ● Secure cables to cable trays with zip ties. ● Seal gaps in cabinet cable entry points with fireproof putty to prevent small living organisms from entering.

IV. Operational Procedures

4.1 Startup Preparation

To ensure the safety of the outdoor cabinet, the following items must be inspected before initial energization or after maintenance:

Table 4.1.1 Inspection Checklist

No.	Inspection Item	Completion Status
1	Verify the installation and operating environment meets requirements.	
2	Confirm the outdoor cabinet is securely anchored to the foundation.	
3	Ensure proper grounding of the outdoor cabinet.	
4	Verify all grounding busbars, DC (±) busbars, AC busbars, and external power busbars are correctly connected and tightened.	
5	Check cable trench supports are intact and cable routing complies with specifications.	
6	Confirm no tools, foreign objects, or drilling debris remain inside the cabinet.	
7	Validate correct polarity of DC connections.	
8	Ensure proper phase sequence of AC connections.	
9	Inspect cables for damage or scratches; verify air vent filters are intact.	
10	Confirm all AC/DC circuit breakers and external auxiliary power switches are in the OFF position.	
11	Reinstall all internal protective panels.	
12	Ensure all equipment covers are properly secured.	
13	Verify auxiliary safety systems (fire protection, temperature control) and alarm devices are installed and functional.	

4.2 Module Operation Guidelines

4.2.1 High-Voltage DC Section Operation

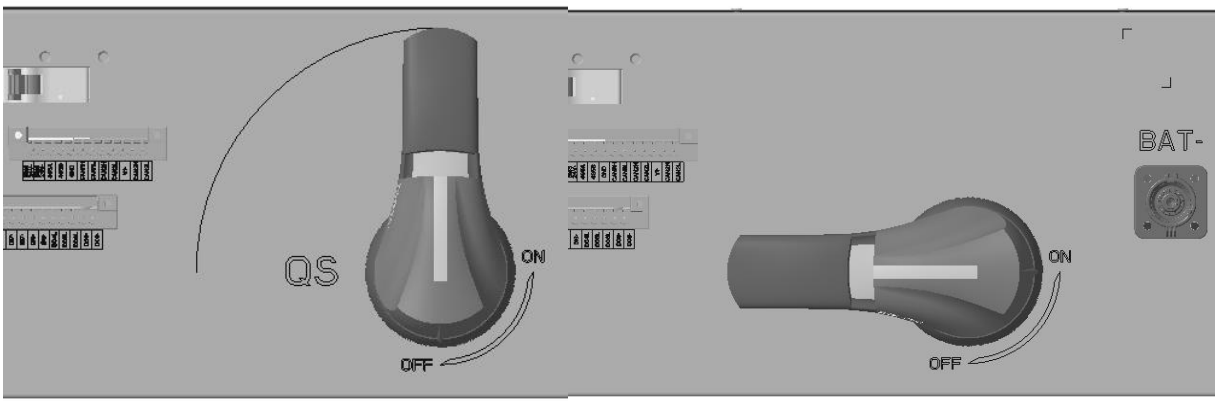
Before maintenance or connecting power cables:

Check the status of the disconnect switch and ensure it is in the OFF position.

Verify all cables are securely connected, including external power lines.

Energization Method:

Rotate the disconnect switch in the high-voltage cabinet from OFF to ON.Close the manual DC disconnect point (see figure below).



OFF Status On Status

Figure 4.2.1.1

⚠ WARNING:
Never operate the disconnect switch under load.

4.2.2 Power Distribution Section Operation Guide

The layout of the power distribution panel is shown in the figure below. It includes:

- DC distribution terminal blocks.
- Signal transfer terminal blocks.
- AC transfer terminal blocks (for powering the liquid cooling unit).
- AC distribution terminal blocks (for supplying power to monitoring devices such as the BMS).

Key Components:

- QF1: Circuit breaker for the liquid cooling unit.
- QF2: Main circuit breaker for monitoring devices.
- QF3: Circuit breaker for the exhaust fan.

Energization Sequence:

- Turn on QF1 to power the liquid cooling unit.
- Turn on QF2, then close the circuit breaker in the high-voltage cabinet. This activates the BMS for self-testing.
- If the self-test passes, the main relay in the high-voltage cabinet closes, preparing the system for high-voltage operation.
- Turn on QF3 to enable the exhaust fan, which can be controlled via the BMS dry contact signals. Once energized, the operation indicator on the cabinet door will illuminate.

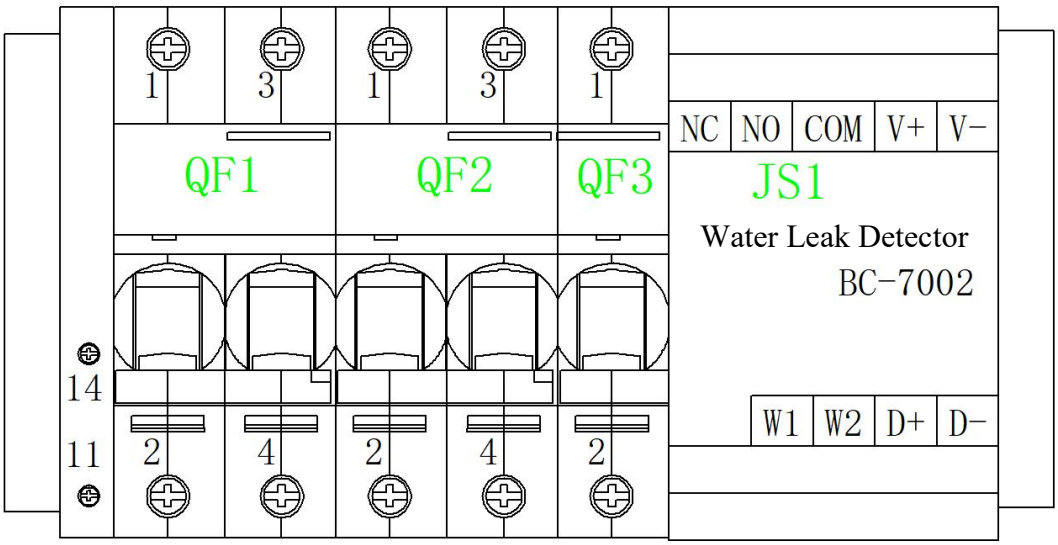


Figure 4.2.2.1 Power Distribution Section of the Cabinet

4.2.3 Fire Protection System

The outdoor cabinet uses aerosol-based fire suppression agents. A dedicated fire control box monitors internal temperatures and activates aerosol canister discharge when triggering conditions are met.

4.2.4 Local Monitoring Operation

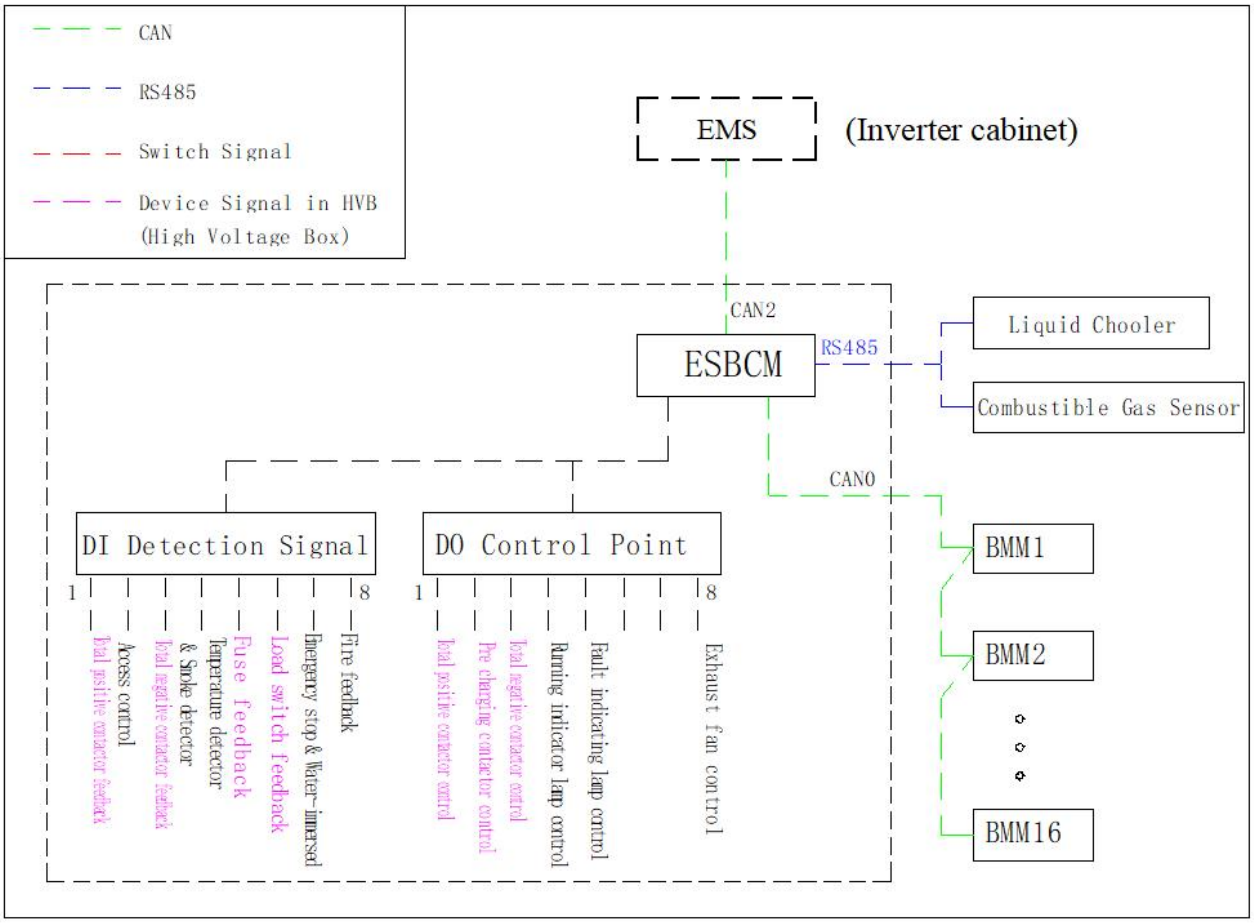


Table 4.2.4.1 Major Communication Devices List

Device Name	Specifications	Unit	Quantity
Liquid Cooling Unit	EMW90HDNC1A	pcs	1
Combustible Gas Detector	Xgard-Bright-GZ-H-02	pcs	1
ESBMM	ESBMM-2412-F	pcs	10

Functional Description:

The ESBCM collects data via DI interfaces (door access, water leak detection, fire protection, switch status, etc.). It communicates with ESBMM via CAN bus and exchanges data with the external EMS.

The liquid cooling unit and combustible gas detector communicate with the ESBCM via RS485.

The ESBCM controls the liquid cooling unit's operation mode based on battery data collected by the ESBMM.

4.3 Power-On Sequence

Step1. Verify external electrical cabinet wiring is correct and the outdoor cabinet is ready for energization.

Step2. Turn on the main control cabinet's disconnect switch from OFF to ON.

Step3. Close the control power MCB (QF) on the main control cabinet, switching it from OFF to ON.

Step4. Turn on the three MCBs (QF1, QF2, QF3) on the distribution panel, switching all from OFF to ON.

Step5. Check the status indicator on the cabinet door. After system self-test completes successfully, the Run indicator will illuminate, signaling the cabinet is ready.

Note:
Do NOT power off the fire protection or liquid cooling systems during operation.
If any step fails, immediately stop and inspect all components.

4.4 Shutdown Procedures

Normal Shutdown:
(1) Stop external charging/discharging of the outdoor cabinet and ensure it is idle.
(2) Turn off MCBs QF1 to QF3 on the distribution panel in sequence.
(3) Disconnect the control power MCB (QF) on the main control cabinet.
(4) Switch off the main control cabinet's disconnect switch.

Emergency Shutdown:
Press the emergency stop button on the cabinet door to immediately cut off the primary circuit and halt charging/discharging.
Note:
Reset faults manually on the EMS touchscreen before restarting the system.

V. Product Maintenance

5.1 General Guidelines

Environmental factors such as temperature, humidity, dust, and vibration can cause aging and wear of internal components in the energy storage system, potentially leading to latent failures. Therefore, daily and periodic maintenance is essential to ensure normal operation and extend system lifespan. All measures to maintain the system in optimal working condition fall under the scope of maintenance.

5.2 Maintenance Precautions

When performing maintenance or repairs, strictly adhere to the following safety rules:

No.	Items
1	Only authorized personnel are permitted to perform maintenance tasks.
2	Wear personal protective equipment (PPE) before starting work: Safety goggles, Gloves, Protective boots, Arc-rated clothing.
2	Disconnect all external connections and internal power sources to the energy storage system.
3	Ensure the system cannot be accidentally re-energized during maintenance.
4	Use a multimeter to confirm the system is fully de-energized.
5	Implement necessary grounding and short-circuit connections.
6	Cover temporarily exposed potentially energized components with insulating materials.

5.3 Maintenance Tasks and Intervals

5.3.1 General System Maintenance

Table 5.3.1.1 Battery System Maintenance Checklist

Inspection Item	Method	Maintenance Interval
Cleaning	Clean the enclosure; remove pests, debris, etc.	Monthly
Safety Isolation Devices	Verify operation within rated specifications.	Annually
Cables	Visually inspect for damage.	Monthly
Warning Labels/Nameplates	Ensure labels are intact and properly mounted.	Monthly
Ventilation Openings	Check for blockages.	Monthly
Battery Health(SOH)	Monitor via EMS for normal State of Health.	Monthly
Operational Status	Review system logs for anomalies.	Monthly

System Voltage	Confirm DC voltage is within normal range.	Monthly
Terminals	Check for corrosion, discoloration, or looseness.	Monthly
Appearance & Temperature	Inspect via EMS for deformation or overheating.	Monthly
Grounding	Test continuity between battery cabinet metal parts and grounding points using a multimeter.	Every 6 months

5.3.2 Battery Box Maintenance

Note: Always disconnect all auxiliary power and main power switches before disassembling or installing battery box.

（1）Tools Required:

- Lift trolley(Load capacity ≥400 kg, lifting height ≥2.5 m).
- Φ6 socket.
- Phillips screwdriver.

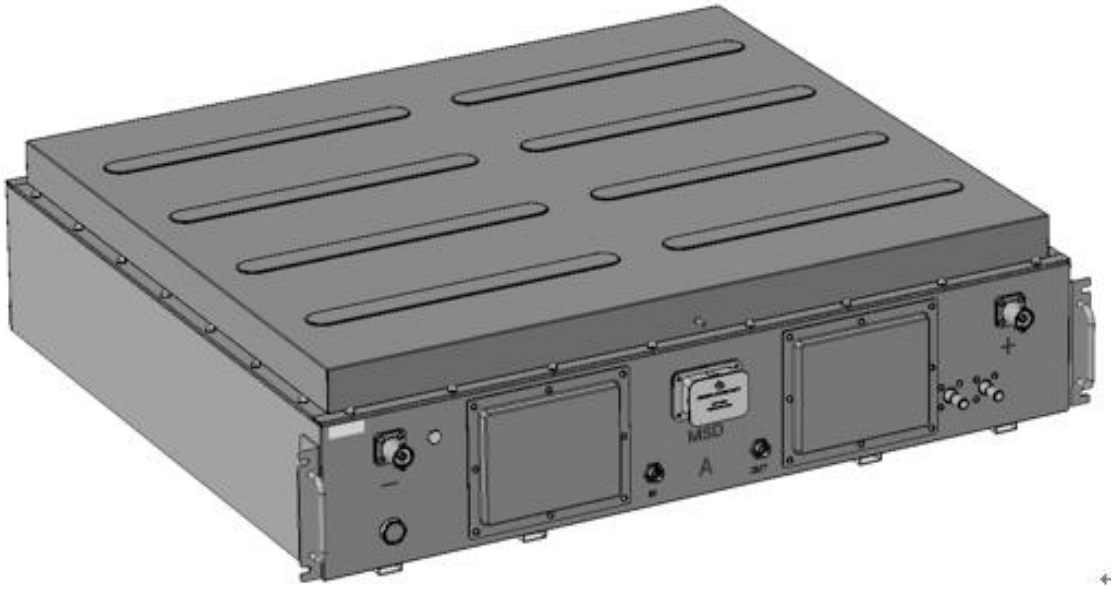


Figure 5.3.2.1 Exterior view of battery box

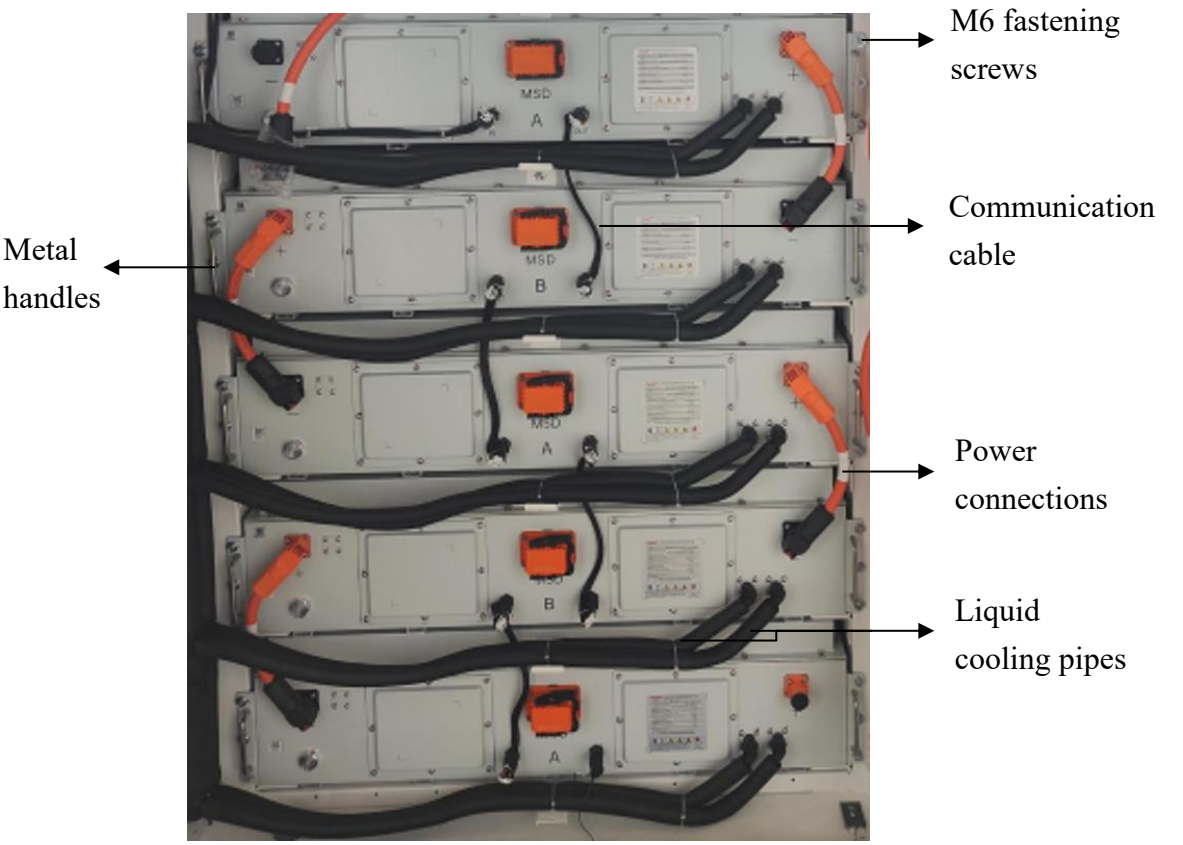


Figure 5.3.2.2 Battery Box Power and Communication Connections

(2) Battery Box Removal Procedure

Depower the system and drain the antifreeze from the liquid cooling pipes.

Disconnect the liquid cooling pipes on the top and bottom of the battery box.

Remove the external communication harness.

Disconnect the external power cables.

Use a Φ6 socket to remove the four M6 cross-recessed hex flange screws.

Carefully slide out the battery box (326 kg). Pull the metal handles and lift the box onto a trolley for transport to storage.

(3) Battery Box Installation Procedure:

Place the battery box on a trolley and position it beneath the installation slot.

Lift the box using the metal handles and slide it into the battery rack with assistance.

Adjust the Φ6 socket torque to 5 N·m and tighten the four M6 cross-recessed hex flange screws in sequence.

Reconnect the power cables according to the wiring diagram.

Clean the work area and organize tools.

(4) Recommended Routine Maintenance

Inspection Item	Method	Maintenance Interval
Fans	Monitor temperature sampling via EMS.	Monthly
Module Cleaning	Ensure modules are free of foreign objects.	Monthly
Visual Inspection	Check for deformation or electrolyte leaks.	Monthly
Cell/Module Connections	Verify internal voltage and insulation via EMS.	Monthly
Grounding	Test continuity between cabinet metal parts and grounding points using a multimeter.	Annually

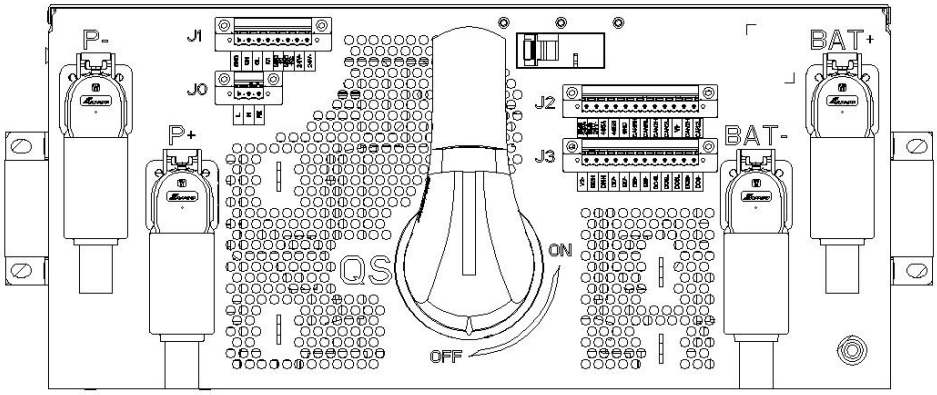
5.3.3 Control Box Maintenance

Note: Always disconnect all auxiliary power and main power switches before disassembling or installing the main control box.

(1) Tools Required:

- Lift trolley (Load capacity ≥50 kg, lifting height ≥2.5 m).
- φ8 socket.
- Phillips screwdriver.

(2) Removal Procedure



P-/P+	DC output ports.	BAT+/BAT-	Battery connection ports.
J1	Internal communication port.	J2	External communication port.
J0	Main control box power supply port.	J3	Environmental monitoring port.

Disconnect the communication harnesses J1, J0, J2, and J3.

Remove the P-/P+ power cables connecting the control box to the inverter cabinet.

Disconnect the BAT+/BAT- power cables between the battery box and main control box.

Use a Phillips screwdriver to remove the four M6 cross-recessed hex flange screws.

Position the lift trolley beneath the control box, slide the box onto the trolley, and transport it to storage.

(3) Installation Procedure

Place the main control bo on the lift trolley and align it below the installation slot.

Raise the trolley to the required height and push the control box into the box rack.

Secure the control box with the four M6 screws using the Phillips screwdriver.

Reconnect the BAT+/BAT- power cables from control box to the battery box.

Reconnect the P-/P+ power cables to the inverter cabinet.

Reattach the communication harnesses J1, J0, J2, and J3.

Clean the work area and organize tools.

(4) Recommended Routine Maintenance

Inspection Item	Method	Maintenance Interval
Appearance	Check for rust, deformation, dirt, or arcing marks.	Monthly
Communication	Verify parameters via the monitoring system.	Daily
Grounding	Test continuity between cabinet metal parts and grounding points using a multimeter.	Annually

5.3.4 Chiller Maintenance

Unit Repair and Maintenance:

Maintenance is divided into two categories: routine maintenance and preventive maintenance.

- Routine maintenance includes general inspections and can be performed by on-site personnel.
- Preventive maintenance must be conducted by qualified professionals familiar with HVAC systems, cooling systems, and electrical equipment.

(1) Pump and Compressor Maintenance

Pumps and compressors are critical components of the refrigeration cycle. Key maintenance tasks include:

- Regularly inspect the pump motor and compressor surfaces for dust buildup. Clean using a cloth or air blower.
- Ensure heat dissipation via the cooling water cycle and the motor’s rear fan.

(2) Condenser Cleaning

Dust accumulation on condenser fins reduces heat exchange efficiency, leading to system malfunctions or high-pressure alarms.

- Clean the condenser frequently, especially in summer.
- Precautions:

Avoid damaging fins during cleaning.

Rinse with water against the airflow direction to maximize effectiveness.

(3) Calibration of High/Low Pressure Protection

The high-pressure cutoff is typically set at 40 Bar, and the low-pressure cutoff at 6 Bar.

- Calibrate annually using a dual-pressure gauge to ensure accuracy.
- Simulate high/low pressure conditions during testing to verify protection settings.

(4) Temperature/Humidity Sensor Calibration

Sensors are factory-calibrated but may drift due to power instability or environmental factors.

- Use a certified reference thermometer/hygrometer for recalibration if deviations occur.

⚠ Important Notes:
① Do not operate in flammable or explosive environments.
② Ensure unobstructed airflow at the condenser inlet/outlet.
③ Avoid frequent power cycling, as repeated startups may damage the unit.
④ Do not attempt unauthorized repairs. Contact the manufacturer or authorized dealer for service to prevent operational failures or equipment damage.
⚠ Warnings:
① Never insert fingers or objects into the condenser inlet/outlet vents to avoid injury or equipment damage.
② Do not damage power or sensor cables, and never unplug/plug the power cord to control the unit.

(5) Recommended Routine Maintenance

Component	Inspection Task	Maintenance Interval
Electrical Controls	Calibrate temperature/pressure sensors	Annually
	Verify protective grounding	Annually

	Calibrate instruments, meters, and clocks	Annually
Air Handling	Inspect fan operation and blade deformation	Quarterly
	Clean/replace air filters	Monthly
	Check water inlet/outlet valves and drains	Monthly
	Inspect for air leaks	Monthly
Compressor Section	Check suction/discharge pressure and temperature anomalies	Quarterly
	Inspect refrigerant pipe fastening	Annually
	Check compressor valve port leaks	Quarterly
Other Components	Clean surface dust and debris	Monthly
	Clean condenser fins	Quarterly
	Inspect fan motor brackets and blades	Quarterly
	Lubricate fan motor bearings	Quarterly
	Verify fan speed control and F.V.S settings	Quarterly

5.3.5 Fire Protection System Maintenance

Recommended routine maintenance tasks and intervals are listed below:

Inspection Item	Method	Maintenance Interval
Temperature/Smoke Sensors	Deactivate the fire suppression tank and test sensor functionality.	Once a year
Combustible Gas Detection	Deactivate the fire suppression tank and verify detector operation.	Once a year
Battery Replacement	Replace batteries in the control box.	Once 3 years

5.3.6 Cabinet Maintenance

Recommended routine maintenance tasks and intervals are listed below:

Inspection Item	Method	Maintenance Interval
Cleaning	Inspect and clean the cabinet interior/exterior.	Once a year
Grounding	Check for loose or corroded screws on grounding busbars.	Once 6–12 months (depending on environment)
PCS Compartment Dust Filter	Replace the filter (same specifications as original).	Once 3–6 months (depending on environment)

Appearance	Inspect for paint damage; repaint if necessary.	Once a year
Sealing	Verify cabinet door waterproofing.	Once a year

5.3.7 BMS/Local Monitoring System Maintenance

Inspection Item	Method	Maintenance Interval
System Status	Check system status via the HMI in the electrical cabinet.	Once a month
SOC Calibration	Fully charge or discharge the energy storage system to recalibrate SOC and avoid drift.	Once a month(calibrate every 20 cycles)

VI. Factory Default Parameter

The outdoor cabinet is pre-configured with default alarm and protection parameters in the ESBCM (Energy Storage Battery Control Module) within the high-voltage box. The default values are as follows:

No.	Parameter	Alarm Level	Trigger Threshold	Hysteresis	Duration	System Action	Alarm Clearance Condition	Charge/Discharge Restriction Clearance
1	Cell Overvoltage (V)	Level 1	3.55	0.2	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	3.6		3s	Disable charging; allow discharging	Threshold – Hysteresis	Alarm cleared + All clusters have discharge current or cell voltage <3.3V
		Level 3	3.65		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
2	Cell Undervoltage (V)	Level 1	2.8	0.2	3s	Trigger alarm report	Threshold + Hysteresis	/
		Level 2	2.7		3s	Allow charging; disable discharging	Threshold + Hysteresis	Alarm cleared + All clusters have charge current
		Level 3	2.6		3s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
3	Cell Voltage Imbalance (mV)	Level 1	300	50	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	500		3s	Disable charging/discharging	Threshold – Hysteresis	Alarm cleared + 30-minute delay
		Leve	700		3s	Trigger dry	Threshold	Alarm

		l 3				contact; shutdown after 3s delay	– Hysteresis	cleared + System restart required
4	High Cell Temp During Charging (°C)	Leve l 1	52	5	3s	Trigger alarm report	Threshold – Hysteresis	/
		Leve l 2	57		3s	Disable charging; allow discharging	Threshold – Hysteresis	Fault resolved
		Leve l 3	62		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
5	Low Cell Temp During Charging (°C)	Leve l 1	5	3	3s	Trigger alarm report	Threshold + Hysteresis	/
		Leve l 2	3		3s	Disable charging; allow discharging	Threshold + Hysteresis	Fault resolved
		Leve l 3	1		3s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
6	High Cell Temp During Discharging (°C)	Leve l 1	52	5	3s	Trigger alarm report	Threshold – Hysteresis	/
		Leve l 2	57		3s	Allow charging; disable discharging	Threshold – Hysteresis	Fault resolved
		Leve l 3	62		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
7	Low Cell Temp During Discharging (°C)	Leve l 1	-10	5	3s	Trigger alarm report	Threshold + Hysteresis	/
		Leve l 2	-15		3s	Allow charging; disable discharging	Threshold + Hysteresis	Fault resolved
		Leve l 3	-20		3s	Trigger dry contact; shutdown	Threshold + Hysteresis	Alarm cleared + System

						after 3s delay		restart required
8	Cell Temperature Gradient (°C)	Level 1	12	3	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	15		3s	Disable charging/discharging	Threshold – Hysteresis	Fault resolved
		Level 3	18		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
9	Low SOC (%)	Level 1	15	2	3s	Alarm only	Threshold + Hysteresis	/
		Level 2	10		3s	Alarm only	Threshold + Hysteresis	/
		Level 3	5		3s	Alarm only	Threshold + Hysteresis	/
10	High SOC (%)	Level 1	101	2	3s	/	/	/
		Level 2	101		3s	/	/	/
		Level 3	101		3s	/	/	/
11	Total Overvoltage (V)	Level 1	3.55*48*5= 852	10	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	3.60*48*5= 864		3s	Disable charging; allow discharging	Threshold – Hysteresis	Alarm cleared + All clusters have discharge current
		Level 3	3.65*48*5= 876		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
12	Total Undervoltage (V)	Level 1	2.8*48*5 = 672	10	3s	Trigger alarm report	Threshold + Hysteresis	/
		Level 2	2.7*48*5 = 648		3s	Allow charging; disable discharging	Threshold + Hysteresis	Alarm cleared + All clusters have charge

								current
		Level 3	2.6*48*5 = 624		3s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
13	Power Module Overheat (°C)	Level 1	90	5	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	95		3s	Disable charging/discharging	Threshold – Hysteresis	Fault resolved
		Level 3	100		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
14	Charge Overcurrent (A)	Level 1	320	10	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	330		3s	Disable charging; allow discharging	Threshold – Hysteresis	Alarm cleared + 30-minute delay or discharge current
		Level 3	345		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
15	Discharge Overcurrent (A)	Level 1	320	10	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	330		3s	Allow charging; disable discharging	Threshold – Hysteresis	Alarm cleared + 30-minute delay or charge current
		Level 3	345		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
16	Low Insulation (kΩ)	Level 1	2000	10	10S/60s	Allow charging/discharging	Threshold + Hysteresis	/

		Level 2	1800		10S/60s	Disable charging/discharging	Threshold + Hysteresis	Fault resolved
		Level 3	1500		10S/60s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
17	Battery Cabinet Overvoltage (V)	Level 1	3.55*48=170.4	5	3s	Trigger alarm report	Threshold – Hysteresis	/
		Level 2	3.60*48=172.8		3s	Disable charging; allow discharging	Threshold – Hysteresis	Alarm cleared + All clusters have discharge current
		Level 3	3.65*48=175.2		3s	Trigger dry contact; shutdown after 3s delay	Threshold – Hysteresis	Alarm cleared + System restart required
18	Battery Cabinet Undervoltage (V)	Level 1	2.7*48=139.6	5	3s	Trigger alarm report	Threshold + Hysteresis	/
		Level 2	2.6*48=124.8		3s	Allow charging; disable discharging	Threshold + Hysteresis	Alarm cleared + All clusters have charge current
		Level 3	2.5*48=120		3s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
19	HMI-BCU Communication Fault	Level 3	/	/	3s	Trigger dry contact; shutdown after 3s delay	Threshold + Hysteresis	Alarm cleared + System restart required
20	BCU-BMU Communication Fault	Level 3	/	/	3s	Trigger dry contact; shutdown after 3s delay	Communication restored	Alarm cleared + System restart required
21	External Signal Fault :	Level 3	/	/	2s	Trigger dry contact; shutdown	Real-time monitoring	Alarm cleared + System

	Fire fault/emergency stop signal/electrical operation					after 3s delay		restart required
22	Cell Voltage Sampling Fault	Level 3	/	/	3s	Trigger dry contact; shutdown after 3s delay	Data sampling restored	Alarm cleared + System restart required
23	Cell Temp Sampling Fault	Level 3	Invalid temp sensors ⩾6 or ⩾ 3 BMUs	/	3s	Trigger dry contact; shutdown after 3s delay	Data sampling restored	Alarm cleared + System restart required
24	Rapid Temp Rise Alarm	Level 2	Temp rise rate >10° C/min	/	3s	Disable charging/discharging	Temp rise rate ⩽ 10° C/min	Fault resolved
25	Breaker/Contactor Fault (Master Control)	Level 3	/	/	3s	Trigger dry contact; shutdown after 3s delay	Fault resolved	Alarm cleared + System restart required
26	Slave peripheral fault (DI detection)	Level 1	/	/	3s	Trigger alarm	Real-time monitoring	/
27	Cluster Current Imbalance	Level 1	Minimum cluster current * 1.25 < maximum cluster current, and stack current > 15A	/	60s	Trigger alarm	Fault condition not met	/

VII. Fault Analysis and Troubleshooting

7.1 Important Notes

⚠ Warnings:
(1) Lethal high voltage may still exist inside the energy storage system under fault conditions!
(2) Only qualified technicians trained in fault diagnosis and repair may perform operations described in this chapter.
(3) Follow all safety protocols during troubleshooting.
(4) Do not attempt repairs beyond the scope of this manual. Contact SUNWODA Energy Technology if unresolved, providing: ● System model and serial number. ● Details of connected components (manufacturer, model, battery configuration). ● Communication scheme of the system. ● Fault description and photos (if applicable).

7.2 Preliminary Check

If the system fails to charge/discharge as expected, check the following before contacting support:

(1) Open-circuit voltage of the battery.

(2) Grid connection and power supply status.

(3) Communication integrity between the system and external EMS/PCS.

7.3 Fault Diagnosis and Resolution Table

Component	Fault Type	Root Cause	Solution
Cell	Reduced Efficiency	Prolonged usage causing severe aging of individual cells.	Replace severely aged cells.
		Prolonged usage leading to poor consistency among individual cells.	Perform manual balancing on cells with significant inconsistency.
	Excessive Cell Voltage Imbalance	Prolonged usage causing degraded consistency of cells within the PACK.	Perform manual balancing.
	Voltage Too Low to Start System After Over-Discharge	Extended idle time after full discharge, causing cell voltage to drop below the threshold.	For long-term idle energy storage systems, perform monthly

			charge/discharge cycles.
		Partial DC loads remain connected after discharge, continuously consuming DC energy.	Disconnect all DC-side loads if the system is unused for extended periods.
	Low Voltage in Individual Cell	Cell failure.	Replace the faulty cell.
		Severe aging of an individual cell.	Replace the severely aged cell.
		Poor consistency of an individual cell.	Perform manual balancing on the highly inconsistent cell.
	SOC Calibration Failure	Cell voltage exceeds normal range.	Refer to the solutions for "Low Voltage in Individual Cell" .
		Ambient temperature does not meet the required conditions (STC).	Restore the ambient temperature to Standard Test Conditions (STC).
PACK	Abnormal Battery Pack	BMU failure.	Replace BMU.
		Incorrect PACK addressing.	Readdress PACKs (required if PACKs are delivered separately).
BMU	Communication Failure	CAN line disconnection.	Replace CAN cable.
	Voltage Imbalance	BMU malfunction (if PACK internal voltage imbalance is detected).	Replace BMU.
	Single Cell Anomaly	BMU malfunction (if wiring is confirmed normal).	Replace BMU.
	Startup Failure	BMU failure.	Replace BMU.
BCMU & Main Control Box	Communication Failure	Loose communication cables.	Reconnect loose cables.
		CAN line break.	Replace CAN line.

		Signal interference.	Eliminate interference sources (e.g., PCS topology).
		Missing terminal resistor.	Verify terminal resistor meets specifications.
	Battery Cluster Fault	Actual fault (e.g., overcurrent, overtemperature, fuse damage).	Resolve the underlying fault.
		Incorrect BCMU parameter settings.	Adjust parameters to appropriate values.
	Indicator Light Anomaly	Abnormal power input.	Restore power input to 24VDC.
	Cluster Isolation	Loose connectors.	Re-plug connectors.
	Temperature Anomaly	Poor internal component contact.	Secure loose components.
		Aged temperature sensor.	Replace aged sensors.
		Incorrect sensor placement.	Relocate sensors away from heat sources.
		Non-compliant operating environment.	Operate within system specifications.
	SOC Anomaly	Extended operation without SOC calibration.	Fully charge/discharge the system monthly to trigger BMS calibration.
	Excessive Inter-Cluster Voltage Imbalance	Incorrect voltage difference protection settings.	Adjust protection values based on terminal voltage.
		Automatic isolation not enabled.	Enable automatic isolation.
	Main Control Box Component Fault	Fuse damage.	Replace damaged components.
		Contactor failure.	
Chiller	Compressor Startup Failure	Power off.	Replace damaged components.
		Overload tripping.	

		Loose electrical connections.	
	Excessive Compressor Noise	Refrigerant leakage.	Repair leaks and refill refrigerant.
		Clogged filter.	Replace filter.
		Faulty expansion valve.	Replace expansion valve.
Cabinet	Water Leakage	Loose screws during transportation.	Tighten all screws.
	Overheating	Unmaintained filter cotton.	Clean/replace filter cotton regularly.
	Corrosion	Untreated paint damage on outdoor cabinet.	Inspect and repaint damaged areas periodically.
Fire Protection	Backup Power Failure	Faulty backup battery.	Replace backup battery.

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