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User Manual

Great One 260 Outdoor Cabinet



Guangzhou Great Power Energy Storage Technology Co., Ltd.

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Version Change History

Revision Date	Release version	Changes
2024.11.01	A01	Initial release
2025.01.21	A02	Added fire fighting strategy and liquid cooling unit maintenance instructions
2025.04.07	A03	Added external meter wiring instructions and system storage instructions
2025.05.09	A04	Added explanation of terms and replaced EMS instruction photos

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Preface

Product Overview

260KWh AC Liquid-Cooled C&I energy storage cabinet is an optimized integration of the Battery Management System (BMS), thermal management, battery, power distribution system, Power Conversion System (PCS), and fire protection system. It features high safety, long cycle life, easy scalability, and high integration, with a single-string design.

For grid-side applications, the cabinet supports harmonic suppression, reactive power compensation, and three-phase imbalance mitigation, while also providing peak shaving, valley filling, peak regulation, and frequency regulation capabilities. To expand the energy storage system, multiple cabinets can be directly connected in parallel—ready for operation once cabling is completed.

This manual describes the functional features and operational guidelines of the liquid-cooled outdoor cabinet, including product installation, parameter configuration, on-site commissioning, fault diagnosis, routine maintenance, and related precautions. Before use, carefully read this manual and ensure all safety instructions are fully understood.

Perform offline switching strictly following the steps in the user manual;

When communicating with domestic technicians, complete one of the

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following two steps:

1. Connect to a local Ethernet cable and change the local network mode to Wired Network;
2. Connect an external local wireless router, obtain a local IoT card, and provide network access to EMS.

Specifications

- EMS: Energy Management System
 - UPS: Uninterruptible Power Supply
 - BMS: Battery Management System
 - ESS: Energy Storage System
 - BAU: Battery Array Unit
 - BMU: Battery Management Unit
 - BCU: Battery Cluster Management Unit
 - PCS: Power Conversion System
 - SOC: State Of Charge
-

Warranty Statement

Under normal operating conditions, our company provides warranty services for any product malfunction or damage during the warranty period (refer to the purchase order for specific warranty duration). Outside the warranty period, repair

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fees will apply.

The following scenarios will incur repair charges, even within the warranty period:

- Damage caused by failure to operate the product in accordance with the manual.
- Damage resulting from fire, flooding, or abnormal voltage conditions.
- Damage due to using the product for unintended purposes.
- Damage caused by exceeding the product's specified operational limits.
- Secondary damage caused by force majeure events (natural disasters, earthquakes, lightning strikes, etc.).

Service fees are calculated according to the manufacturer's standard rates. If a contractual agreement exists, its terms shall take precedence. For detailed warranty terms, please refer to the "Product Warranty Card."

Safety Precautions

Safety Notice

- This section outlines critical safety guidelines for the proper use of this product.

Before operation, carefully read the manual and fully understand all safety instructions. Failure to comply may result in fatal injuries, severe harm, or equipment damage.

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- The terms "Danger," "Warning," and "Caution" in this manual do not cover all safety requirements but serve as supplementary reminders to general safety practices.
- This product must only be used in environments meeting its design specifications. Otherwise, malfunctions may occur. Functional abnormalities or component damage caused by non-compliance are excluded from product quality warranties.
- Our company bears no legal liability for personal injuries, property losses, or other accidents resulting from violations of this manual's instructions or improper operation.
- This product only be used in remote outdoor locations where applicable installation specifications and standards permit. It must not be used in dusty or sandy environments, nor in marine or seismic conditions.

Safety Level Definitions

	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a hazardous situation which, if not avoided,

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	could result in minor or moderate injury or equipment damage.
--	---

Safety Warning Labeling



To prevent unauthorized personnel from approaching or accidentally operating the equipment, thereby avoiding potential hazards, strictly adhere to the following protocols:

- Place highly visible warning signs at the front and rear power switches of the liquid-cooled outdoor cabinet to prevent accidental switch-on and potential accidents.
- Erect warning signboards or install safety barrier tape around the operational area to restrict access.
- After completing maintenance or servicing, always remove the cabinet door key and store it securely to prevent unauthorized access.

Escape Route Requirements



- During all operations (including maintenance and servicing) on liquid-cooled outdoor cabinets, escape routes must remain completely unobstructed at all times.

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- It is strictly prohibited to place any objects or occupy escape routes in any manner.

Battery Energy Storage Safety Protection



- Deadly high voltage exists between the positive and negative terminals of the energy storage battery pack. Accidental contact may result in electric shock or fatal injury.
- Before performing any maintenance, ensure all connections between the energy storage converter (PCS) and the battery system are fully disconnected.
- Place clear warning signs at all disconnection points to prevent accidental re-connection.

Safety During Operation

- Some product illustrations in this manual may show components with covers or safety guards removed for clarity. Always reinstall all protective covers before operation and follow the manual' s safety procedures.
- Product images in this manual are for reference only and may differ slightly from the actual ordered product. Always refer to the delivered equipment for accurate specifications.

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Unpacking Inspection



- If the product is found with internal water ingress, missing components, or damaged parts during unpacking, please contact after-sales service immediately!
- Carefully check the packing list. If any discrepancies are found between the list and the product name, please contact after-sales service promptly!



- Before opening the package, inspect the external packaging for integrity, including any signs of damage, water exposure, moisture, or deformation.
- Open the packaging layer by layer in sequence. Violent striking or hammering is strictly prohibited!
- After unpacking, carefully check against the packing list to verify that the equipment, accessories, and documentation are complete.

Storage and Transportation Requirement

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- Always use professional lifting equipment and have qualified personnel handle large or heavy products. Otherwise, there is a risk of injury or product damage!
- Before vertically lifting the product, ensure that components such as the front cover and terminal blocks are securely fastened with screws. Otherwise, loose parts may cause injury or product damage!
- When the product is lifted by hoisting equipment, personnel are prohibited from standing or staying underneath it.
- When lifting the product with wire ropes, do so smoothly and evenly. Avoid vibration, impact, tilting, or keeping the product suspended for extended periods, otherwise there is a risk of injury or product damage!



- When moving the product, always handle it gently and watch your step to prevent tripping or falling, otherwise there is a risk of injury or product damage!
- Strictly follow the specified storage and transportation requirements for the product, otherwise there is a risk of product damage.
- Avoid storage and transportation in areas with water splashes, rain exposure, direct sunlight, strong electric fields, strong magnetic fields, or severe vibrations.
- Avoid storing the product for more than 3 months. For longer storage periods,

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implement stricter protective measures and necessary inspections.

- Ensure the product is properly packaged before vehicle transportation. For long-distance transport, sealed containers must be used.
- It is strictly prohibited to transport this product together with any equipment or items that may affect or damage it.

Installation Requirements



- Only professionals trained in electrical equipment operation may install this product. Unauthorized personnel are strictly prohibited from performing installation!



- Read the product manual and safety precautions thoroughly before installation!
- Do not install in areas with strong electric fields or electromagnetic interference!
- Ensure the installation site has sufficient mechanical strength to support the product's weight.
- Do not wear loose clothing or jewelry—risk of electric shock!
- Avoid installing in enclosed spaces (e.g., cabinets or boxes)—may cause overheating or fire!
- Do not modify the product in any way!
- Do not loosen fixed bolts or marked screws on components!
- If installing near transformers or high-EMI devices, use shielding protection to prevent malfunctions.



- When installing the product, please cover the air inlet and outlet of the product with

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cloth or paper, etc., in order to prevent metal shavings, oil, water and other foreign objects from entering the product during drilling, which may cause the product to malfunction. After the work is finished, please remove the cover to avoid the cover blocking the ventilation holes and affecting the heat dissipation, resulting in abnormal heating of the product.

During wiring operations



- Only qualified professionals are permitted to perform equipment installation, wiring, maintenance, inspection, or component replacement. Unauthorized personnel are strictly prohibited!
- Before wiring, disconnect all power sources. After power-off, wait at least five minutes before performing wiring operations due to residual voltage in internal capacitors. Measure the DC voltage of the main circuit to confirm it is within safe limits; otherwise, there is a risk of electric shock.
- All wiring operations, cover removal, or circuit board contact must be performed with the power disconnected; otherwise, there is a risk of electric shock.
- Ensure proper grounding of equipment and products; otherwise, there is a risk of electric shock.



- The cables used for wiring must meet the specified wire gauge and shielding requirements. The shielding layer of shielded cables must be reliably grounded at one end only!
- Terminal screws must be tightened strictly according to the torque specified in the manual. Insufficient or excessive tightening torque may cause overheating, damage at connection points, posing a fire hazard!
- After wiring is completed, you must verify all cable connections are correct, and ensure no screws, washers or exposed wire ends remain inside the product, otherwise it may cause electric shock or product damage risks!



- Strictly follow electrostatic discharge (ESD) prevention procedures and wear an anti-static wrist strap when performing wiring operations to avoid damaging the equipment or internal circuits.
- When wiring control circuits, use twisted-pair shielded cables and connect the shielding layer to the product's grounding terminal. Failure to do so may cause abnormal product operation.

During power-up



- Before power-on, ensure the product is properly installed and all wiring connections are secure.
- Before power-on, verify the power supply meets product specifications to prevent product damage or fire hazards!
- It is strictly prohibited to open cabinet doors/protective covers, touch any terminals, or disassemble components while powered on - risk of electric shock!



- After completing wiring and parameter configuration, conduct a test run to verify safe machine operation - otherwise may cause personal injury or equipment damage.
- Before energizing, confirm the product's rated voltage matches the power supply voltage. Incorrect voltage may cause fire hazards.
- Before energizing, ensure no personnel are near the product/machinery - otherwise may result in serious injury or death.

During system operation



- Only qualified professionals are permitted to operate the product. Unauthorized operation may result in serious injury or death!

- It is strictly prohibited to touch any wiring terminals, disassemble any components, or remove any parts while the equipment is powered on - risk of electric shock!



- Do not touch equipment enclosures, fans, or other surfaces to check temperature - risk of burns!
- During operation, prevent foreign objects (especially metal) from falling into the equipment - may cause fire or equipment damage!

During maintenance procedures



- Only qualified professionals may perform installation, wiring, maintenance, inspection, or component replacement.
- Maintenance while equipment is energized is strictly prohibited - risk of electric shock!
- After disconnecting all power sources, wait at least 5 minutes before performing maintenance.



- Perform daily and periodic inspections and maintenance on equipment and products in accordance with maintenance requirements, and maintain proper maintenance records.

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During repair operations



- Only qualified professionals are permitted to perform equipment installation, wiring, maintenance, inspection, or component replacement. Unauthorized personnel are strictly prohibited!
- Repairing equipment while energized is strictly prohibited—risk of electric shock!
- During maintenance, always power off the equipment and confirm the energy storage system has completely stopped operating before performing any maintenance or repair operations.
- After disconnecting all power sources, wait at least five minutes before conducting equipment inspection or repair.
- Even when all external circuits are disconnected, high voltage may still exist between the positive and negative terminals of the energy storage battery pack. Some measurements require live testing, which must be performed by qualified professionals using specialized instruments.
- Do not modify any internal components of the battery system to avoid potential hazards.



- When a circuit breaker trips, wait at least five minutes before restoring power or

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operating the equipment - otherwise may cause personal injury and equipment damage.

- For equipment failures or damage, qualified personnel must perform troubleshooting and repairs strictly according to maintenance guidelines, with proper repair documentation.
- Replace vulnerable components only per the product's replacement instructions.
- Never continue using damaged equipment - risk of severe injury or further equipment damage.
- After equipment replacement, always reconfirm wiring connections and parameter settings.

During disposal process



- Decommission equipment and products in strict compliance with national regulations and standards to prevent property damage or personal injury!
- Process and recycle decommissioned equipment and products according to industrial waste disposal standards to avoid environmental pollution.

Safety Labels

To ensure safe operation, strictly comply with all safety labels affixed to the equipment. Do not damage or remove any safety labels.

Safety warning labels	Instruction manual contents
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	The cabinet contains high voltage; before maintenance, ensure all power supplies are disconnected, wait at least 5 minutes, and only after confirming all capacitive and other energy-storing components are fully discharged may qualified personnel perform operations.		
<table border="1"> <tr> <td>  </td><td>  注意/CAUTION 大接触电流！在接通电源之前必须先接地！ HIGH TOUCH CURRENT Connect to earth before connecting to supply! </td></tr> </table>			 注意/CAUTION 大接触电流！在接通电源之前必须先接地！ HIGH TOUCH CURRENT Connect to earth before connecting to supply!
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1 Product Information

The Great One 260 Outdoor Cabinet Energy Storage System is our company's independently developed product capable of both grid-connected and off-grid operation. As a crucial component in smart grid energy storage applications, it effectively regulates power resources, balances daily and seasonal electricity demand variations, manages supply-demand gaps, and ensures grid security, serving as an essential foundation for renewable energy utilization and an effective means to achieve intelligent grid management. The system comprises battery clusters, high-voltage boxes, PCS (Power Conversion System), fire protection systems, and liquid cooling systems.

1.1 Product Principle

Liquid-cooled outdoor cabinet is mainly composed of liquid-cooled PACK, high-voltage box, liquid cooler, fire protection, energy management system (EMS), etc.

Liquid-cooled PACK: It consists of 65 battery cells connected in series, with a built-in battery management system that can monitor the status of each battery and built-in fire protection to ensure PACK-level fire safety.

High-voltage box: responsible for managing a cluster of batteries, collecting operating information of the batteries in this cluster, fault diagnosis and alarm,

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battery balancing strategy analysis, SOC calculation, insulation detection, relay adhesion detection, controlling related relays, and communicating data with PCS and EMS.

Liquid cooler: responsible for thermal management, keeping the battery temperature within a certain range and maintaining the consistency of battery temperature.

Firefighting System: Reduce the impact of fire after thermal runaway of the battery.

PCS: Responsible for the AC input and output of the outdoor cabinet, can exchange data with the BMS and EMS, can switch between grid-connected and off-grid, and can realize parallel operation of multiple outdoor cabinets.

Energy Management System (EMS): used to manage the entire outdoor cabinet, intelligently control the start and stop of the liquid cooler, and intelligently control the PCS for charging and discharging. Intelligent control realizes functions such as parallel connection of multiple outdoor cabinets and reverse power protection, while calculating and displaying the charging and discharging amount and displaying the revenue situation.

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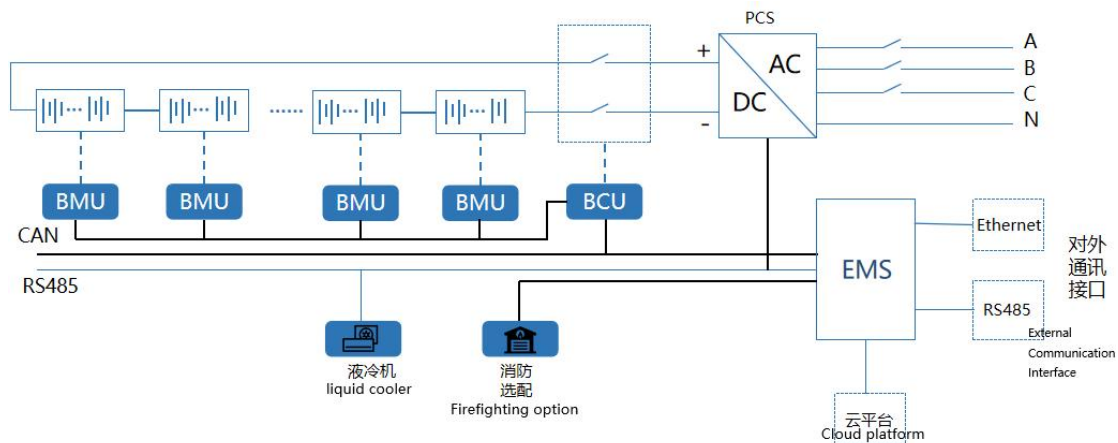


Figure 1-1 System topology

1.2 Nameplate Instruction

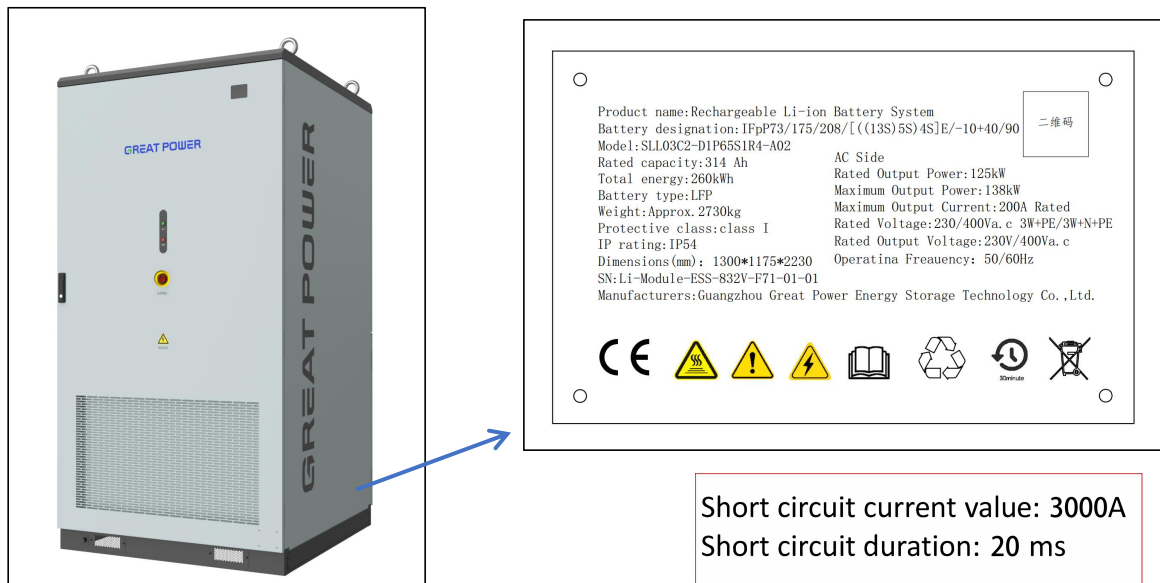


Figure 1-2 Nameplate Explanation Diagram

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1.3 Product Specifications

Table 1-1 Electrical Specifications

Project		260kWh
DC battery parameters	Cell Type	GSP71173204F-314AH 3.2V
	Battery system configuration	1P260S
	Battery box model	GSP71173204F-314Ah-1P65S
	Battery box combination	65S1P*4
	Rated voltage (V)	832
	Battery voltage range (Vd.c.)	728~936
	Battery system energy (kWh)	260
	Rated current (A)	157
	Maximum current (A)	194
	Charge and discharge rate	0.5C
	Cooling method	Liquid Cooling
AC parameters (grid-connected)	Rated charge and discharge power (kW)	125
	Maximum charge and discharge power (kW)	138
	Rated charge and discharge current (A)	200
	Rated grid voltage (V)	400

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Project		260kWh
	Permissible grid voltage range	230/400
	Rated grid frequency (Hz)	50/60
	Maximum efficiency	98.5%
	Overload capacity	110%, long term
	Power factor range	-1~1
	Overload capacity	1.2Pn, lasting 1 minute
AC parameters (off-grid)	Rated output voltage (V)	230/400
	Voltage total harmonic distortion	<3% (linear load)
	System efficiency	≥88% (standard working conditions)
	Communication interface	LAN/485
	Operating temperature (°C)	-20~+55 (> 45°C derating)
	Noise (dB)	≤75
	Dimensions (W*D*H) (mm)	1175*1300*2230
	Weight (kg)	≈2730
Protect	DC input	Circuit Breaker + Fuse
	AC Input	breaker
	Overvoltage protection	DC Type II
	Fire protection system	Aerosol
Line entry method	Bottom cable entry / Top cable entry	
Environmental requirements	Allowable ambient temperature (°C)	-20~55 (> 45°C derating)

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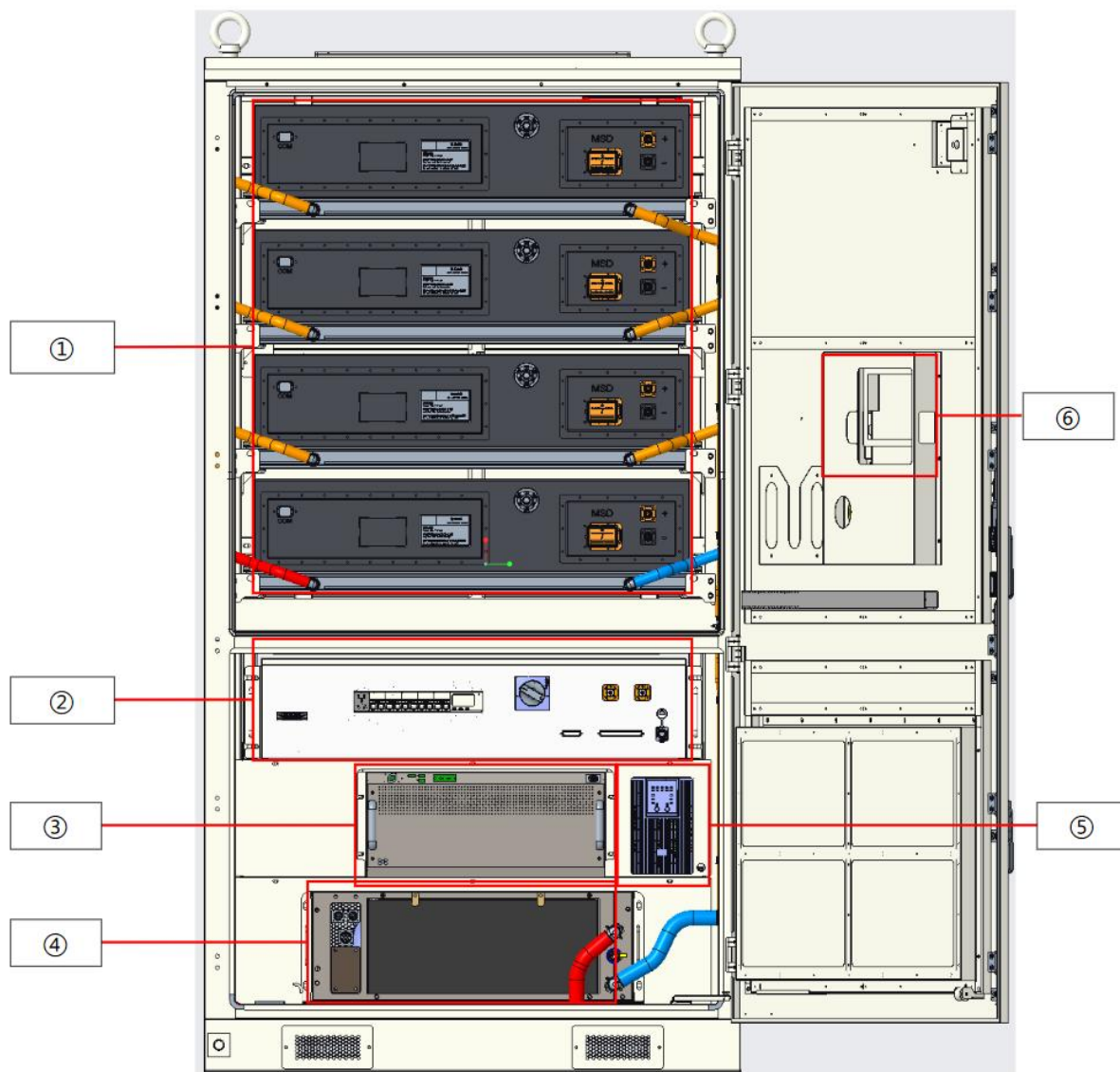
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Project		260kWh
	Allowable ambient humidity (%RH)	0~95
	Working altitude (m)	< 2000
	Protection level	IP54
	Cooling method	Intelligent Liquid Cooling

1.4. Description of main components



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Figure 1-3 Great One 260 main components diagram

Table 1-2 Description of the main components of Great One 260

NO.	Name	Illustrate
1	Energy storage unit	The core part of the energy storage system, used to store electrical energy.
2	High voltage box and power distribution integrated cabinet	It mainly supplies power to internal liquid coolers, high-voltage boxes, EMS and other equipment.
3	PCS	The main function of the energy storage converter is to realize the energy exchange between the battery and the power grid and control the charging and discharging of the battery. In the grid-connected system, the converter mainly operates in the current source (P/Q) mode to realize peak shaving and valley filling, frequency modulation and peak regulation, active power reserve and reactive power support for the power grid. At the same time, the converter also supports multiple modes such as constant voltage, constant current and constant power. Charge and discharge mode.
4	Liquid Cooler	The liquid cooling unit is used to regulate the temperature of the battery pack in the energy storage system to ensure that it always operates within the appropriate temperature range to maintain the optimal working state of the system.
5	UPS	Uninterruptible Power Supply
6	EMS	The energy management system intelligently manages the entire outdoor cabinet, calculates the charge and discharge capacity, and calculates the benefits.

1.4.1 Power Distribution

UPS is an uninterruptible power supply with energy storage device. It is mainly used to provide uninterrupted power supply to some equipment with high

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requirements on power supply stability. When the mains input is normal, UPS can stabilize the output voltage and frequency, and protect the load equipment from voltage fluctuations and frequency changes. UPS also has filtering function, which can reduce electromagnetic and radio frequency interference to ensure the normal operation of load equipment; when the mains power is interrupted (such as power outage), UPS can quickly switch to battery power supply to protect the software and hardware of the load equipment from damage, and ensure the uninterrupted operation of the load equipment through battery inverter power supply.

1.4.2 PCS

The main function of PCS (energy storage converter) is to realize the power conversion between the power grid and lithium batteries, and monitor and manage the exchange process. This system includes lithium batteries, battery management equipment and energy management equipment. The schematic diagram is as follows:

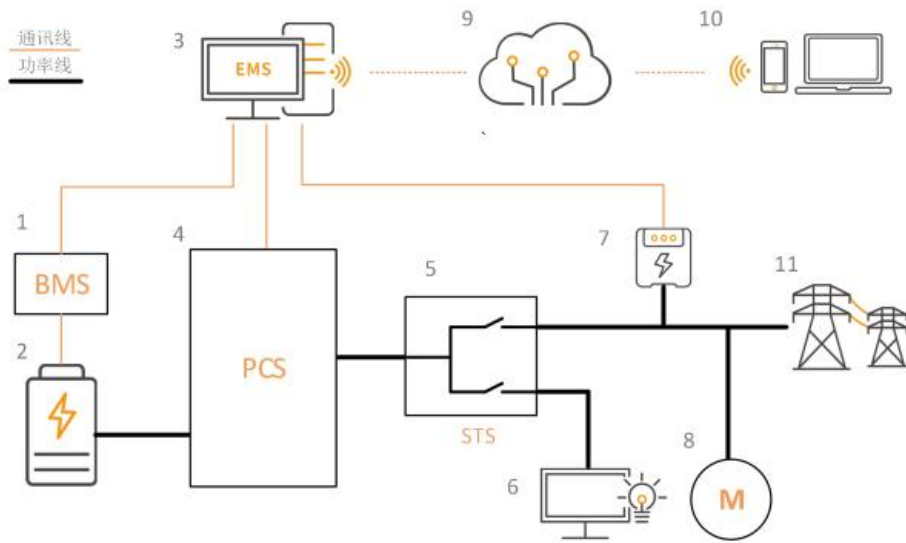


Figure 1-4 Schematic diagram of energy storage conversion system

Table 1-3 Description of energy storage conversion system

NO.	Name	Illustrate
①	Lithium battery	Lithium iron phosphate material
②	BMS	The battery management system is responsible for the management, protection and monitoring of the battery pack.
③	EMS	The energy management system is responsible for the energy scheduling and monitoring of the entire system.
④	Power grid	When the energy storage PCS product works in grid-connected mode, the AC side must be connected to the grid.
⑤	PCS	The energy storage inverter is responsible for the energy exchange between the battery pack and the power grid.

Illustrate

The orange connecting wire is the power cable, and the blue connecting wire is the monitoring communication cable.

The panel appearance of the PCS modular machine is shown in Figure 1-5:

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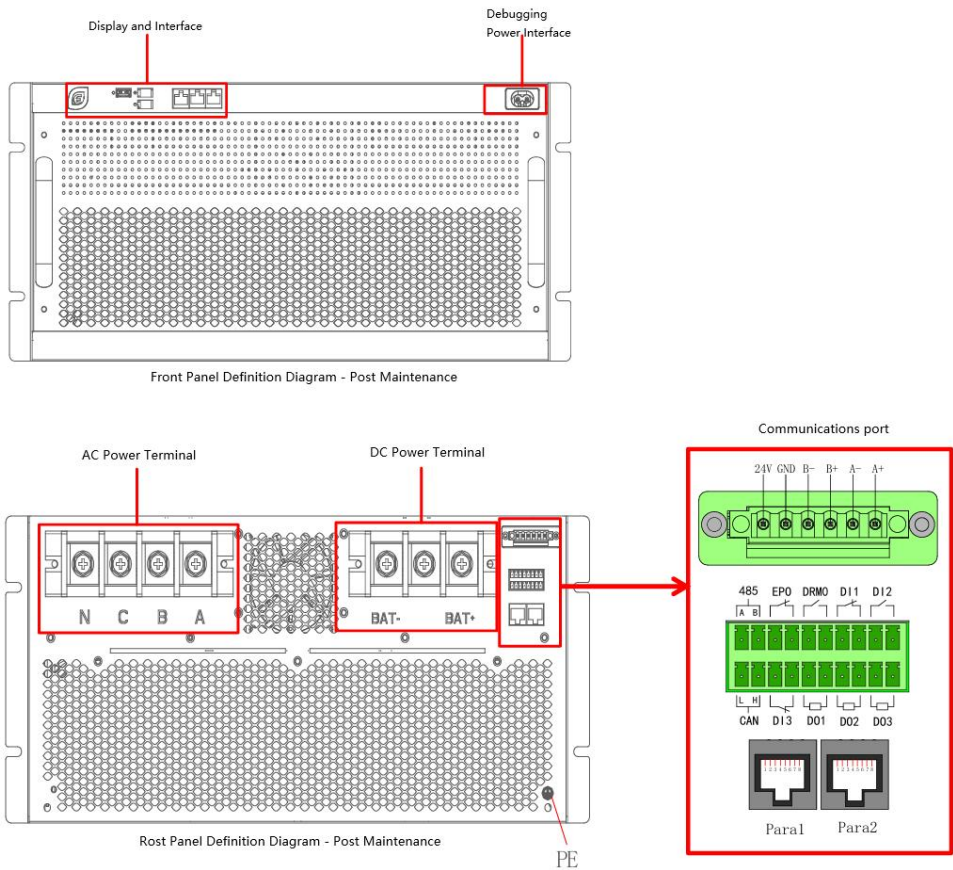


Figure 1-5 PCS-125kW module panel appearance

Table 1-4 Component Description

NO.	Description
1	Indicator Lights
2	DC terminal block (M8)
3	AC terminal block (M8)
4	Ground terminal block (M6)

The display and interface panel of the energy storage converter is shown in

Figure 1-7:

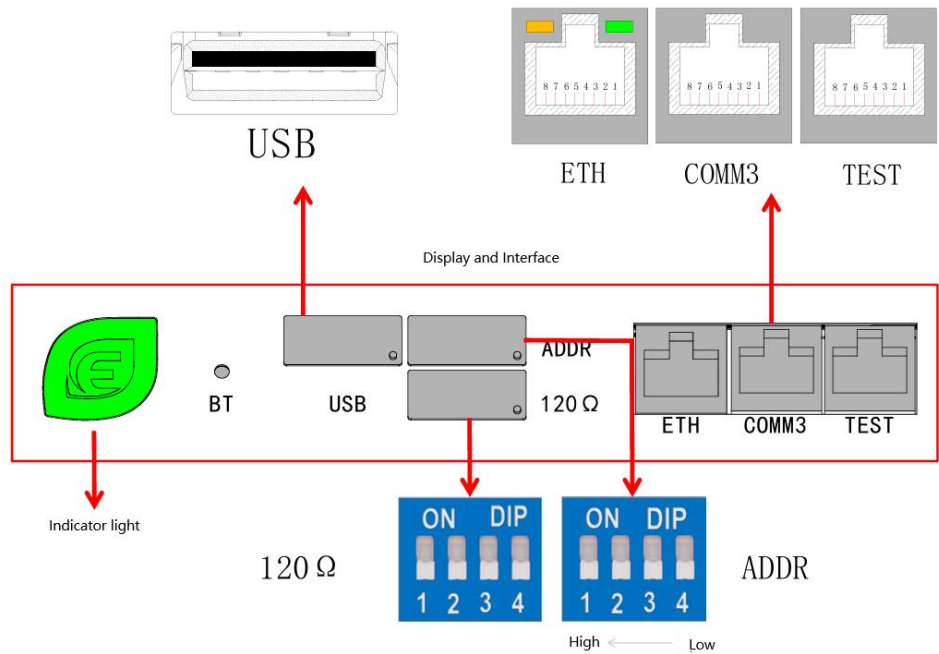


Figure 1-6 Display and interface panel diagram

Table 1-5 Definition of indicator lights

Name/Symbol	Functional Description
Indicator Lights	The green light is on for a long time when the output power is running; In standby mode (0kW operation), the green light flashes for 0.5s; When the machine is not turned on and there is no fault, the green light flashes slowly for 1s; The red light stays on when there is a fault.
BT	Bluetooth indicator light; The blue light turns on when the Bluetooth connection is successful.
USB	Reserved USB port for upgrading software/configuration files
ADDR	"ADDR" is the module address setting dip switch (binary), the 4th bit is the lowest bit (carry from right to left)
120Ω	"120Ω" This port is a 4-bit binary DIP switch 1.ARM_CAN1 reserves CAN communication matching resistor, and the upper switch is used to connect to the 120Ω matching resistor; 2. ARM_CAN2 120Ω reserved CAN communication matching resistor,

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Name/Symbol	Functional Description
	dial up to connect to 120Ω matching resistor; 3. SYNC_CAN1 Para CAN signal matching resistor, PCS parallel communication, dial up to connect to 120Ω matching resistor; 4. DSP_CAN2 Phoenix terminal CAN signal matching resistor, dial up to connect to 120Ω matching resistor.
ETH	Ethernet port, supports ModbusTCP protocol, can be connected to EMS or exchange
COMM3	Reserve
TEST	Dedicated interface for background debugging
Debug power interface	220V AC power input (for debugging only)
DC (AC) power port	AC and DC power connection port
PE	Ground wire interface (M6 screw)

1.4.3 Fire Fighting System

The PACK class fire fighting system consists of an aerosol fire fighting unit which is activated by temperature.

The system-level fire protection system consists of cabinet smoke detectors, temperature detectors, sound and light alarms, and fire extinguishing devices. The sound and light alarms in a single outdoor cabinet are connected to the smoke detectors. When the smoke detector detects that the combustible gas or smoke reaches a certain level, the sound and light alarm is activated. When the

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temperature detector detects that the temperature reaches a certain level, the fire protection system opens the aerosol fire protection module to spray the fire extinguishing agent and activate the fire suppression system.

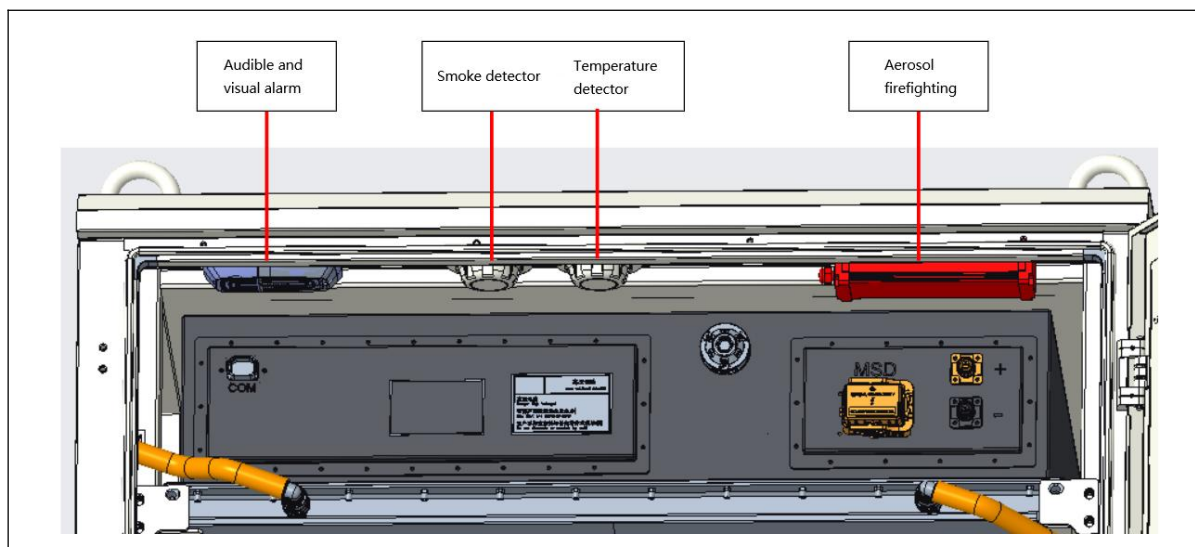
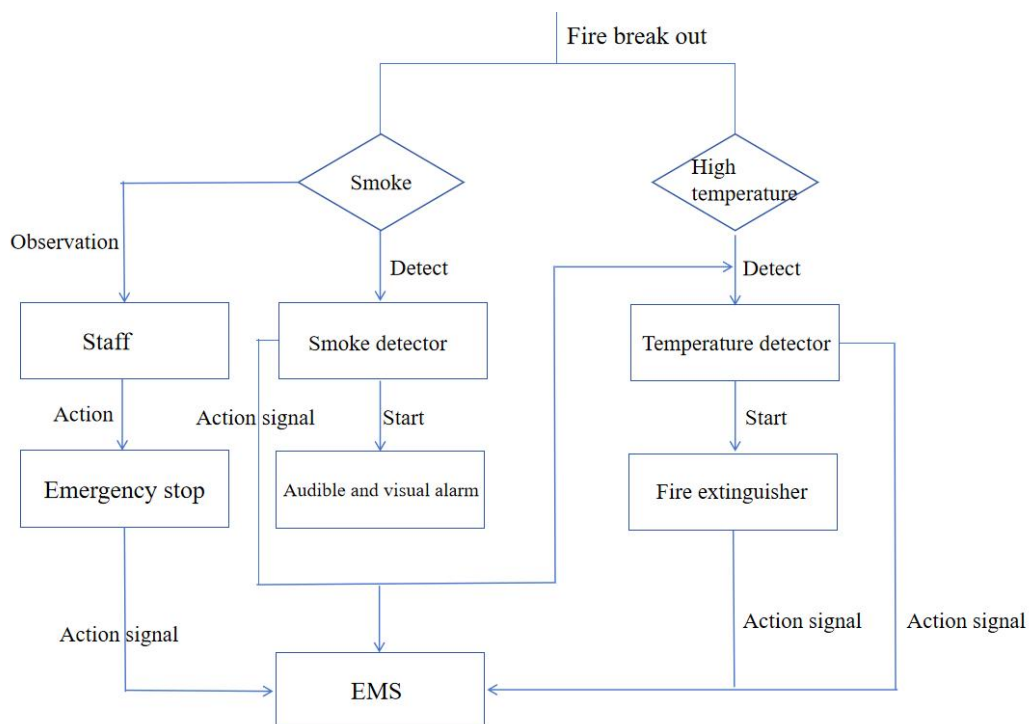


Figure 1-7 Fire protection system diagram

The fire protection system control logic diagram is as follows:



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Figure 1-8 Fire control strategy diagram

1.4.4 Liquid Cooler

The liquid cooling unit is mainly composed of a compressor, a condenser, a throttling element, an evaporator, a water pump, an expansion valve, a PTC liquid heater and necessary control components. The liquid cooling unit is used to adjust the temperature of the battery pack in the energy storage system to ensure that it always works within the appropriate temperature range to maintain the best working state of the system. It has the following functions:

- Accurate measurement and monitoring of coolant temperature.
- When the battery pack temperature is high, effective heat dissipation is performed to prevent thermal runaway accidents.
- Preheat the battery when it is at a low temperature to raise the battery temperature and ensure charging and discharging performance and safety at low temperatures.

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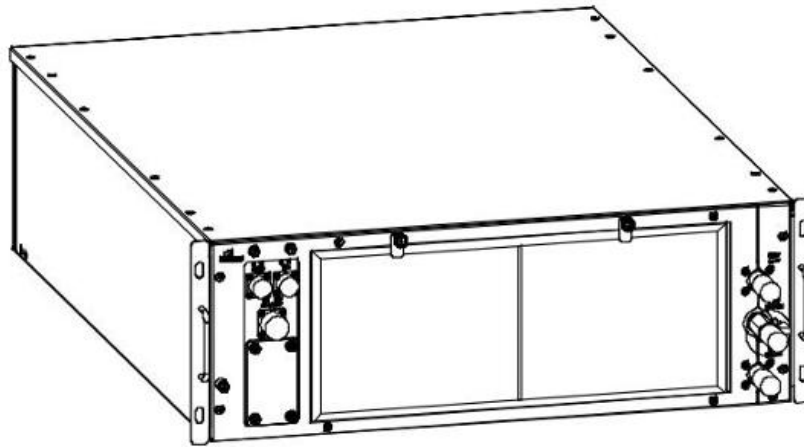


Figure 1-9 Liquid cooler appearance

The working principle is shown in the figure below:

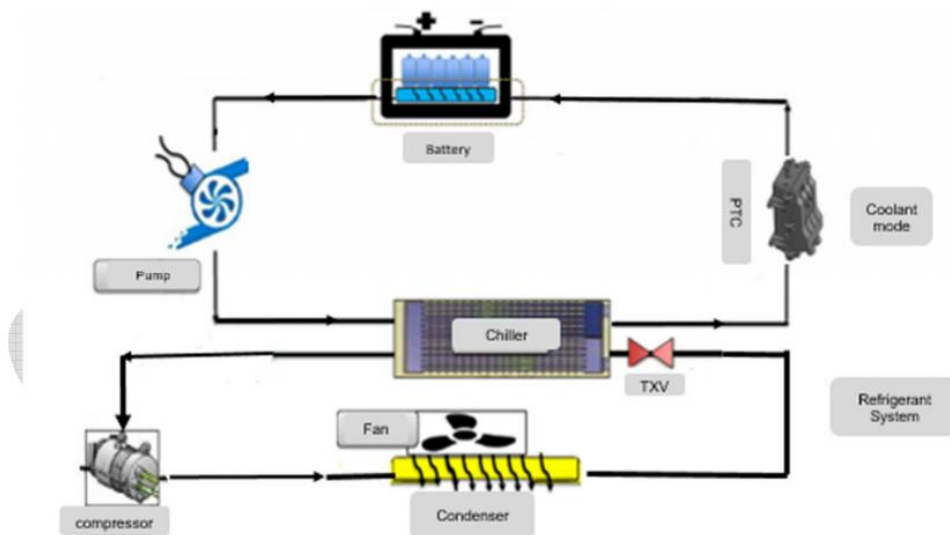


Figure 1-10 Schematic diagram of the working principle of the cooling machine

Cooling mode

Both the refrigerant circulation circuit and the coolant circulation circuit are open.

- On the refrigerant side, the compressor compresses the low-temperature,

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low-pressure gaseous refrigerant into a high-temperature, high-pressure gaseous refrigerant and enters the condenser. After forced convection cooling by the condensing fan, it undergoes a phase change and releases heat to become a medium-temperature, high-pressure liquid refrigerant and enters the throttle valve. After isenthalpic throttling and pressure reduction in the throttle valve, it becomes a low-temperature, low-pressure liquid mist refrigerant and enters the evaporator. In the evaporator, the liquid mist refrigerant evaporates and absorbs the heat of the coolant to become a low-temperature, low-pressure gaseous refrigerant, and then enters the compressor to start the next cycle.

- On the coolant side, the liquid pump works to make the high-temperature coolant in the battery pack cooling plate enter the evaporator to exchange heat with the refrigerant, becoming low-temperature coolant, which flows back into the battery pack cooling plate to dissipate heat and cool the battery pack.

Heating mode

The refrigerant circulation loop, compressor and condensing fan are all closed, and the coolant circulation loop is opened. On the coolant side, the water pump is started, and the heater is turned on. The coolant flows through the heater to be heated, and then flows back into the battery pack cooling plate to achieve heating and heat preservation of the battery pack.

Refrigeration start/stop

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When the set cooling start threshold is reached, the liquid cooling unit will turn on the compressor and start to cool the coolant by heat exchange;

When the set cooling stop threshold is reached, the liquid cooling unit will turn off the compressor and start cooling the coolant by heat exchange.

Heating start/stop

The refrigerant circulation loop, compressor, and condenser fan are all shut off, while the coolant circulation loop is activated. On the coolant side, the water pump starts and the heater turns on. The coolant flows through the heater to be warmed, then returns to the battery pack cooling plates to provide heating and insulation for the battery pack.

Technical Parameters

Table 1-5 Technical parameters of liquid cooling unit

Item	Specification
Supported voltage range	220V±15%, 50/60±3Hz
Cooling input power @L35/W18	1.5kW
Heating input power @Tu=10 °C	2.2kW
Heating capacity @Tu=10 °C	2kW
Cooling capacity @L35/W18	3kW
Operating temperature	-30°C~+55°C
Coolant Type	50% ethylene glycol aqueous solution
Refrigerant Type	R134A

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Item	Specification
Rated circulating water flow	30L/min
Protection level	IPX5
Noise level @1m away	75dB(A)
Communication interface	RS485/CAN

1.4.5 BMS

The energy storage battery management system (BMS) is mainly used to monitor the battery pack in real time. It can detect the battery cell voltage, total voltage, total current, temperature, etc., and judge the battery operation status in real time, upload battery pack status information and alarm information, etc., and cut off the output of the battery pack circuit for protection when necessary.

The BMS system consists of a two-level architecture consisting of a slave control BMU (battery management unit) and a cluster control BCU (battery cluster management unit). It uses the CAN bus to realize information exchange between the upper and lower layers and is powered by a 24V DC voltage.

The BMU has the function of monitoring the voltage and temperature of the single cells in the battery module, and can balance the power differences between batteries to improve battery consistency.

BCU is responsible for managing all BMUs in the battery pack, and has the functions of current collection, total voltage collection, and leakage detection of

the battery cluster. When the battery pack status is abnormal, it drives the high-voltage power contactor to disconnect, so that the battery cluster is out of operation, ensuring the safety of battery use and completing the battery capacity and SOC calibration. At the same time, BCU can communicate with PCS through external CAN or 485 bus to control the PCS charging and discharging process of the energy storage system.

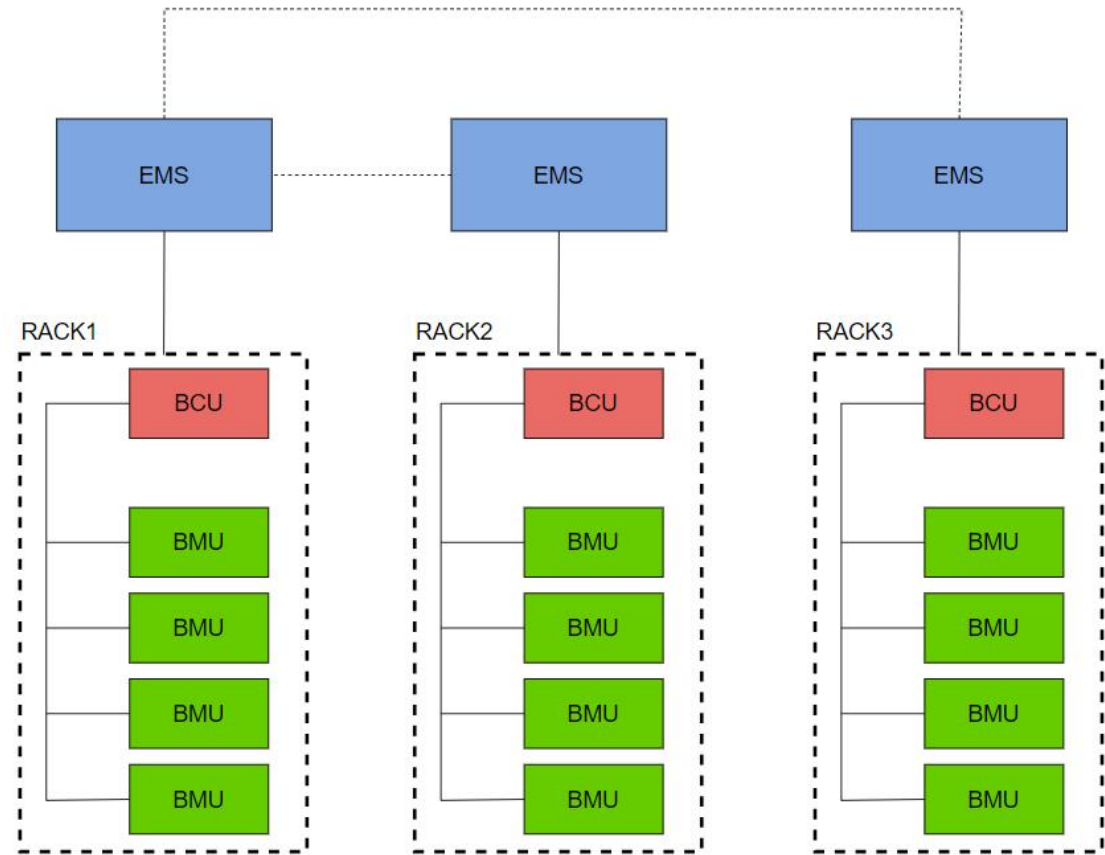


Figure 1-10 Battery management system topology diagram

Table 1-7 Battery Management Unit

NO.	Item	Specification
1	Operating temperature range	-40°C-85°C
2	Single cell voltage sampling accuracy	<±3mV
3	Single cell voltage acquisition range	1-5V
4	Total voltage sampling accuracy	<±0.2%
5	Total voltage detection range	100-1500V
6	Current sampling accuracy	<±0.2%
7	Protection level	IP2X

1.4.6 EMS

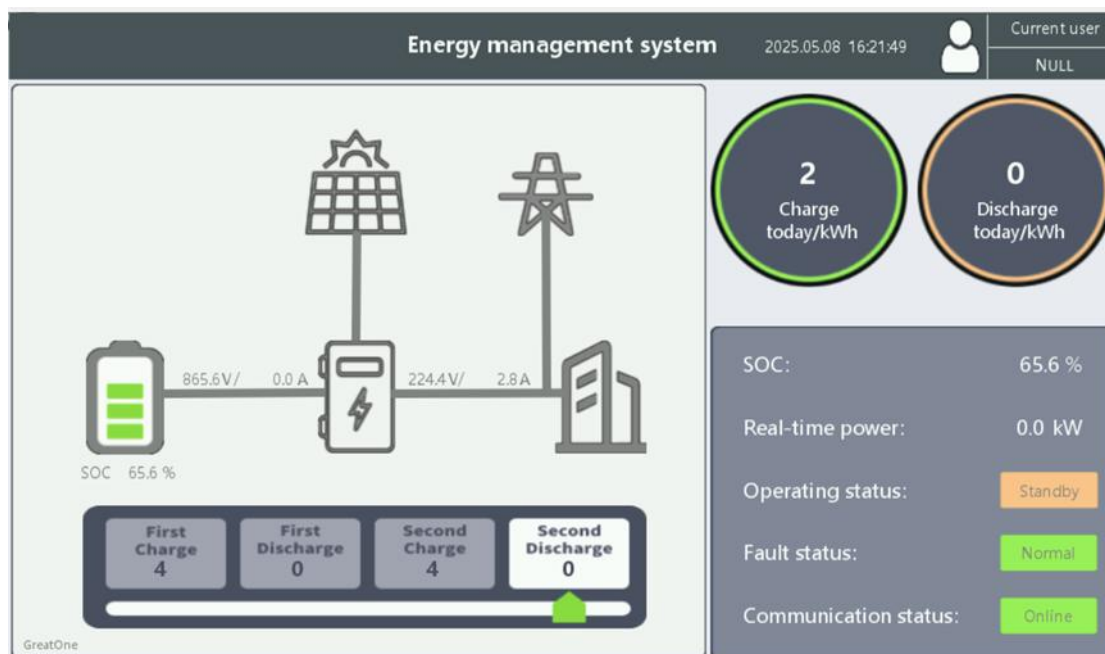
The EMS system is the nerve center and energy management center of the energy storage power station, and performs comprehensive information perception on the operation, environmental status and personnel management of various types of equipment in the energy storage power station. It monitors the operation information of BMS, PCS, air conditioning, fire protection, etc., and integrates the EMS system power generation and energy storage monitoring, power supply monitoring and other functions. At the same time, it can integrate the microgrid system power generation and PCS control, load control and other

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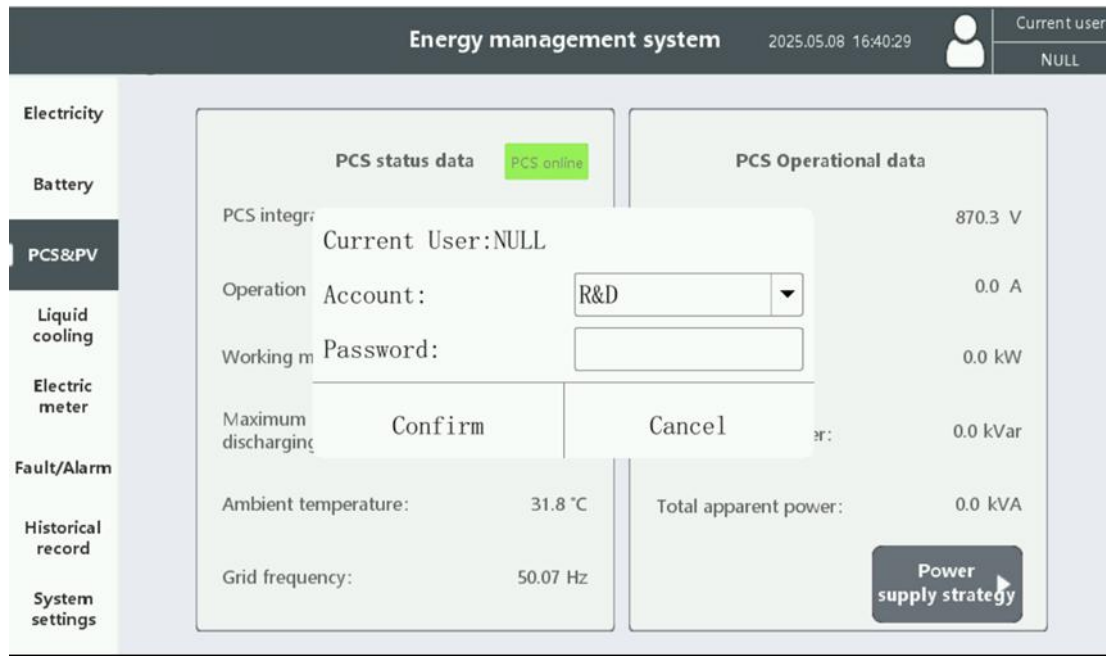
functions. It can realize the planned operation mode and the dispatching operation mode, and reasonably distribute the adjustment instructions according to the current battery pack and PCS operation information.

EMS system screen (for reference only)

1.Introduction to the stand-alone homepage



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- 1) On the left side of the stand-alone homepage is the system topology diagram, and below are the charge and discharge amounts of each stage: one charge, one discharge, two charges, and two discharges; the upper right corner is the cabinet's charge and discharge amount today; the lower right corner is the cabinet status data, including SOC, real-time power, operating status, fault status, and communication status with the device;
- 2) The top menu bar displays the time and logged-in account.
- 3) Account name: **Please contact the technical support person for Greatpower**
- 4) Password: **Please contact the technical support team of Greatpower**
- 5) Click "Energy Management System" in the top menu bar to enter the next level device menu page.

2. Introduction to the home page of the parallel master and slave

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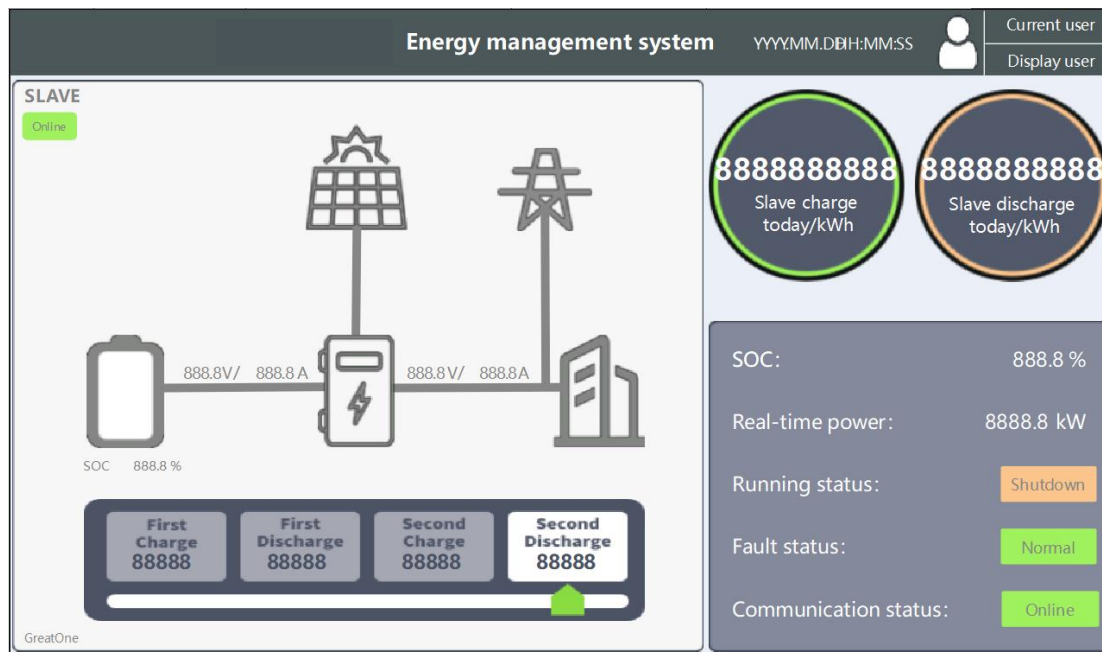
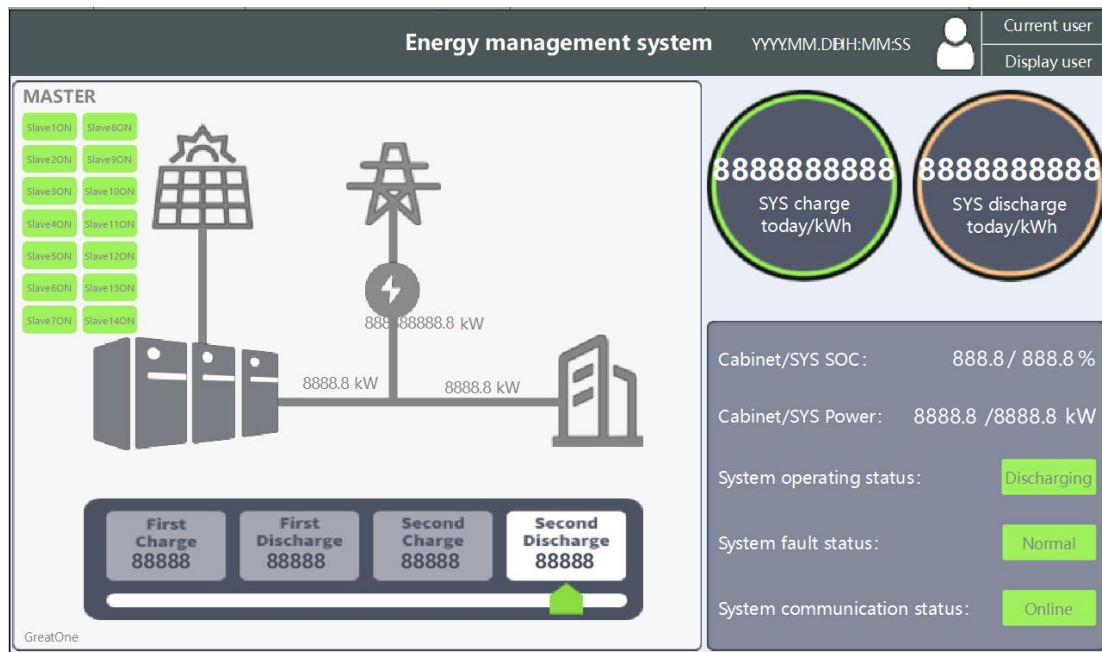
Tel: +86 020-39196888

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Fax: +86-756-3922218

E-mail: info@greatpower.net

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1) Home page of parallel host & slave, layout is similar to the single machine page

3. Device-level pages

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Great Power

2025.11.06 15:30:41

Energy management system

Current user

Language

Electricity

Battery

PCS&PV

Liquid cooling

Electric meter

Fault/Alarm

Historical record

System settings

First charge:0 kWh

First discharge:0 kWh

Second charge:0 kWh

Second discharge:0 kWh

Charge today:0 kWh

Discharge today:0 kWh

Total charge:0.00 kWh

Total discharge:0.00 kWh

Power data

Electricity

Battery

PCS&PV

Liquid cooling

Electric meter

Fault/Alarm

Historical record

System settings

Battery basic data

BAT online

Total voltage/current:865.6V / 0.0 A

SOC/SOH:65.6% / 99.9%

Max allowable charge current:160.0 A

Max allowable discharge current:160.0 A

Average individual cell voltage/temperature:3329 mV / 27℃

P/N insulation resistance:8137 KΩ / 5228 KΩ

Battery peak data

Max cell voltage:3331 mV / (2 - 58)

Min cell voltage:3322 mV / (4 - 43)

Max cell temperature:29℃ / (1 - 27)

Min cell temperature:27℃ / (1 - 7)

Max pressure/temperature difference:9 mV / 2℃

BMS maintenance

Energy management system

2025.05.08 16:42:35

Current user

R&D

Battery Data

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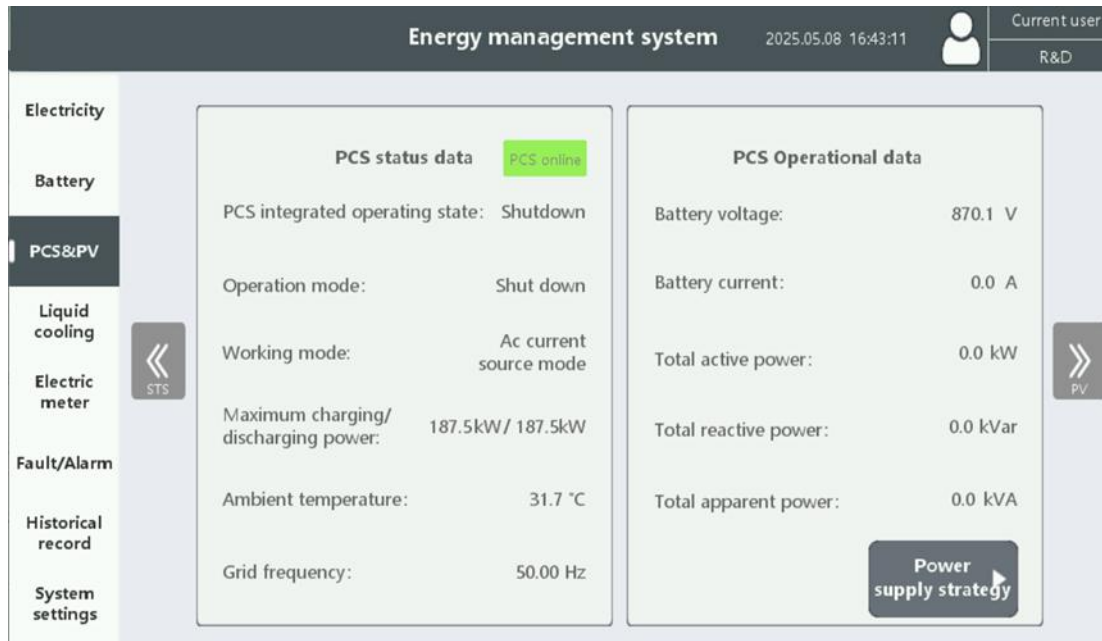
Tel: +86 020-39196888

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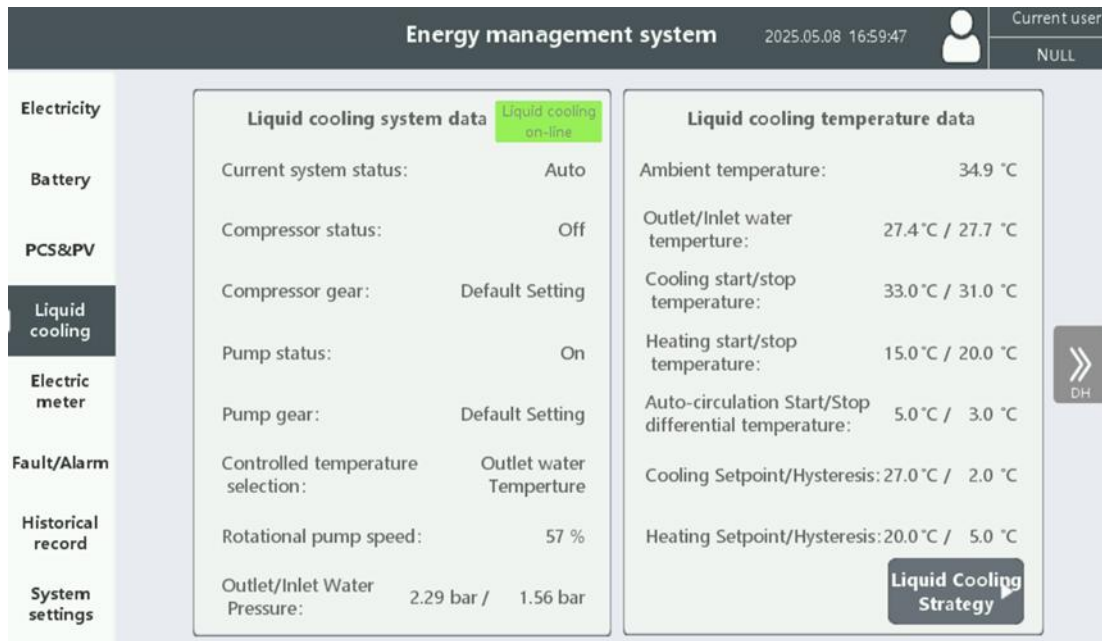
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PCS Data



Liquid Cooling Data

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E-mail: info@greatpower.net

Energy management system

2025.05.08 17:00:21



Current user

NULL

Energy Storage Meter

Real-time data		Meter on-line
A-phase V/A:	223.9V /	0.800 A
B-phase V/A:	223.5V /	0.400 A
C-phase V/A:	223.7V /	0.400 A
Instant active power:	0.2000	kW
Total power factor:	0.957	
AC frequency:	50.03 Hz	

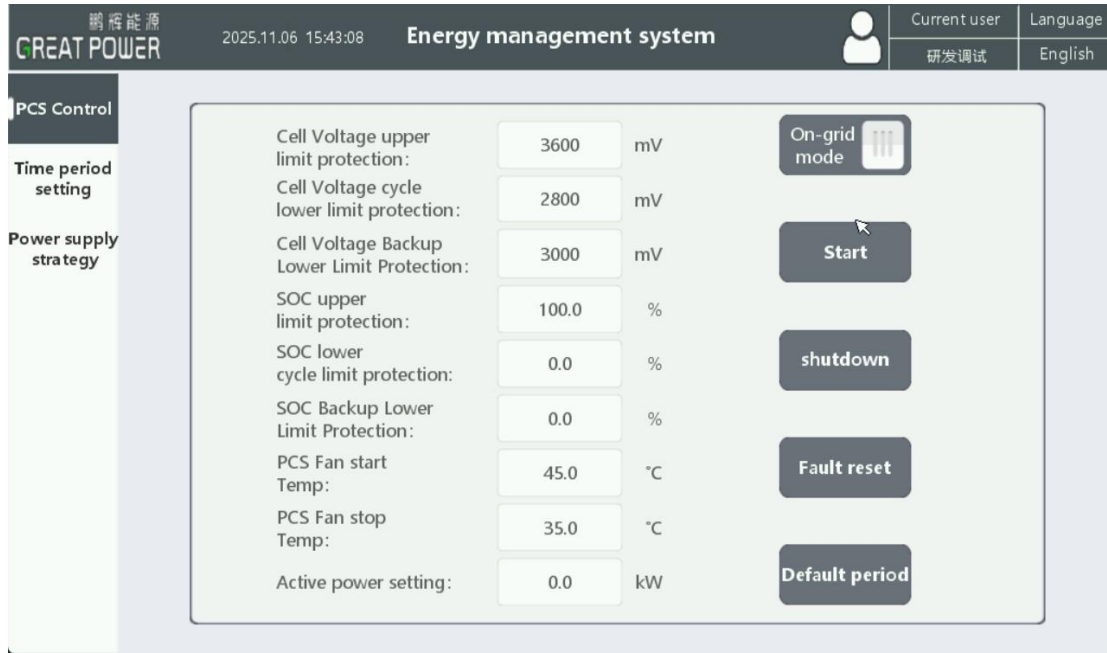
Time period	Charge/kWh	Discharge/kWh
Sharp Peak:	0.00	0.00
Peak:	0.00	0.00
Shoulder:	12171.60	10495.60
Valley:	0.00	0.00
Deep Valley :	0.00	0.00
Total:	12171.60	10495.60

Electricity meter data

- 1) Data information such as BMS, PCS, chillers, metering equipment and so on;
- 2) On the left is the menu bar, which can switch between pages;
- 3) On the PCS page, you can click "Power Supply Strategy" to enter the PCS control page and the power supply strategy page; on the cooling machine page, you can click "Cooling Cooling Strategy" to enter the cooling machine control page;
- 4) Click "Fault/Alarm" to enter the fault page; click "Historical record" to enter the history page; click "System Settings" to enter the system parameter settings page.

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4. PCS control & power supply strategy setting



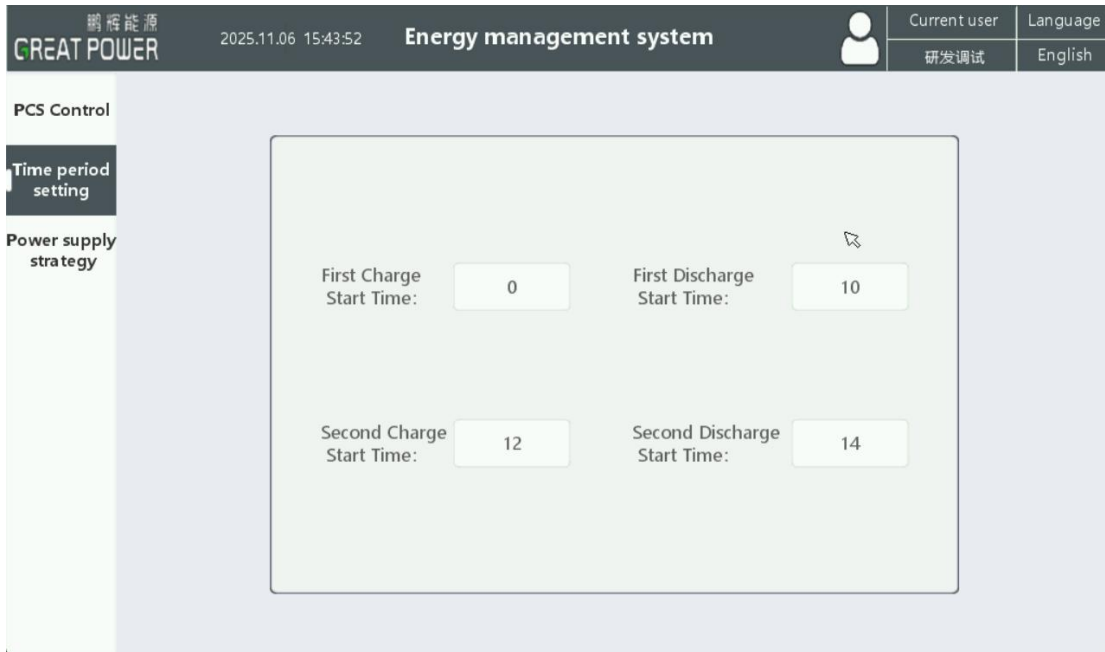
The screenshot displays the 'Energy management system' interface. The top header includes the 'GREAT POWER' logo, the date '2025.11.06 15:43:08', and the system name. A sidebar on the left lists 'PCS Control', 'Time period setting', and 'Power supply strategy'. The main content area is titled 'PCS Control' and contains a table of settings:

Parameter	Value	Unit
Cell Voltage upper limit protection:	3600	mV
Cell Voltage cycle lower limit protection:	2800	mV
Cell Voltage Backup Lower Limit Protection:	3000	mV
SOC upper limit protection:	100.0	%
SOC lower cycle limit protection:	0.0	%
SOC Backup Lower Limit Protection:	0.0	%
PCS Fan start Temp:	45.0	°C
PCS Fan stop Temp:	35.0	°C
Active power setting:	0.0	kW

On the right side of the settings table, there are several control buttons: 'On-grid mode' (with a grid icon), 'Start', 'shutdown', 'Fault reset', and 'Default period'.

- 1) On the PCS control page, you can set the single cell voltage charge and discharge protection value, PCS fan start and stop value, grid-connection and off-grid mode, fault reset, and restore the default power supply strategy;

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Time Slot Configuration Interface Example

Time Slot Configuration Interface Example

- 1) Time Slot Configuration: Sets the start times for the first daily charge cycle, first discharge cycle, second charge cycle, and second discharge cycle. (Note: These settings must align with the time periods defined in the power supply strategy to ensure the energy values for C1/D1/C2/D2 cycles are accurately displayed on the dashboard.)

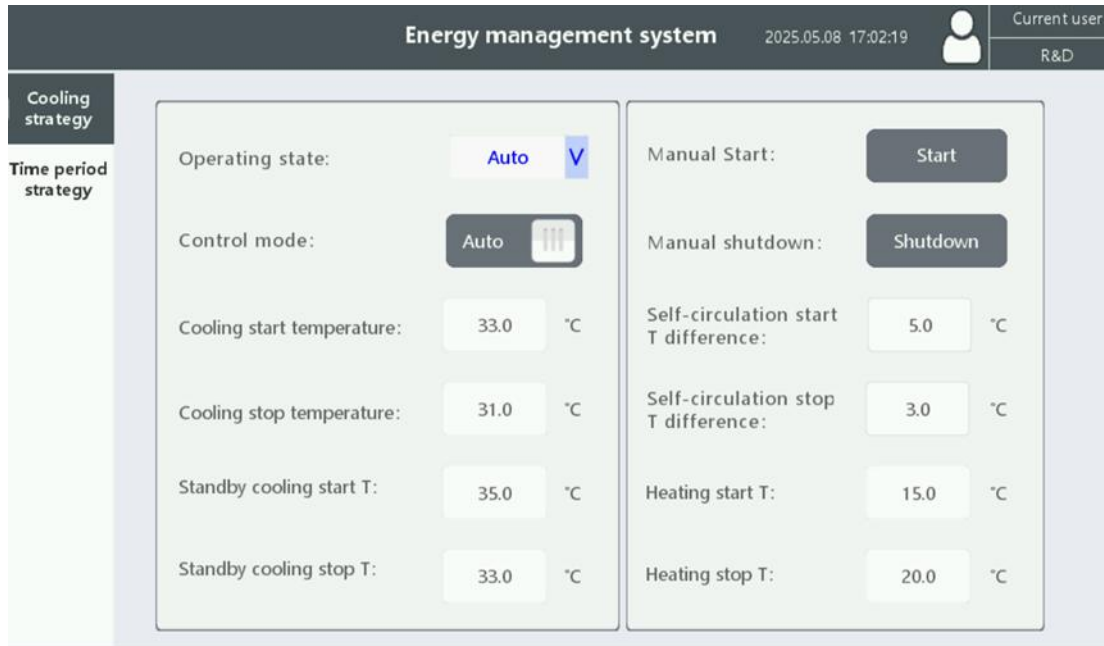
Energy management system				2025.05.08 17:01:49		Current user
						R&D
PCS Control	Start time	End time	State	Power (KW)		
Time period setting	00:01:00	02:00:00	Standby	0.0		
	02:00:00	04:00:00	Standby	0.0		
Power supply strategy	04:00:00	06:00:00	Standby	0.0		
	06:00:00	08:00:00	Standby	0.0		
	08:00:00	10:00:00	Standby	0.0		
	10:00:00	12:00:00	Standby	0.0		
	12:00:00	14:00:00	Standby	0.0		
	14:18:00	16:00:00	Standby	0.0		
	16:00:00	18:00:00	Standby	0.0		
	18:00:00	19:00:00	Standby	0.0		
	21:00:00	23:00:00	Standby	0.0		
	22:00:00	23:59:00	Standby	0.0		

Example Diagram of Power Supply Strategy Interface

- 1) On the power supply strategy page, you can set the start time and end time to adjust the time period;
- 2) Power can be input, and charging and discharging power can be adjusted (positive number means discharging, negative number means charging, and 0 means standby);
- 3) If no time period is set, the device will be in standby mode by default;
- 4) If there are overlaps in the time periods, the execution will be based on the time period above.

5. Refrigeration system control page

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The screenshot displays the 'Energy management system' interface. At the top, it shows the date and time '2025.05.08 17:02:19' and the current user 'R&D'. The main section is titled 'Cooling strategy' and 'Time period strategy'. It contains two columns of controls:

- Left Column:**
 - Operating state: Auto (selected with a blue 'V' icon)
 - Control mode: Auto (selected with a blue icon)
 - Cooling start temperature: 33.0 °C
 - Cooling stop temperature: 31.0 °C
 - Standby cooling start T: 35.0 °C
 - Standby cooling stop T: 33.0 °C
- Right Column:**
 - Manual Start: Start button
 - Manual shutdown: Shutdown button
 - Self-circulation start T difference: 5.0 °C
 - Self-circulation stop T difference: 3.0 °C
 - Heating start T: 15.0 °C
 - Heating stop T: 20.0 °C

Example Diagram of Liquid Cooling Strategy Interface

- 1) On the cooling strategy page, you can set the cooling/heating start and stop temperatures in the running state; the cooling start and stop temperatures in the standby state; and the self-circulation start and stop temperatures;
- 2) You can set the automatic control/manual control operation mode. In the automatic control mode, the system automatically starts and stops according to the set parameters; in the manual control mode, the operation status is manually sent, and you can turn the machine on and off by clicking.

Energy management system

2025.05.08 17:02:33



Current user

R&D

Cooling strategy

Time period strategy

	First charge period	First discharge period	Second charge period	Second discharge period
Water temperature cooling point:	27.0	27.0	27.0	27.0
Cooling differential:	2.0	2.0	2.0	2.0
Water temperature heating point:	20.0	20.0	20.0	20.0
Heating differential	5.0	5.0	5.0	5.0

- 1) On the cooling machine period strategy page, you can set the water temperature cooling point, cooling hysteresis, water temperature heating point, and heating hysteresis for each period of one charge, one discharge, two charges, and two discharges.

6.Fault/Alarm

Energy management system					
2025.05.08 17:03:42					Current user
					R&D
PCS Alarm	Start date	Start time	Start time	End time	Fault information
Cooling Fault	1				
	2				
BMS Alarm	3				
	4				
System Fault	5				
	6				
Fault summary	7				
	8				
	9				
	10				
start		end			last next

- 1) Click Fault/Alarm to enter the fault alarm interface and view real-time and historical fault data;
- 2) The menu bar on the left can switch to other device fault pages.

Energy management system					2025.05.08 17:04:01	Current user	
						R&D	
Status record		Start date	Start time	End date	End time	Fault information	
	1	2025/05/08	17:01:06			PCS: Standby	
Operation log	2	2025/05/08	16:57:31	2025/05/08	17:01:06	PCS: Fault	
	3	2025/05/08	16:57:28	2025/05/08	16:57:31	PCS: Standby	
System historical data	4	2025/05/08	16:57:02	2025/05/08	16:57:29	PCS: Fault	
	5	2025/05/08	16:56:57	2025/05/08	16:57:02	PCS: Standby	
Power curve	6	2025/05/08	16:49:14	2025/05/08	16:56:57	PCS: Fault	
	7	2025/05/08	16:49:13	2025/05/08	16:49:14	PCS: Standby	
	8	2025/05/08	16:48:45	2025/05/08	16:49:13	PCS: Fault	
	9	2025/05/08	16:48:41	2025/05/08	16:48:45	PCS: Standby	
	10	2025/05/08	16:43:04	2025/05/08	16:48:41	PCS: Fault	
start		end				last	next

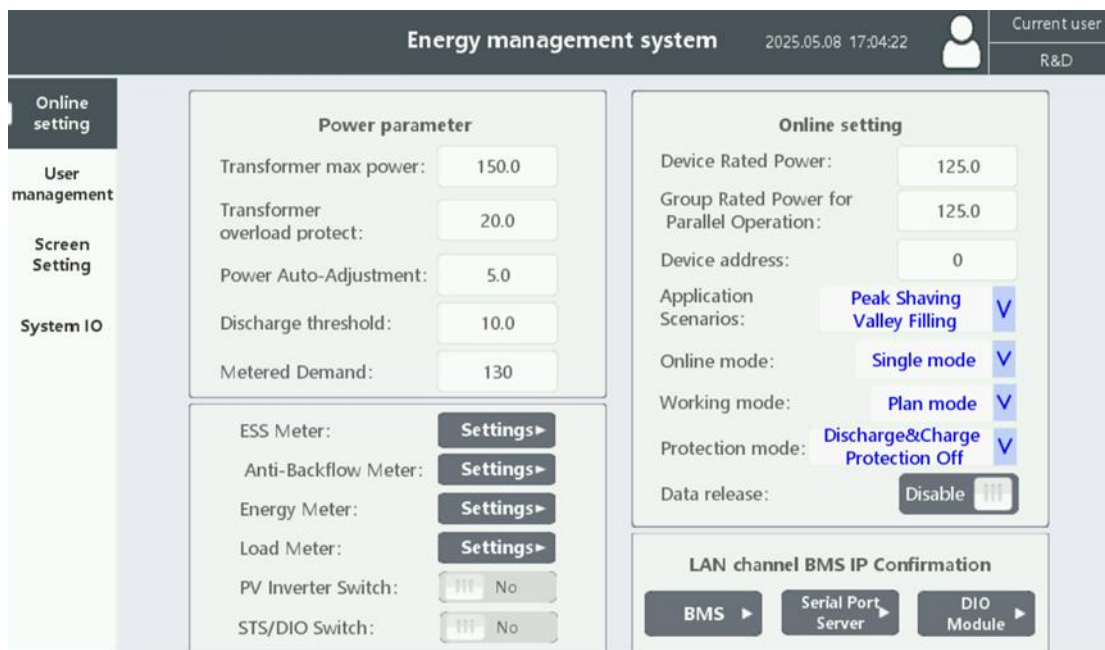
- 1) Click on the history record to enter the history record page to view the

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status record, operation record, data record and power curve;

2) The menu bar on the left can be used to switch pages.

7.System/Connection Settings



The screenshot displays the 'Energy management system' interface. At the top, it shows the date and time '2025.05.08 17:04:22' and the current user 'R&D'. On the left, a vertical menu bar includes 'Online setting', 'User management', 'Screen Setting', and 'System IO'. The main content area is divided into two columns. The left column, titled 'Power parameter', contains input fields for 'Transformer max power' (150.0), 'Transformer overload protect' (20.0), 'Power Auto-Adjustment' (5.0), 'Discharge threshold' (10.0), and 'Metered Demand' (130). Below these are buttons for 'ESS Meter', 'Anti-Backflow Meter', 'Energy Meter', and 'Load Meter', each with a 'Settings' link. At the bottom of this column are toggle switches for 'PV Inverter Switch' and 'STS/DIO Switch', both currently set to 'No'. The right column, titled 'Online setting', contains input fields for 'Device Rated Power' (125.0), 'Group Rated Power for Parallel Operation' (125.0), and 'Device address' (0). It also features dropdown menus for 'Application Scenarios' (with 'Peak Shaving' and 'Valley Filling' selected), 'Online mode' (with 'Single mode' selected), 'Working mode' (with 'Plan mode' selected), and 'Protection mode' (with 'Discharge&Charge' and 'Protection Off' selected). A 'Data release' button is set to 'Disable'. At the bottom of the right column, there is a section for 'LAN channel BMS IP Confirmation' with buttons for 'BMS', 'Serial Port Server', and 'DIO Module'.

1) Click System Settings to enter the online settings page, where you can set power parameters, demand parameters, meter ratio, online settings, and IP settings;

2) Parameter meaning:

- Transformer maximum power: the maximum output power supported by the transformer connected to the system;
- Transformer protection buffer power: During the charging process, if the transformer is detected to be overloaded ($P > \text{transformer maximum power}$ -

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transformer protection buffer power), the EMS will reduce the charging power to ensure that the transformer is not overloaded;

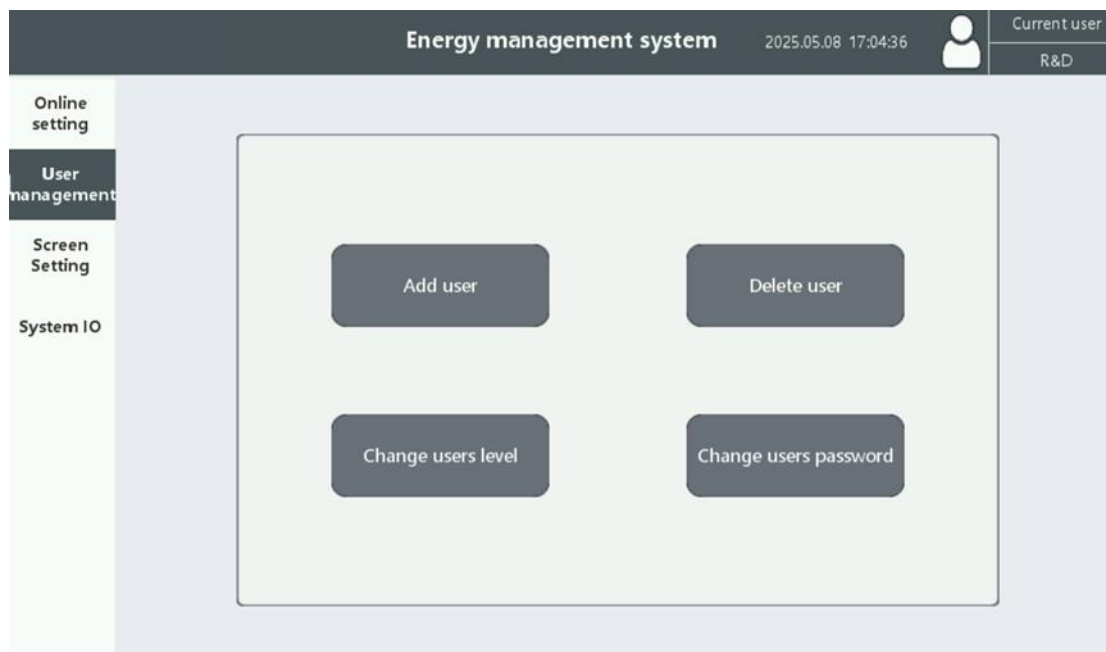
- Adjustment-free power: During the discharge process, if the load power is detected to exceed the adjustment-free power range, the EMS will adjust the PCS output power;
- Demand starting power: During the discharge period, if the transformer output power is detected to be greater than the demand starting power setting value, the EMS will issue an output command;
- Energy storage meter ratio: Set the meter ratio in the energy storage cabinet;
- Load meter setting: set with/without load meter;
- Load meter ratio: Set the anti-backflow meter ratio;
- Rated power of this unit: the maximum output power of this cabinet;
- Rated power of parallel group: the maximum output power of the system after several cabinets are connected in parallel to form a parallel system;
- Local address: No need to set when using a single machine; when using in parallel, the master is set to 0, and the slaves are set to 1, 2, 3, etc.
- Online mode: You can choose local automatic, local manual, centralized control host, centralized control slave; corresponding to single machine automatic operation, single machine manual control, parallel machine as host

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operation, parallel machine as slave operation;

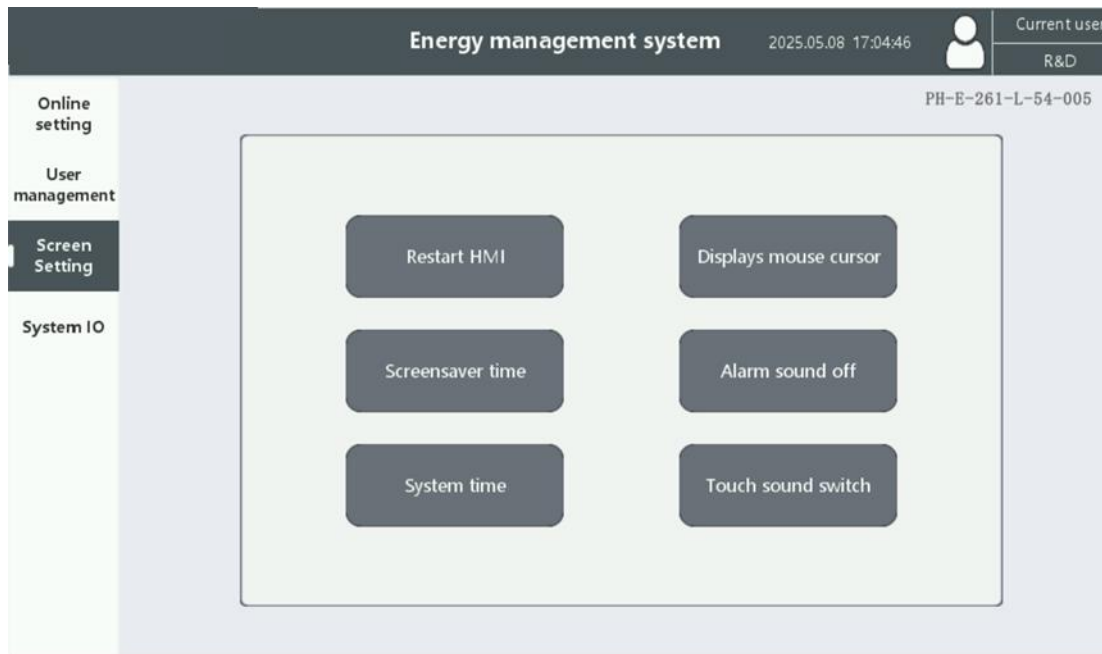
- Protection mode: Four modes can be set: discharge protection and charging protection, discharge protection, charging protection, and discharge protection and charging protection off; corresponding to discharge backflow protection & charging transformer protection, discharge backflow protection, charging transformer protection, and discharge backflow protection & charging transformer protection off
- Communication settings: Shield communication in special situations.

Generally, no settings are required.



- 1) You can add users, delete users, modify user levels, and change passwords.

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2) You can restart the screen, set screen parameters, time, etc.

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2 Unpacking and Handling

2.1 Unpacking

2.1.1 Checking after Unpacking

After unpacking, the following items must be inspected:

Table 2–1 Inspection After Unpacking

NO.	Inspection Item	Completion Status
1	All optional accessories ordered are complete	
2	The nameplate information matches the ordered product model.	
3	Warning labels are free from damage, scratches, blurring, etc.	

2.1.2 Precautions for Unpacking

- For liquid-cooled outdoor cabinets, do not remove the packaging during storage; remove it only during installation.
- When receiving goods from the transportation company, carefully inspect the products and verify each received item against the delivery note. If any items are missing or damaged, notify the transportation company immediately upon discovery.
- Before unpacking, check whether the outer packaging of the product is intact,

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free from damage, soaking, moisture, deformation, etc.

- Open the packaging layer by layer in sequence. Violent knocking is strictly prohibited!

2.2 Storage

- During storage, try to use the original packaging from the company.
- The temperature should be maintained between -20°C and +50°C.
- The equipment must be placed in a clean and dry space, avoiding areas exposed to water splashes, rain, humidity, high temperatures, or direct outdoor sunlight.
- The storage area must be free of harmful gases, flammable or explosive materials, and corrosive chemicals.
- For long-term storage, cover the equipment or take appropriate measures to ensure the modules are not contaminated or affected by the environment.
- Avoid mechanical shocks, heavy pressure, strong electric fields, and strong magnetic fields.
- Avoid direct sunlight. Keep a distance of $\geq 2\text{m}$ from heat sources and $\geq 50\text{cm}$ from walls, windows, or air inlets.



- For products stored under the above conditions for more than 3 months, a supplementary charge is required.

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-
- For products stored under the above conditions for more than 6 months, a capacity verification test must be performed.
 - For products stored under the above conditions for more than 1 year, re-inspection is required before use.
-

2.3 Handling



- Ensure the product is securely packaged before vehicle transportation. Use enclosed transport cases for long-distance shipping.
 - Do not transport this product together with equipment or items that may affect or damage it.
-

Forklift Handling

Adjust the width of the forklift arms so that the center of gravity falls in the middle of the arms.

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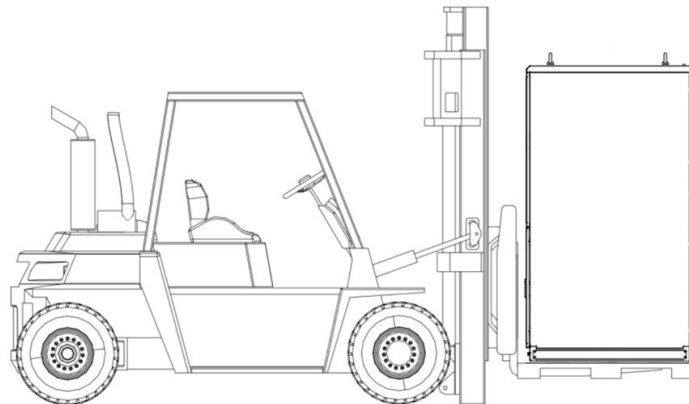


Figure 2-1 Schematic Diagram of Forklift Handling Without Packaging (Image for Reference Only)



Perform a test lift. If the position is unsuitable, adjust the forklift arms. Once properly aligned, lift the liquid-cooled outdoor cabinet and move it to the desired location.

- During handling, the tilt angle of the liquid-cooled outdoor cabinet must be less than 10°, and the lifting height should be minimized.
- Hydraulic trolleys are prohibited from long-distance transport or use on slopes, as this may damage the trolley.
- Lift and lower gently to avoid impact or vibration. When lowering the forklift, ensure no feet are caught underneath.
- When moving, secure the cabinet with straps and ensure the ground is level.
- Due to the height of the equipment, which may obstruct the operator's view, it is recommended to assign a guide for the operator if necessary.
- Keep personnel away during forklift operation.

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Crane Handling

When transporting without packaging, use flexible slings or straps. A single strap must support a weight of at least 4 tons.

Secure the cabinet tightly with straps and follow the steps below.

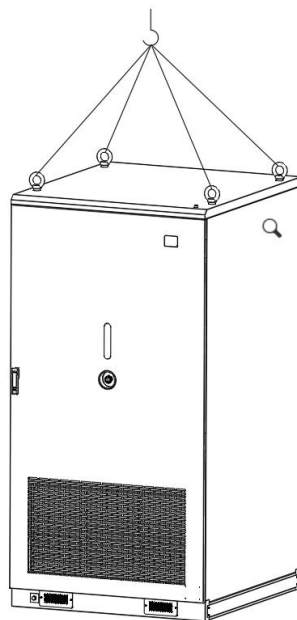


Figure 2-2 Schematic Diagram of Crane Handling Without Packaging (Image for Reference Only)



Perform a test lift to confirm the straps can bear the weight of the liquid-cooled outdoor cabinet and that the lift is balanced without tilting.

- The hook position must be at the center of gravity, at least 1m above the cabinet top.
- After lifting, the swing angle must be less than 10°.
- Before handling, ensure the cabinet's front door is locked to prevent

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accidental opening during transport, which may cause injury.

- Lift and lower gently to avoid impact or vibration.
 - Keep personnel away during crane operation.
-

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3、 Mechanical Installation

3.1 Safety Precautions

Failure to follow the safety precautions below during installation may result in equipment damage, personal injury, or severe accidents. Strictly adhere to the following guidelines:



- Installation must be performed by qualified professionals in compliance with all warning instructions.
- Before installation, ensure the mechanical strength of the installation site is sufficient to support the equipment weight; otherwise, mechanical hazards may occur.
- During installation, avoid wearing loose clothing or jewelry to prevent electric shock hazards.



- To facilitate installation and maintenance, ensure sufficient space around the equipment: adequate cooling airflow, necessary clearances, and space for cables and cable support structures.
 - Ensure that any rack-mounted components or assemblies are properly
-

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grounded, with unpainted contact surfaces.

- Copper is recommended as the grounding material.

3.2 Pre-Installation Preparation

3.2.1 Environmental Requirements

Table 3–1 Installation Environmental Requirements

Item	Environmental Requirements
Item Site Requirements	• A well-ventilated environment must be maintained. • Air intake and exhaust vents must be professionally protected against rain, windblown sand, and dust. • Ensure no trees are nearby to prevent branches or leaves from blocking the cabinet door or air intake during strong winds. • Necessary fireproofing, waterproofing, and rodent-proofing measures must be in place. • Keep away from areas with concentrated toxic or hazardous gases. • Avoid flammable, explosive, or corrosive materials.
Foundation Requirements	• The installation surface must be flat, dry, and free of standing water. • Ensure the ground is level, stable, and capable of bearing the weight of the liquid-cooled outdoor cabinet.
Space Requirements	Sufficient clearance must be maintained around the cabinet (front, rear, sides, and top) for heat dissipation, maintenance, and emergency access.
Altitude	≤2000m (non-standard treatment for high-altitude models).
Temperature	-20°C~50°C
Relative Humidity	0%~95%RH.

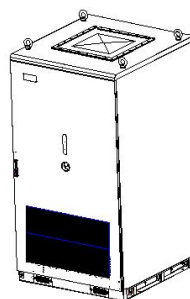
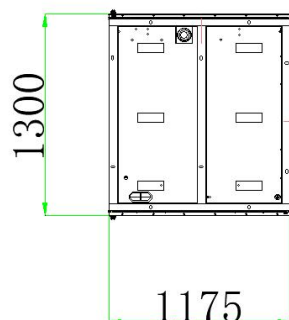
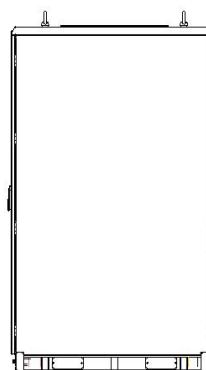
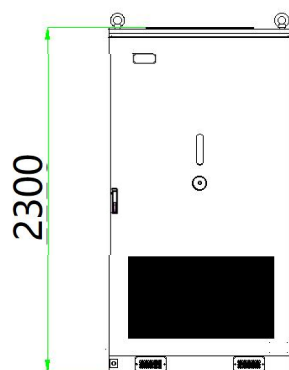


Moisture ingress can damage the energy storage terminal! To ensure proper operation:

- Do not open the cabinet door when ambient humidity exceeds 85%.
- Avoid opening the cabinet door, performing maintenance, or inspections during rainy or excessively humid conditions.

3.2.2 Installation Site Requirements

External Dimension



Foundation Requirements

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The liquid-cooled outdoor cabinet must be installed on a concrete or other non-combustible surface. The installation plane must be level, sturdy, flat, and capable of bearing sufficient load. Depressions or tilting are strictly prohibited.

When constructing the foundation, the wiring requirements of the liquid-cooled outdoor cabinet must be considered, with cable trenches or entry holes pre-reserved. Please refer to the following diagram for the installation hole layout.

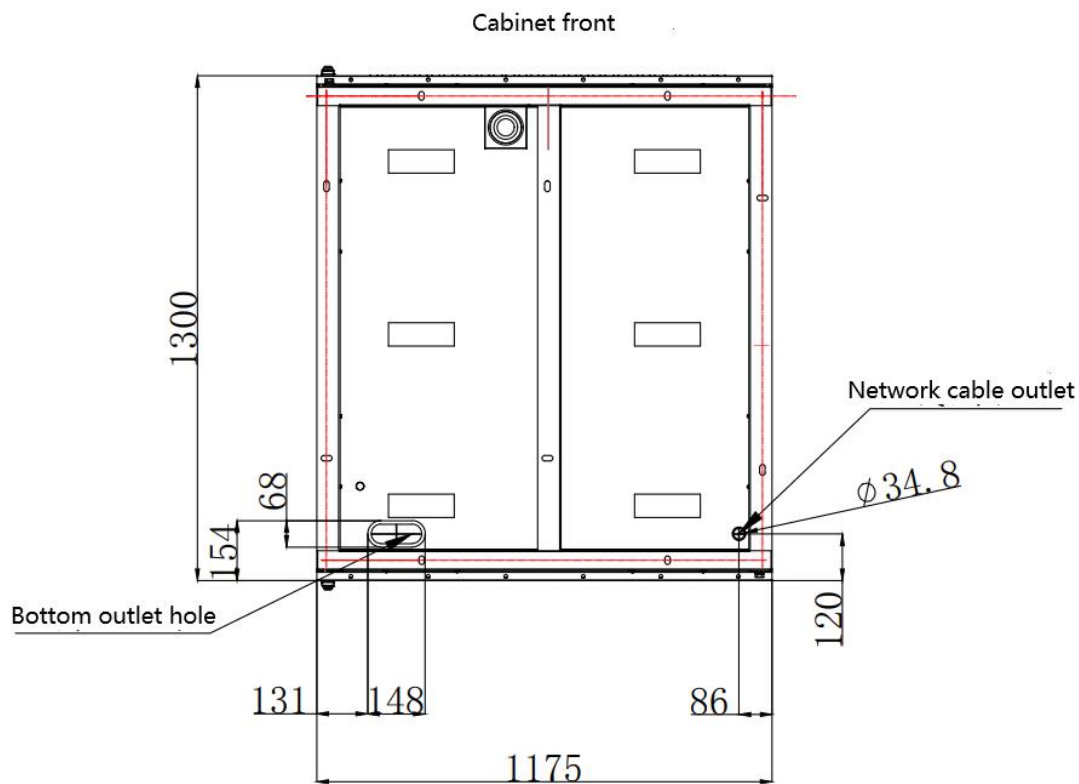


Figure 3-1 Mounting Hole Layout (Unit: mm)

The U-shaped holes (marked with numbers) serve as power cable entry/exit points with dimensions of 60 × 140mm , The circular holes function as

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communication cable entry/exit points with 30mm diameter

For installations on hard surfaces, bolted connection method is recommended.

A corresponding base plate may be fabricated, with connection points adjustable according to actual site conditions.

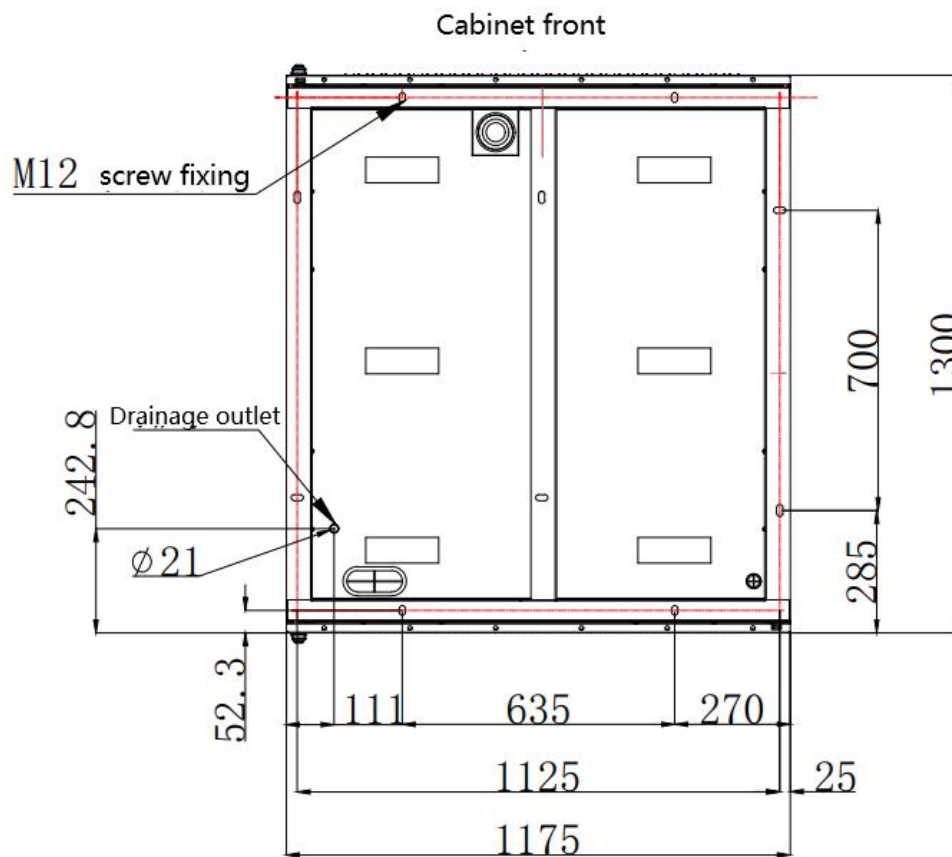


Figure 3-2 Bottom Bolt Schematic Diagram

Notes:

- During construction, ensure the equipment base is positioned above the local historical highest water level.

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-
- Equipment installation (including height, embedded components, conduit routing, etc.) shall be adjusted according to construction specifications and site conditions.
 - The elevation of equipment foundation may be adjusted based on actual equipment and site requirements.
 - The foundation design is based on a maximum equipment weight of 4 tons. If equipment weight exceeds this value, structural verification is required.
-

Notes:

-
- The embedded parts detail drawing shows bolted connection between upper equipment and embedded components.
 - Conduits may be replaced with 2×Ø125mm and 2×Ø50mm PVC pipes as per site conditions.
-

For installations on non-rigid surfaces (e.g. lawn areas), foundation construction must be completed prior to installation, welding connection method is recommended for equipment installation and connection points should be adjusted according to actual site conditions

Cable Trench Requirements:

The liquid-cooled outdoor cabinet utilizes bottom cable entry. To prevent

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foreign object intrusion: no side entry ports are provided on the cabinet and pre-installed cable trenches are required at installation site. Trench specifications:

- Must incorporate dust-proof and rodent-proof design to prevent foreign object entry
- Requires waterproof and moisture-proof design to prevent cable aging/short circuits affecting cabinet operation
- Due to the high power output of liquid-cooled outdoor cabinets, thicker cables are required. When designing cable trenches, the cross-sectional area of the cables must be fully accounted for.

3.2.3 Installation Space Requirement

Single liquid-cooled Outdoor Cabinet Installation

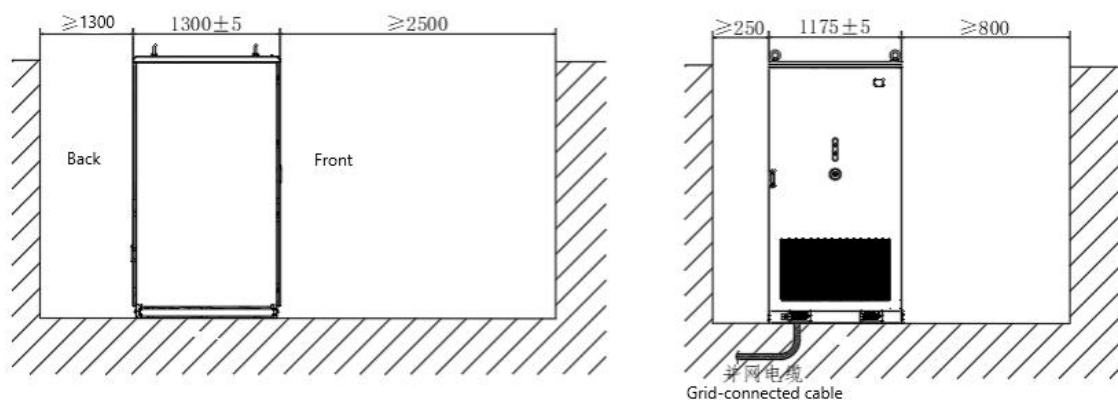


Figure 3-3 Schematic diagram of installation space requirements for a single liquid-cooled cabinet (unit: mm)

Liquid Cooled Outdoor Cabinet Parallel Installation

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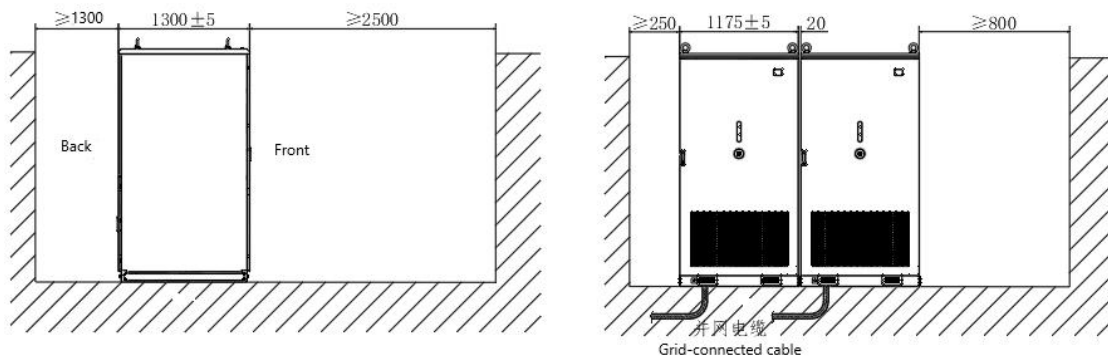


Figure 3-4 Schematic diagram of space requirements for parallel installation of liquid-cooled cabinets (unit: mm)

3.2.4 Installation Tool Preparation

Table 3-2 Mechanical Installation Tools List

Tool	Qty.	Instruction
Forklift/Crane	1 pcs	For indoor and outdoor transportation

3.3 Installing Liquid-cooled Outdoor Cabinet

1. Confirm the fixing holes on the installation surface align with the bottom mounting holes of the cabinet. Refer to "Figure 3-1" for hole positions.
2. Transport the liquid-cooled outdoor cabinet to the installation location.
3. Align the screw holes and secure the equipment to channel steel or foundation using 10 M12 bolts with an installation torque of 27N·m. Alternatively, the cabinet can be welded to channel steel or prefabricated metal flooring, taking care to avoid welding burns and implement anti-rust measures.

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- Handle the liquid-cooled outdoor cabinet with care during transportation.
- Before placement, ensure the installation surface has no depressions and can fully support the cabinet's weight.

3.4 Post-installation Inspection

After installation, verify each item in the table below and check the corresponding box for compliant items.

Table 3-3 Installation Inspection Checklist

NO.	Item	Corrective Action	Confirmation
1	The liquid-cooled outdoor cabinet is properly installed at pre-designed fixed points without looseness.	If loose, retighten screws.	
2	Installation space meets recommended dimensions specified in "3.2.3 Installation Space Requirements".	If space is insufficient, consider redesigning the external cabinet before installation.	
3	Cooling circuit is circulating properly.	If abnormal, adjust water pipe positions.	

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4 Electrical Installation

4.1 Safety Precautions

To ensure the safety of installation personnel, necessary protective measures must be taken when performing electrical installation of this product. The following regulations must be observed during electrical installation:



Only qualified professionals may perform installation operations on the liquid-cooled outdoor cabinet, and must strictly follow the user manual guidelines during installation.

- Installation personnel must comply with relevant electrical operation regulations in their country or region.
 - Installation under live conditions is prohibited to avoid electric shock hazards.
 - Before installation, all switches of the liquid-cooled outdoor cabinet and external front-end equipment must be turned off. Wait for 5 minutes to confirm all cables and internal components of the cabinet are de-energized.
 - Warning signs must be placed at disconnected locations to prevent accidental re-energization during installation.
 - Necessary grounding and short-circuit connections must be performed.
-

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- Live components must be properly insulated with insulating materials to prevent personal injury.

4.2 Pre-wiring Preparation

4.2.1 Installation Tool Preparation

Table 4-1 Electrical Installation Tools List

Tool	Qty	Instruction
Adjustable Torque Wrench	1set	For tightening nuts
Socket and Wrench Set	1set	Maximum torque must exceed 45N·m
Phillips Screwdriver	2 pcs	For M6 and M4 screws
Automatic Wire Stripper	1 pcs	For stripping cable sheaths
Tape Measure	1 pcs	For measuring wire length
Automatic Crimping Tool	1 pcs	For crimping wire cores, sealing plugs and flat pin sockets

4.2.2 Cable Preparation

Table 4-2 Terminal Block Cable Fabrication Recommendations

Terminals	Maximum Voltage	Maximum Current	Terminal Model	Recommended Cable
Grounding Cable			OT Terminal	35mm ²
Power Supply	400V AC	200A	OT Terminal	4*70mm ²

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Cable				
EMS Communicat ion			RJ45 Connector	Shielded Network Cable

Notes

The communication cables are relatively thin and require protection to prevent breakage under tension.

- Cables must meet voltage insulation ratings and have necessary protection to avoid damage or scratches to the insulation layer.
-

4.3 Pre-Wiring Inspection

To ensure the safety of installation personnel, necessary protective measures must be implemented during electrical installation of this product. The following procedures must be strictly followed:

- All power sources connected to the converter must be disconnected to ensure the converter is de-energized.
- Warning signs must be placed at the disconnected locations to prevent accidental re-energization during installation.
- After power-off, wait for 5 minutes to confirm the converter interior is completely de-energized before proceeding with any operations.
- Proper grounding and short-circuit connections must be established.
- Live components must be properly insulated with appropriate materials to

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prevent personnel injury.

- Only qualified professionals may perform installation operations on the converter, strictly following the user manual guidelines.
- Installation personnel must comply with all relevant electrical operation regulations in their country/region.

Table 4-3 Pre-Wiring Checklist

No.	Inspection Item	Confirmation
1	Cables used meet specified wire gauge and shielding requirements	
2	Ensure proper grounding of equipment and products	
3	Follow ESD protection procedures (anti-static wrist strap worn)	
4	All necessary wiring accessories are prepared and ready	

4.4 Grounding

Connect the grounding wire of liquid-cooled outdoor cabinet, the wire diameter of the grounding wire is 35 flat, copper nose, and the length is customized by the customer. There are two grounding points, front and back (please refer to the following figure).

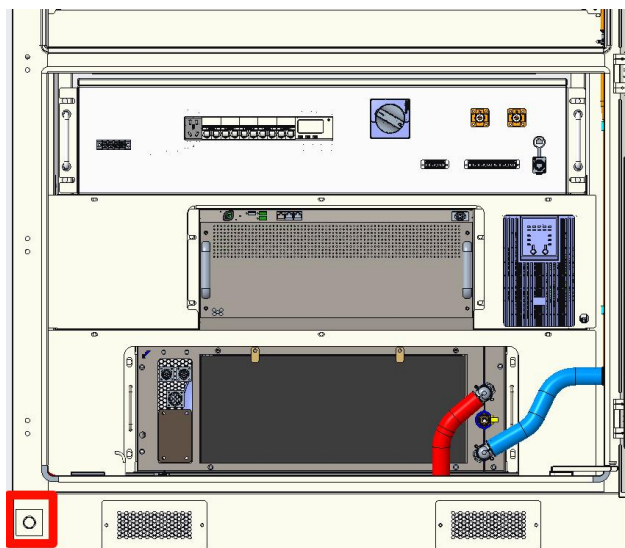


Figure 4-1 Positive Grounding Location Schematic

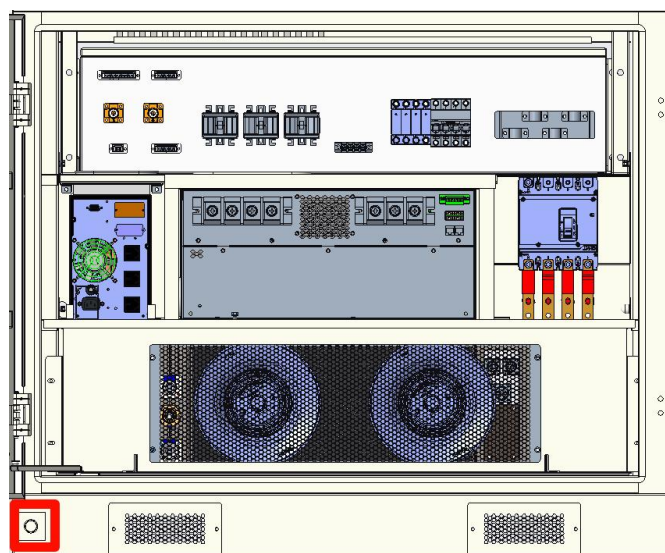


Figure 4-2 Schematic of Back Ground Location

4.5 DC Side Wiring

DC terminal wiring procedure:

1. Confirm both the converter and cables are de-energized.

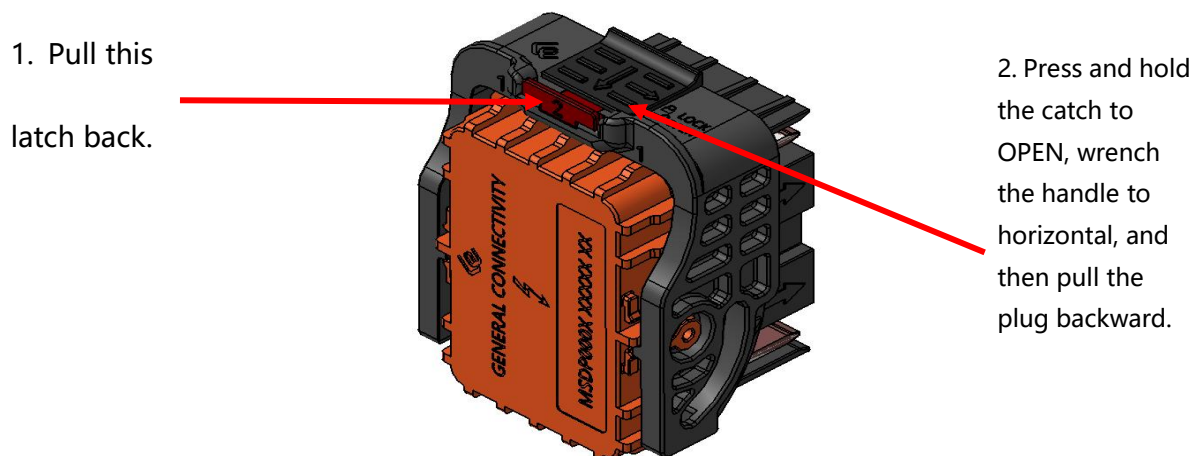
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2. Identify cable polarity (positive/negative) and label accordingly.
3. Measure the resistance of positive and negative poles to PE and the resistance between positive and negative poles, the resistance value should be megohm level, if it does not meet the requirements, please check the line.
4. Pull out the positive and negative terminal plugs from the panel, crimp the corresponding cables, crimp the cables with a suitable crimping tool, crimp them and insert them into the corresponding sockets with a maximum torque of 75N.



- When connecting/disconnecting, never use excessive force to avoid damaging wire harnesses and connectors.
- Correctly identify positive and negative terminal plugs. A two-person operation (one performing the task and one supervising) is recommended.

MSD (Manual Service Disconnect) Operation Diagram



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Figure 4-3 Schematic diagram of MSD operation

4.6 AC Side Wiring

AC terminal wiring procedure:

1. Verify both the converter and cables are de-energized.
2. Identify cable phases (A/B/C) and label accordingly. Match cable markings with the phase sequence of converter's AC output terminals.



AC wiring interference



- Do not proceed until grounding faults are resolved.
- Incorrect wiring sequence may cause fire.

- Loose cable connections may cause fire.
- Improper wiring will lead to converter malfunction and potential equipment damage.

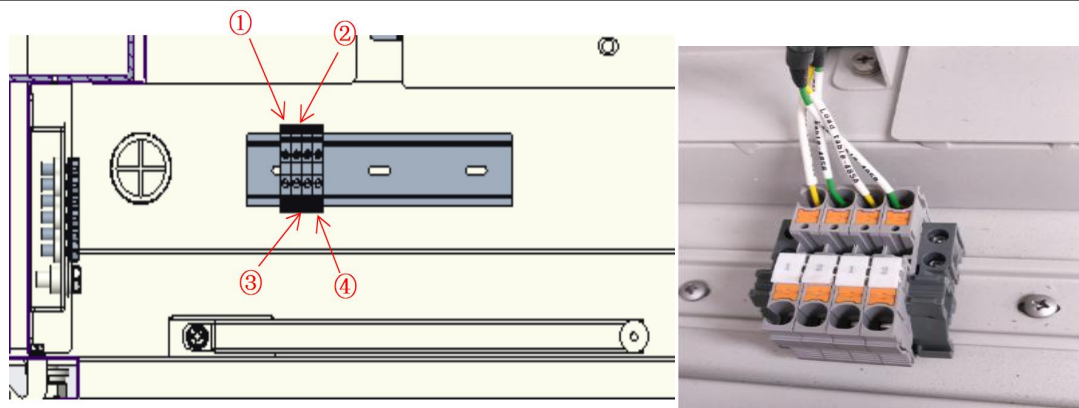
4.7 External Meter Communication Wiring

External meter communication wiring procedure:

1. Confirm both converter and cables are de-energized.
2. Verify RS485 A/B wire sequence of meter communication harness. Follow the diagram below strictly to avoid reverse connection.
3. Select either "Load Meter" or "Gateway Meter" on the EMS control panel.

Table 4-4 Terminal Block Definition

①	②	③	④
Load table-485A	Load table-485B	gateway table-485A	gateway table-485B



- Load table: load meter, gateway table: hurdle table

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4.8 Checking after Wiring

After wiring is completed, the following items must be rechecked and measured to avoid damage to the equipment and loss of property:

Table 4-5 Post-Installation Checklist

NO.	Inspection Project	Status of Completion
1	Disconnect both battery-side and grid-side switches to ensure the converter's DC and AC sides are completely de-energized before measure.	
2	Positive and negative connections between the lithium battery and the converter, AC phase sequence is correct and has been tightened, measure the resistance between the three phases, it should be megohm level, if it is K level or smaller need to check the wiring.	
3	External control cables, ground wires, and communication wires have been tightened.	
4	Cables are in good condition and not torn or cracked.	
5	Clean up the installation area with no tools or foreign objects left in the installation area.	

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5 Trial Operation

5.1 Pre-Operation Inspection

Before operation, the following items must be checked::

NO.	Item	Confirmation
1	Check for condensation on the liquid-cooled outdoor cabinet and components (water film or droplets on surfaces). If present, activate the cabinet fan for ventilation until the condensation disappears. Inspect pipeline connections to ensure no leakage.	
2	Measure whether the input voltage of the liquid-cooled outdoor cabinet is within the specified range, and confirm there are no phase loss or short circuit faults.	
3	Power input terminals (A, B, C, N) must be correctly and securely connected.	
4	The liquid-cooled outdoor cabinet must be reliably grounded.	
5	All control signal cables are correctly wired.	
6	Wiring terminals are intact without damage and have been insulated.	
7	No foreign objects such as wire ends or metal debris that could cause short circuits in signal or power lines are present inside or outside the liquid-cooled outdoor cabinet.	
8	The cooling circuit is functioning properly.	

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5.2 Power on Procedure

After confirming all pre-operation checks are completed, follow these steps to power on the energy storage liquid-cooled outdoor cabinet:

1. Set the QF1 molded case circuit breaker (located at the rear of the high-voltage box) to the "ON" position. close the three-phase four-wire grid-connected switch in the AC power cabinet. Successful power-on indication: PCS indicator light flashes green If confirmed, proceed to the next step.



Figure 5-1 Plastic Case Circuit Breaker Switch

2. Close the distribution cabinet switches in the following sequence: TMS POWER, Dehumidifier, UPS Power, and Socket Switch. Power on the UPS - if the meter display lights up, this confirms normal 24V output.
3. Close the BMS Power switch and wait for 5 seconds. Then rotate the high-voltage cabinet circuit breaker to the ON position. When the cabinet door's green light remains steadily illuminated, this indicates successful system power-up.

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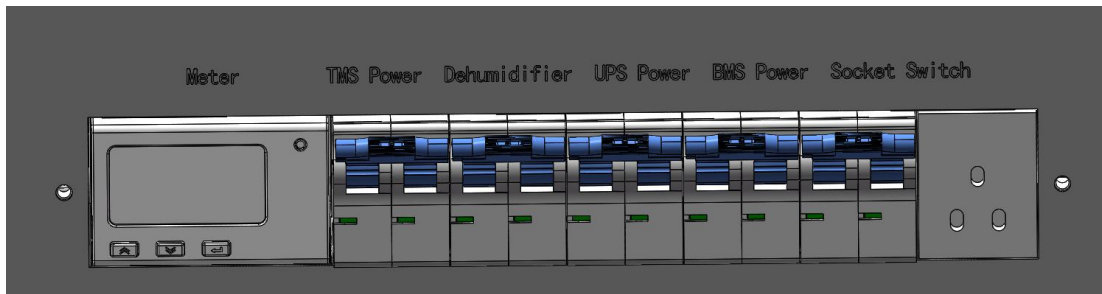


Figure 5-2 Distribution Cabinet Switch Normal Operating Condition

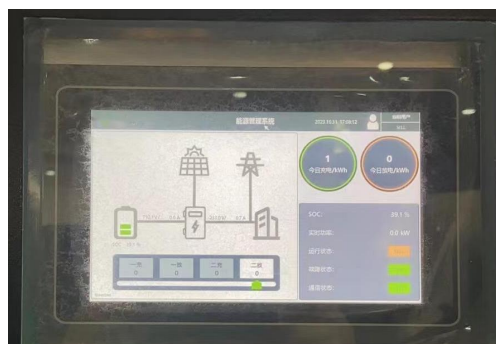


Figure 5-3 EMS screen and cabinet door green light normal operation status



Liquid-cooled outdoor cabinets need to be turned on in strict accordance with the above steps, otherwise there is a risk of damaging the system equipment or causing it to work improperly.

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5.3 Shutdown Procedure

5.3.1 Normal Shutdown

1、Deactivate 24V Output

Turn off the BMS Power switch and shut down the UPS

2、Sequentially disconnect distribution cabinet breakers:

Socket Switch、UPS Power、 Dehumidifier、 TMS POWER:

3、 Switch the corresponding external cabinet circuit breaker to OFF; Turn the molded case circuit breaker to OFF position; Finally, turn the high-voltage cabinet circuit breaker to OFF.



Figure 5-4 Plastic Case Circuit Breaker Switch



A warning sign is required at the disconnect switch to prevent others from

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accidentally powering up.

5.3.2 Emergency Stop

In case of emergency, tap the red emergency stop button on the front cabinet door to stop the converter and automatically disconnect the power circuit in the liquid-cooled outdoor cabinet.



- After disconnecting all input power to the liquid-cooled outdoor cabinet, wait for 5 minutes before opening the door to inspect the liquid-cooled outdoor cabinet.
 - Before opening the door, make sure that there is no power inside the cabinet.
 - Under normal conditions, shut down the liquid-cooled outdoor cabinet using the normal shutdown procedure. Emergency shutdown must be used in case of emergency to ensure a quick response and to protect life safety, the liquid-cooled outdoor cabinet and peripheral equipment.
-

5.4 System Trial Operation

During the trial operation of the system, the energy storage system interacts with external sources via DC converters or energy storage inverters. The following points should be noted during trial operation:

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Website: <http://www.greatpower.net>

E-mail: info@greatpower.net

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Capacity Calibration: Ensure the battery can complete a full normal charge-discharge cycle. By default, the rated capacity is adjusted during the first ten cycles of initial system operation. Therefore, deep charge-discharge cycles should be performed during trial operation and joint debugging. It is recommended to conduct a capacity calibration during the trial operation, with a Depth of Discharge (DOD) of 100%, tested at the product's rated power. The default process consists of three stages: "full discharge + rest (2h) + full charge," as detailed below:

Full Discharge: Perform a full discharge test on the RACK, discharging to SOC = 5%.

Rest: Allow the system to rest for at least 2 hours (for SOC calibration). During this period, there should be no charge or discharge current, and the auxiliary power supply to the switch box is not required.

Full Charge: After the rest period, perform a full charge test, charging to SOC = 100%.

Depending on site conditions, the capacity calibration process can be adjusted to "full charge + rest (2h) + full discharge." If the energy storage battery is fully discharged and will not be used for an extended period, it should be recharged promptly.

Operational Stability: Components such as busbars, communication systems, and data acquisition devices should operate at rated power during debugging where

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possible. This helps identify any abnormalities in the system installation. Special attention should be paid to overheating, overcurrent, overvoltage, over-discharge, and other abnormal conditions, which should be addressed promptly to avoid safety hazards.

5.5 Master & Slave Settings

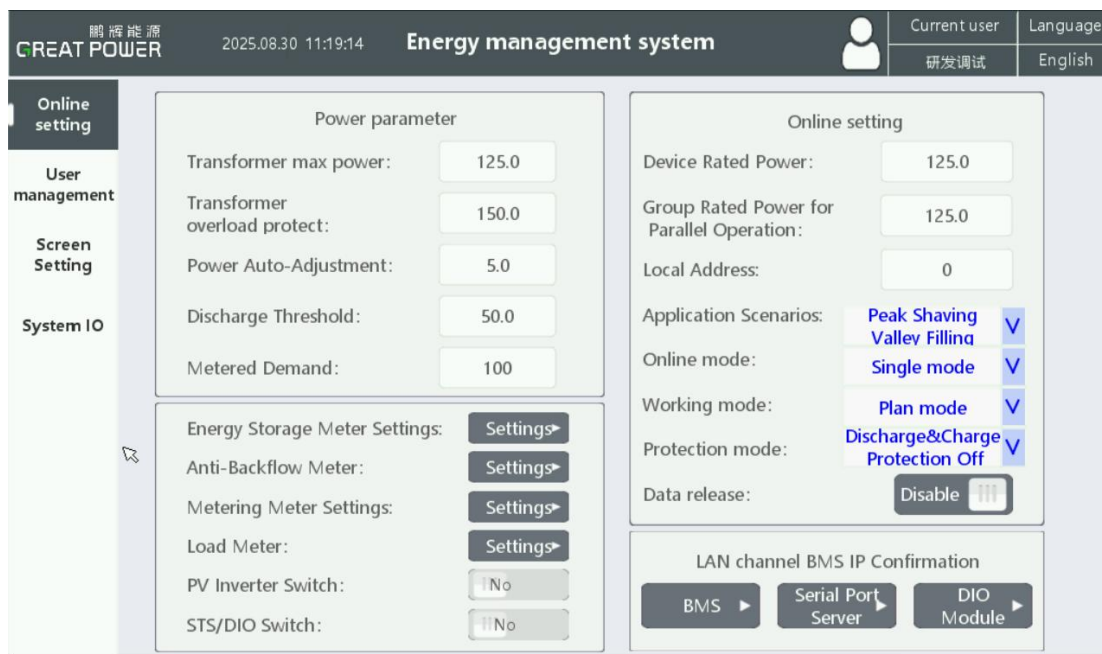


Figure 7.1 Example of the Online Setup Interface

1) Click system settings to access the Online Settings page, where you can configure power parameters, demand parameters, meter transformation ratio, online settings, and IP settings.

2) Parameter Meaning:

- **Maximum Transformer Power:** The maximum power output supported by the transformer connected to the system;

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- Transformer Protection Buffer Power: During charging, if monitoring indicates the transformer is about to operate in overload ($P > \text{Maximum Transformer Power} - \text{Transformer Protection Buffer Power}$), the EMS will reduce the charging power to prevent transformer overload;
- No-adjustment power: During discharge, if load power fluctuations exceed the no-adjustment power range, the EMS adjusts the PCS output power;
- Demand-Start Power: During discharge periods, if the load power exceeds the demand-start power threshold, the energy storage system supplies power up to its maximum output capacity.
- Energy Storage Meter Ratio: Set the meter ratio for the energy storage cabinet;
- Gateway Meter Configuration: Set load/no-load meter; (The gateway meter referred to below currently corresponds to the load meter)
- Metering Transformer Ratio: Set the anti-reverse flow meter ratio;
- Rated Power: Maximum output power of this cabinet;
- Rated Power of Parallel System: Maximum output power of the system when multiple cabinets are connected in parallel;
- Unit Address: Not required for standalone operation; in parallel operation, set the master unit to 0 and slave units to 1, 2, 3, etc.
- On-line Mode: Selectable options include Local Auto, Local Manual, Centralized Control Master, and Centralized Control Slave; corresponding to standalone auto

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operation, standalone manual control, parallel operation as master unit, and parallel operation as slave unit respectively.

- Protection Mode: Configurable to four modes: Discharge Reverse Protection & Charge Transformer Overload Protection On, Discharge Reverse Protection On, Charge Transformer Overload Protection On, Discharge Reverse Protection & Charge Transformer Overload Protection Off.
- Communication Settings: Masks communication status under specific conditions; generally requires no configuration.

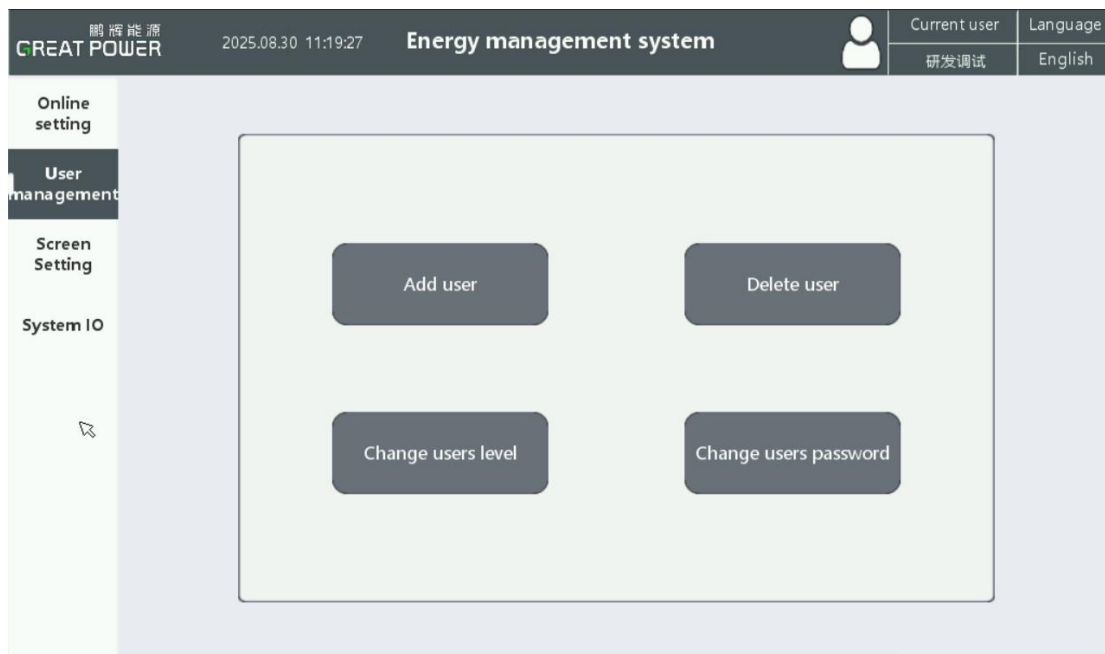


Figure 7.2 User Management Interface Example

It can add users, delete users, modify user levels, modify passwords.

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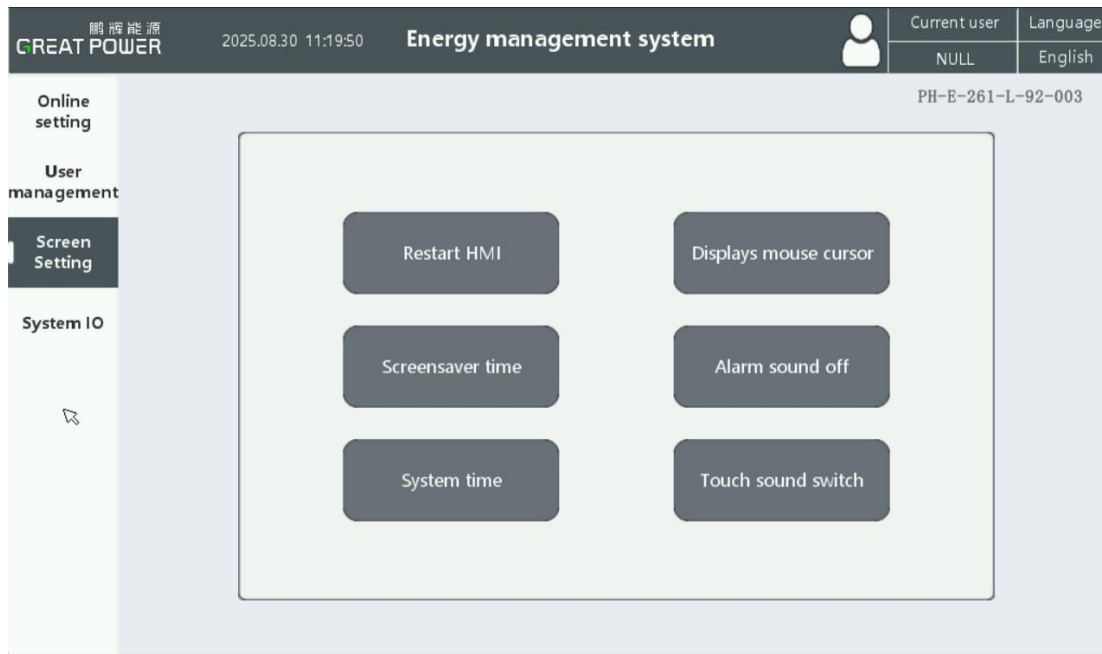


Figure 7.3 Example of the Screen Settings Interface

1) Capable of restarting the screen, configuring screen parameters, system time, etc.

1. Online Configuration Steps

Special note: The following settings related to IP and online mode require a restart to take effect after configuration. The recommended approach is to restart the screen after completing all necessary parameter settings, then test for normal operation.

1) Set the BMS IP addresses for the Host, Slave 1, Slave 2, etc. as follows (configured via the BMS host computer):

Host BMS IP: 192.168.1.200

Slave 1 BMS IP: 192.168.1.201

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Slave 2 BMS IP: 192.168.1.202

.....

2) Set the host, slave 1, slave 2... local addresses, and LAN channel IP as follows:

Host local address: 0

Slave 1 local address: 1

Slave 2 local address: 2

...

Master LAN Channel IP: 192.168.1.200, click to set IP

Slave 1 LAN Channel IP: 192.168.1.201, click to set IP

Slave 2 LAN Channel IP: 192.168.1.202, click to set IP

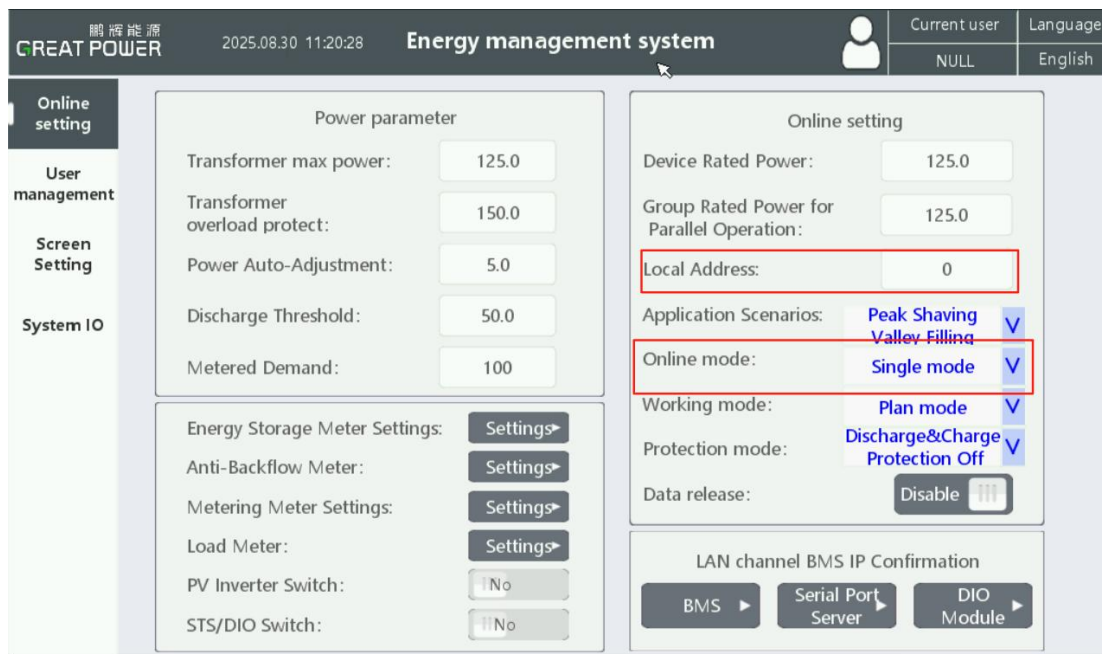
...

Host Connection Mode: Central Control Host

Slave 1 Connection Mode: Central Control Slave

Slave 2 Connection Mode: Central Control Slave

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The screenshot shows the 'Energy management system' web interface. The top header includes the 'GREAT POWER' logo, the date '2025.08.30 11:20:28', the title 'Energy management system', a user icon, 'Current user: NULL', and 'Language: English'. A left sidebar contains navigation links: 'Online setting', 'User management', 'Screen Setting', and 'System IO'. The main content area is divided into two columns. The left column, titled 'Power parameter', includes fields for 'Transformer max power: 125.0', 'Transformer overload protect: 150.0', 'Power Auto-Adjustment: 5.0', 'Discharge Threshold: 50.0', and 'Metered Demand: 100'. Below these are sections for 'Energy Storage Meter Settings', 'Anti-Backflow Meter', 'Metering Meter Settings', 'Load Meter', 'PV Inverter Switch' (set to 'No'), and 'STS/DIO Switch' (set to 'No'). The right column, titled 'Online setting', includes 'Device Rated Power: 125.0', 'Group Rated Power for Parallel Operation: 125.0', 'Local Address: 0' (highlighted with a red box), 'Application Scenarios' (with 'Peak Shaving' and 'Valley Filling' selected), 'Online mode: Single mode' (highlighted with a red box), 'Working mode: Plan mode', 'Protection mode: Discharge&Charge' and 'Protection Off', and 'Data release: Disable'. At the bottom right, there is a 'LAN channel BMS IP Confirmation' section with buttons for 'BMS', 'Serial Port Server', and 'DIO Module'.

Figure 8.1 Host Configuration Example Diagram

3) Set the EMS IP addresses for the host, slave 1, slave 2, etc. as follows:

Host EMS IP: 192.168.1.100

Slave 1 EMS IP: 192.168.1.101

Slave 2 EMS IP: 192.168.1.102

.....

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The screenshot displays the '能源管理系统' (Energy Management System) configuration page. The left sidebar contains navigation options: '联机设置' (Link Settings), '用户管理' (User Management), '屏幕设置' (Screen Settings), and '系统信息' (System Information). The main content area is divided into several sections:

- 功率参数 (Power Parameters):** Includes settings for '变压器最大功率' (Transformer Max Power: 800.0), '变压器保护缓冲功率' (Transformer Protection Buffer Power: 200.0), '免调功率' (No-Adjust Power: 5.0), and '需量启动功率' (Demand Start Power: 10.0).
- 电表变比 (Meter Ratio):** Includes '储能电表变比' (Energy Storage Meter Ratio: 50.0000) and '负载电表设置' (Load Meter Setting: 无).
- 联机设置 (Link Settings):** Includes '本机额定功率' (Local Rated Power: 100.0), '并网群额定功率' (Grid Group Rated Power: 200.0), '本机地址' (Local Address: 1), '联机模式' (Link Mode: 集控从机), '保护模式' (Protection Mode: 放防充保), and '数据释放' (Data Release: 禁止).
- LAN通道BMS IP确认 (LAN Channel BMS IP Confirmation):** Shows the '默认IP' (Default IP) as 192.168.1.201 and a '设置IP' (Set IP) button.

Figure 8.2 Example Slave Configuration Diagram

4) Set the EMS IP addresses for the host, slave 1, slave 2, etc. as follows:

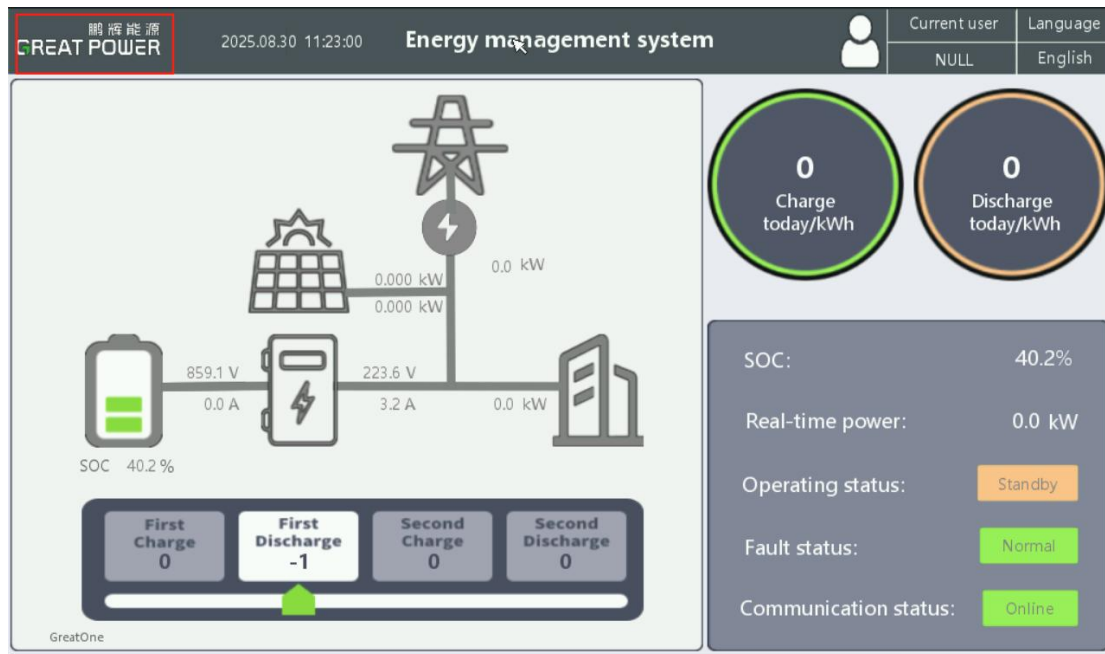
Host EMS IP: 192.168.1.100

Slave 1 EMS IP: 192.168.1.101

Slave 2 EMS IP: 192.168.1.102

.....

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① Press and hold the logo in the upper-left corner for 5 seconds to enter the system settings page.

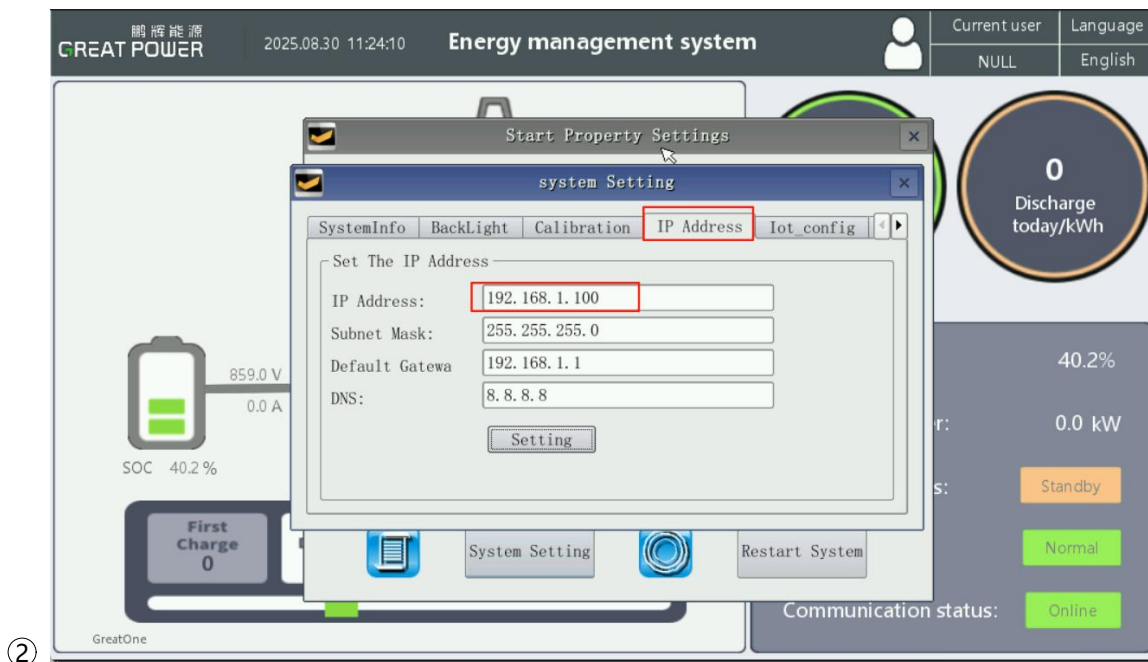


Figure 8.4 Host IP Configuration Example Diagram

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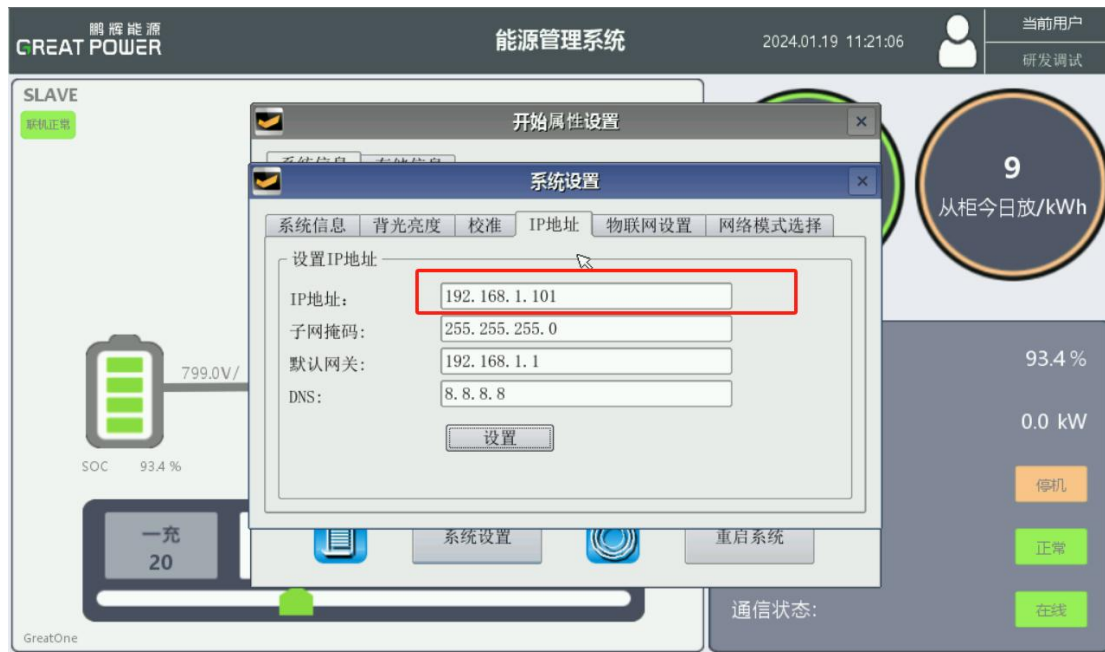


Figure 8.5 Example Diagram of Slave IP Settings

② Click System Settings - IP Address to modify the IP address.

③ After modification, click Restart System.

5) Transformer, Meter, and on-line Settings

① Set the transformer's maximum power to the actual maximum output power of the connected transformer.

② Set the transformer protection buffer power to 5–10% of the transformer's maximum power. The greater the variation in site load, this value can be set is higher.

③ Set the energy storage meter ratio, load meter ratio, presence of load meters, unit rated power, group rated power, and protection mode according to actual site conditions.

 2025.08.30 11:25:09 Energy management system Current user 研发调试 Language English				
PCS Control	Start time	End time	State	Power (KW)
Time period setting	00:01:00	02:00:00	Standby	0.0
	02:00:00	04:00:00	Standby	0.0
Power supply strategy	04:00:00	06:00:00	Standby	0.0
	06:00:00	08:00:00	Standby	0.0
	08:00:00	10:00:00	Standby	0.0
	10:00:00	12:00:00	Standby	0.0
	12:00:00	14:00:00	Standby	0.0
	14:00:00	16:00:00	Standby	0.0
	16:00:00	18:00:00	Standby	0.0
	18:00:00	19:00:00	Standby	0.0
	19:00:00	22:00:00	Standby	0.0
	22:00:00	23:59:00	Standby	0.0

Figure 8.6 Example Diagram of Power Supply Strategy

- ① After parallel operation is completed, the power supply strategy only needs to be configured on the master unit; no configuration is required on the slave units.
 - ② The power rating corresponds to the system power after parallel operation.
- 6) Check if it is functioning properly.

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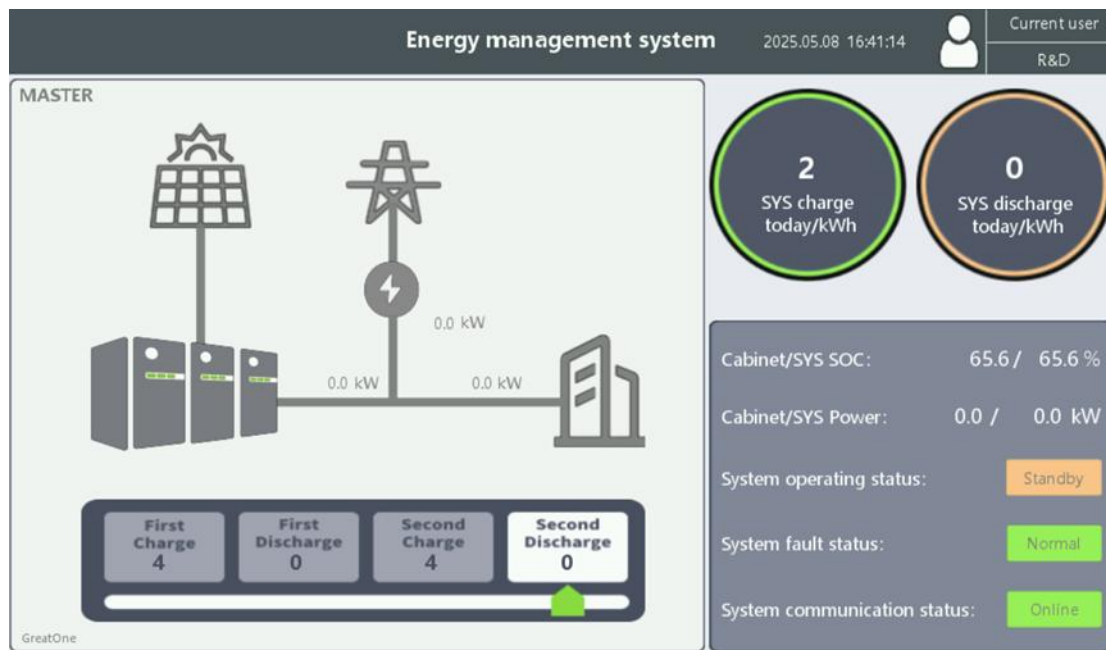


Figure 8.7 Example Diagram of Host System Without Faults

- ① After host system synchronization is complete, the upper-left corner normally displays [Slave Online].
- ② The status bar in the lower-left corner shows no faults and no offline units.
- ③ Power supply policies can be executed normally.

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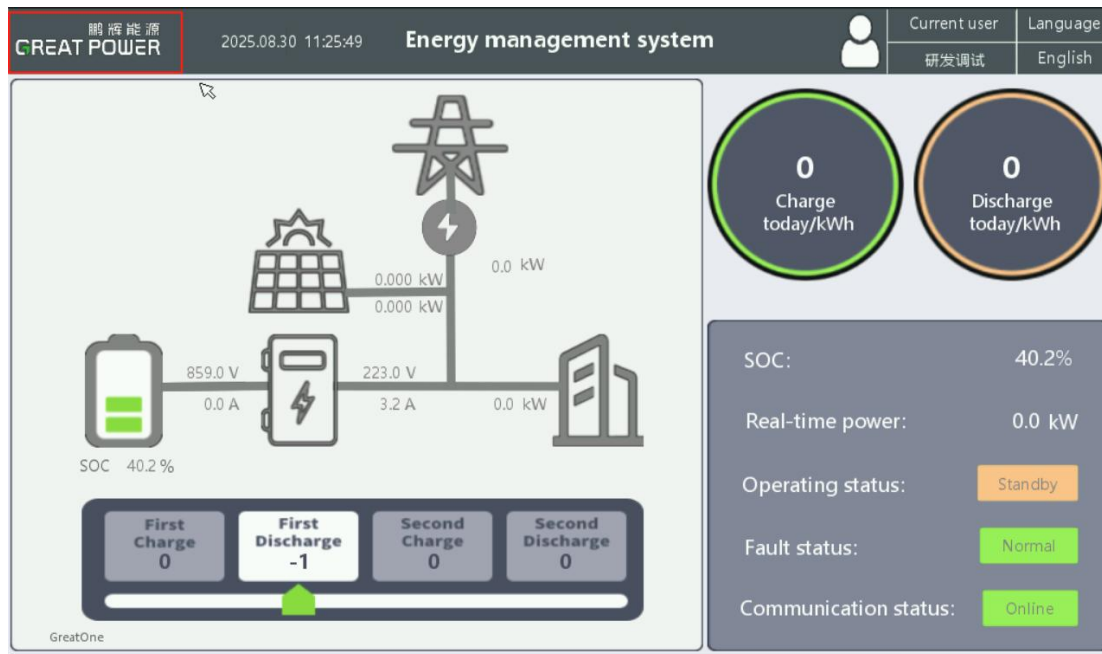


Figure 8.8 Example Diagram of Slave Unit Without Fault

- ④ After completing the slave-to-master transition, the upper-left corner should display [Online Status Normal] under normal conditions.
- ⑤ The status bar in the lower-left corner shows no faults or offline status.
- ⑥ The device can be correctly controlled by the master host, meaning it executes policies set by the master host normally.

2. Anti-Backflow and Overload Protection Principles & Logic

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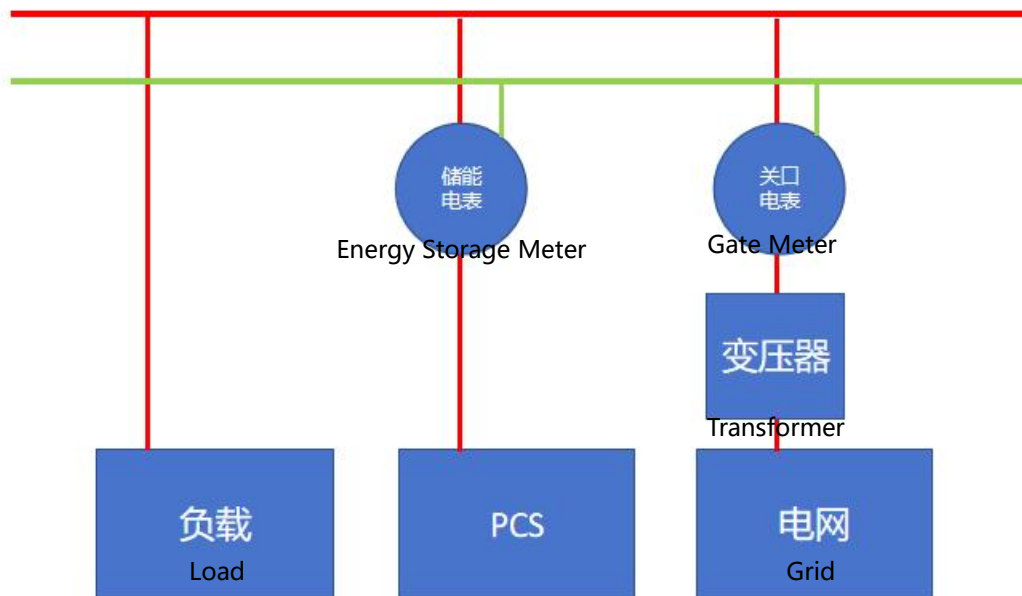
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1) Anti-Backflow Principle

During the discharge phase of the energy storage system, the EMS must continuously calculate the power demand at the load end and dynamically adjust the PCS output power to ensure the load primarily utilizes electricity from the energy storage system.

2) Anti-Overload Principle

During the charging phase of the energy storage system, the EMS must constantly monitor the real-time power of the transformer. If the transformer approaches overload conditions, the EMS dynamically adjusts the PCS input power to ensure the total power does not exceed the transformer's maximum output capacity.

3) Backflow Prevention Power Calculation Logic

① Grid connection point power < Load power - Discharge threshold

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② Grid connection point power < BMS permitted discharge power

③ Grid connection point power < Cabinet maximum power

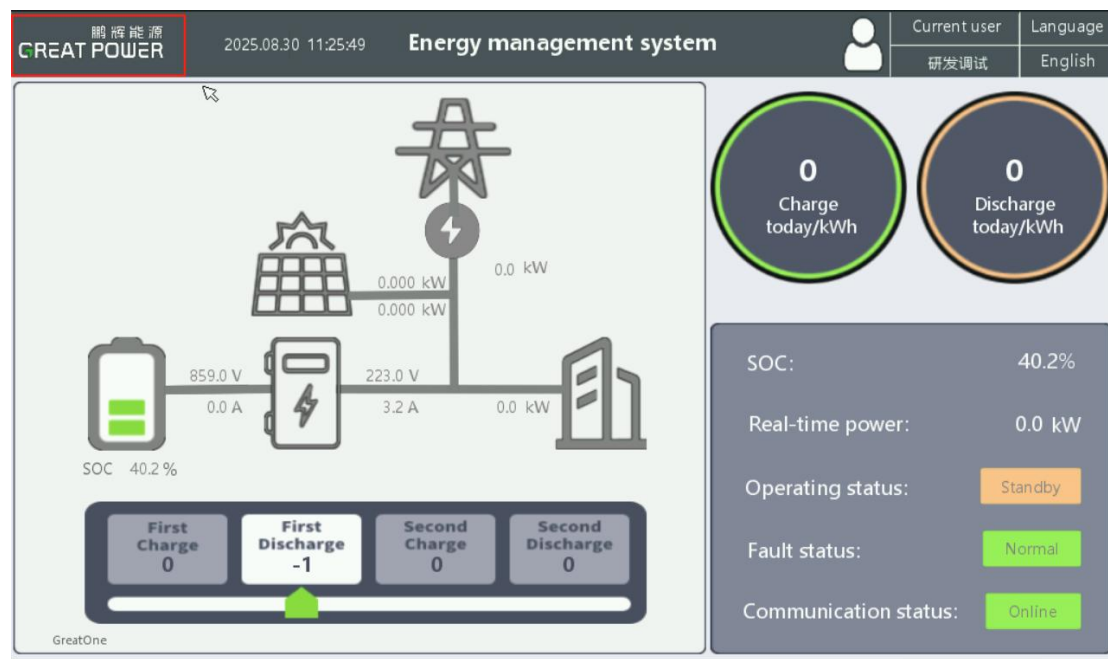
4) Overload Prevention Power Calculation Logic

① Grid connection point power > Load power - (Transformer maximum power - Transformer overload protection margin)

② Grid connection point power > (-BMS permitted charging power)

③ Grid connection point power > (-Cabinet maximum power)

3. Switch to Wired Internet



Long press the Great Power Energy icon

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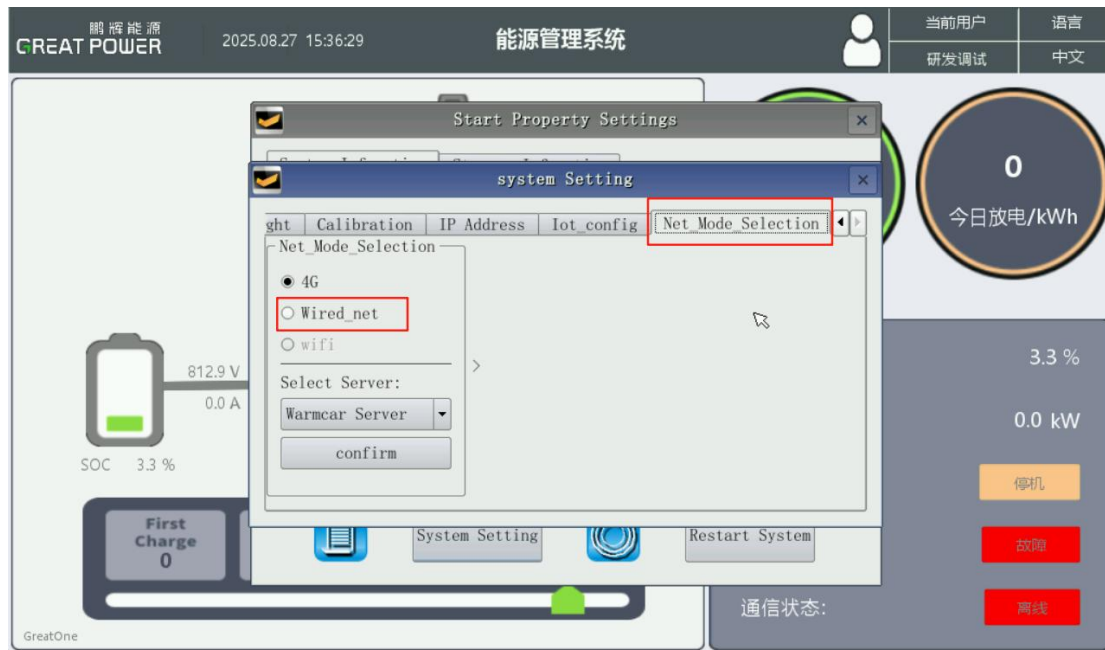
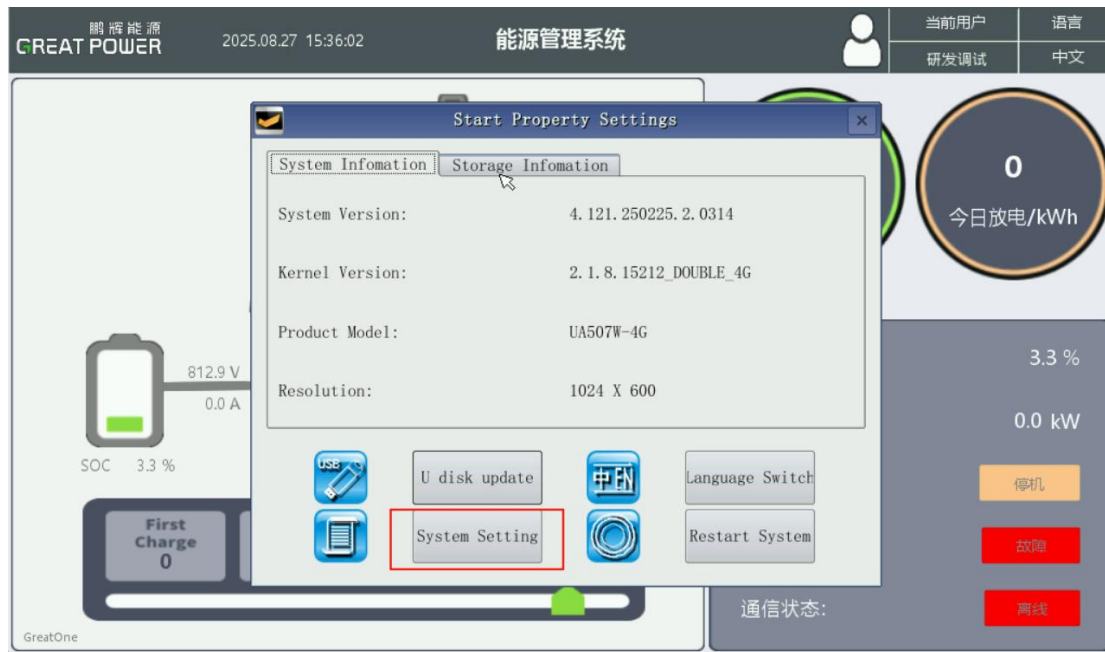
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Select wired network connection

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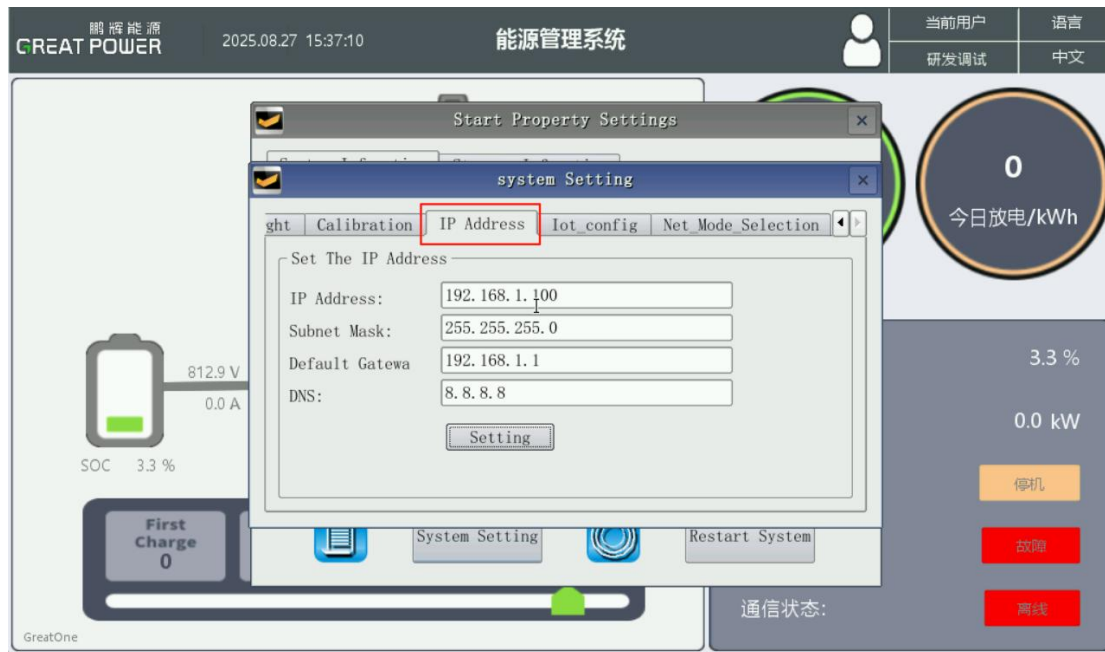
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The IP address should also be modified appropriately.

After configuration, a restart is required for changes to take effect.

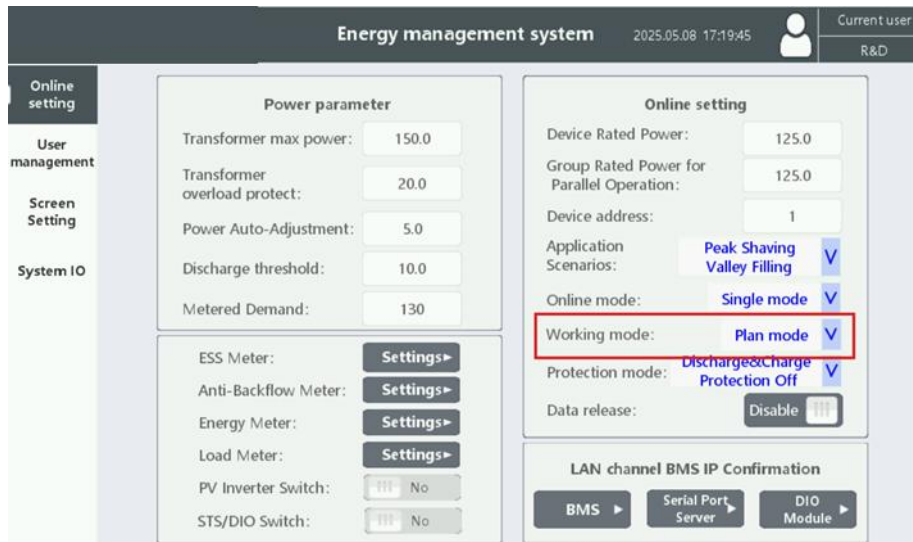
4. Off-Grid Operation Steps

Note: Do not connect to the grid during off-grid operation!

Before performing off-grid operation, follow the startup steps in Section 5.2 to power on the system. After confirming that the system is functioning correctly, proceed with the following steps for off-grid operation of the liquid-cooled outdoor energy storage cabinet:

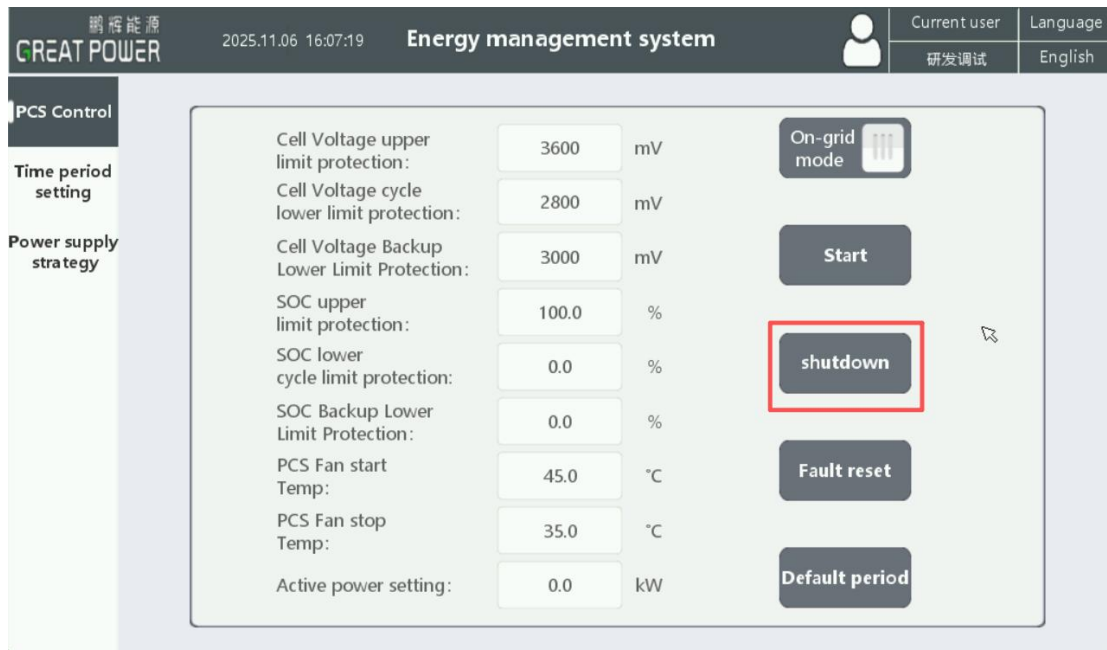
1. Change the system setting from "Online Mode" to "Manual Mode";

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The screenshot shows the 'Energy management system' interface. The top bar includes the date '2025.05.08 17:19:45' and the current user 'R&D'. The left sidebar has options: 'Online setting', 'User management', 'Screen Setting', and 'System IO'. The main area is divided into two columns. The left column, 'Power parameter', includes fields for Transformer max power (150.0), Transformer overload protect (20.0), Power Auto-Adjustment (5.0), Discharge threshold (10.0), Metered Demand (130), and several meters (ESS, Anti-Backflow, Energy, Load) with 'Settings' buttons. The right column, 'Online setting', includes Device Rated Power (125.0), Group Rated Power for Parallel Operation (125.0), Device address (1), Application Scenarios (Peak Shaving, Valley Filling), Online mode (Single mode), Working mode (Plan mode, highlighted with a red box), Protection mode (Discharge, Charge, Protection Off), and Data release (Disable). At the bottom, there's a 'LAN channel BMS IP Confirmation' section with buttons for BMS, Serial Port Server, and DIO Module.

2. Manually stop the PCS via the PCS control interface;



The screenshot shows the 'PCS Control' interface. The top bar includes the date '2025.11.06 16:07:19' and the current user '研发调试' (R&D Debug). The left sidebar has options: 'PCS Control', 'Time period setting', and 'Power supply strategy'. The main area displays various parameters in a table-like format: Cell Voltage upper limit protection (3600 mV), Cell Voltage cycle lower limit protection (2800 mV), Cell Voltage Backup Lower Limit Protection (3000 mV), SOC upper limit protection (100.0 %), SOC lower cycle limit protection (0.0 %), SOC Backup Lower Limit Protection (0.0 %), PCS Fan start Temp (45.0 °C), PCS Fan stop Temp (35.0 °C), and Active power setting (0.0 kW). To the right of these parameters are several control buttons: 'On-grid mode', 'Start', 'shutdown' (highlighted with a red box), 'Fault reset', and 'Default period'.

3. Disconnect the grid circuit breaker and verify that the energy storage cabinet has no grid input;

4. Connect the load between the output terminal of the energy storage cabinet

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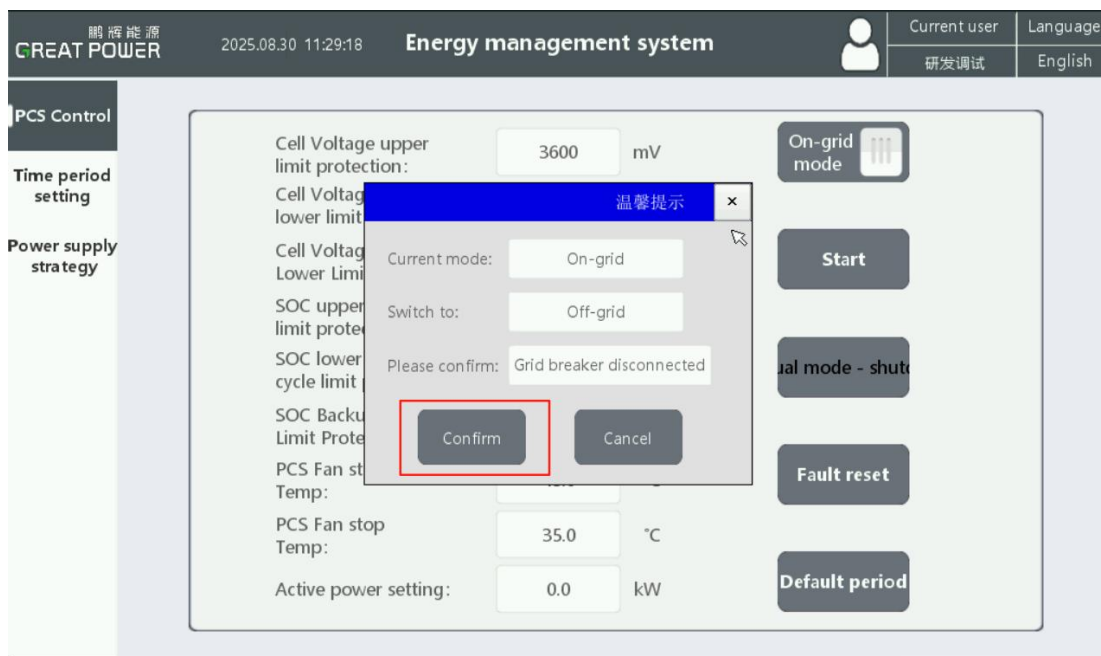
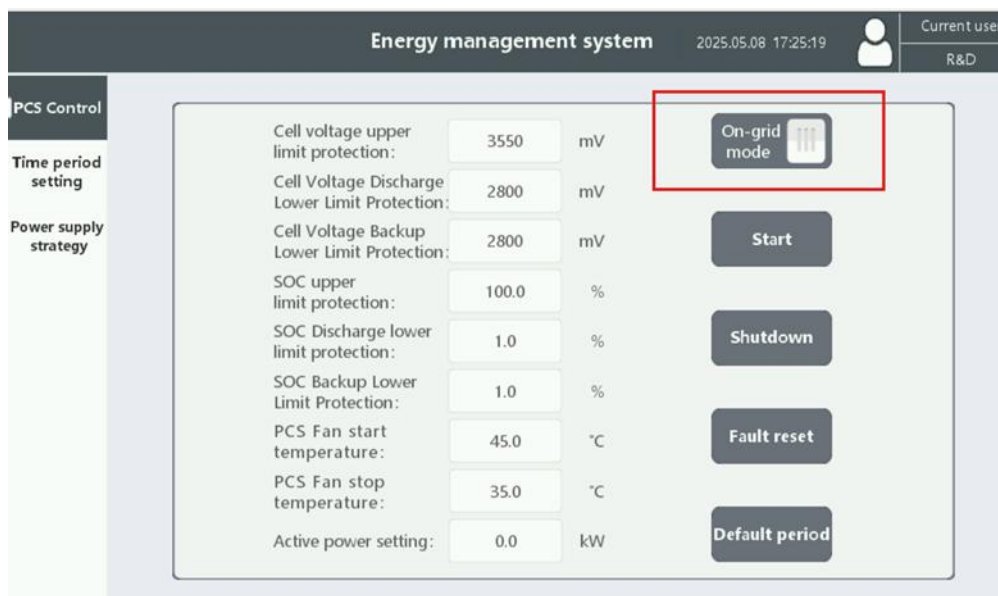
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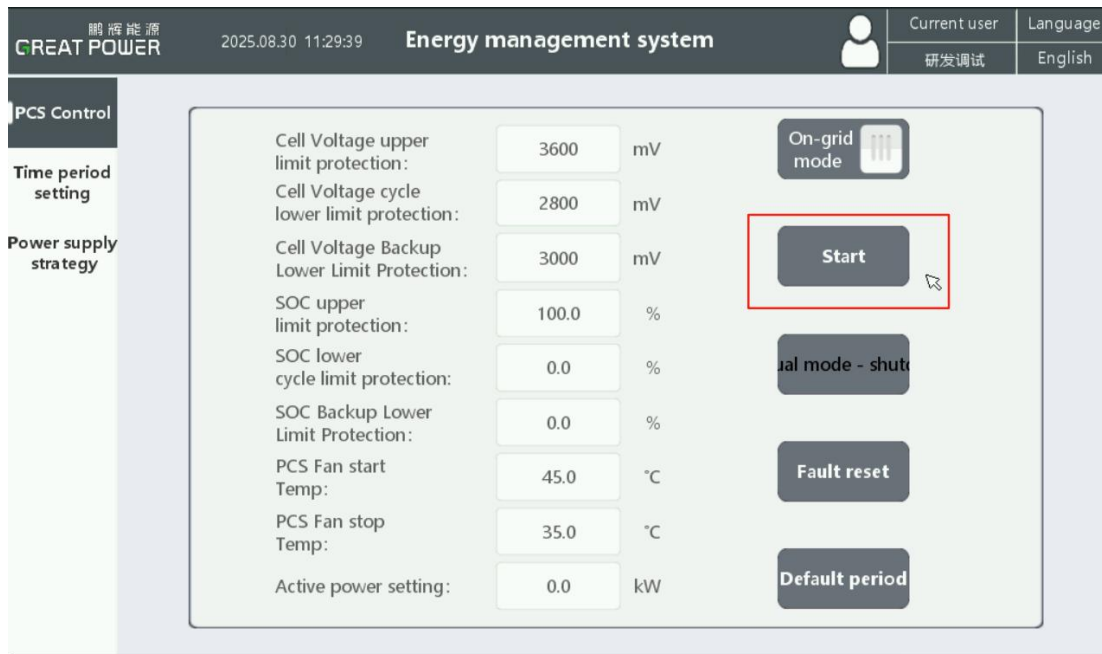
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and the grid input line;

5. Press and hold the off-grid switch button on the PCS control interface until the confirmation screen appears, then switch the PCS to Off-Grid Mode;



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6. Off-grid switching is complete;

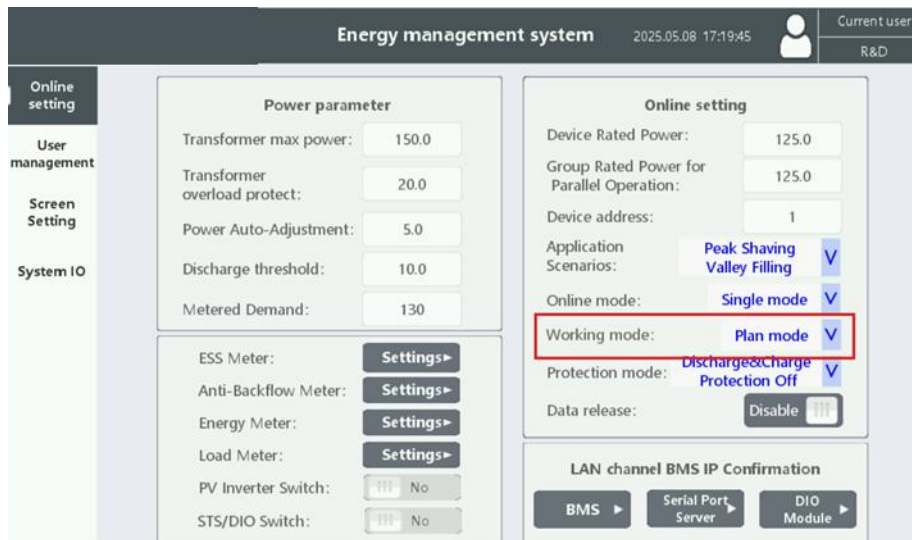
7. After connecting the load, the system will automatically begin off-grid discharging.

5. Grid-Connected Operation Steps

Before performing grid connection operations, follow the startup procedure to power on the system. After verifying the system is in proper working order, proceed with the grid connection operation for the outdoor liquid-cooled energy storage cabinet according to the following steps.

1. Change the system setting from "Online Mode" to "Manual Mode."

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Energy management system 2025.05.08 17:19:45

Current user: R&D

Power parameter

Transformer max power:	150.0
Transformer overload protect:	20.0
Power Auto-Adjustment:	5.0
Discharge threshold:	10.0
Metered Demand:	130

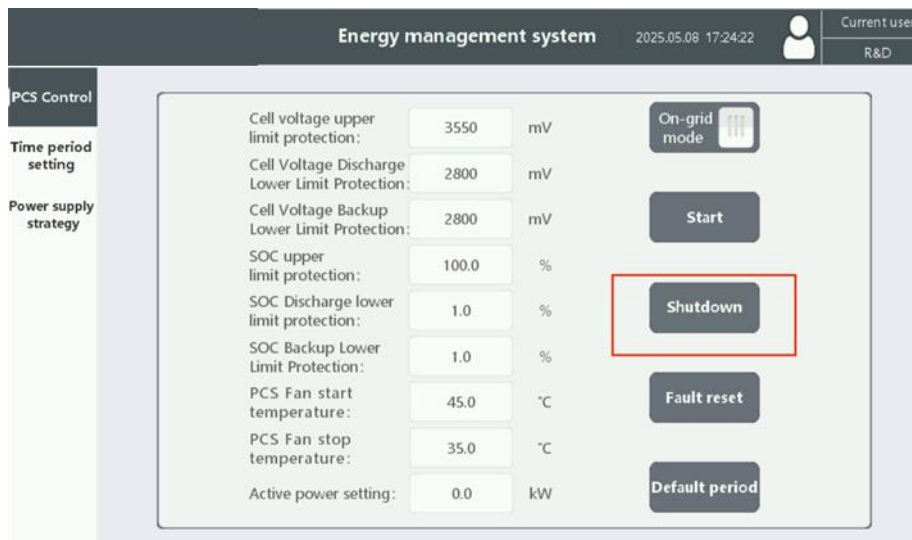
Online setting

Device Rated Power:	125.0
Group Rated Power for Parallel Operation:	125.0
Device address:	1
Application Scenarios:	Peak Shaving Valley Filling
Online mode:	Single mode
Working mode:	Plan mode
Protection mode:	Discharge & Charge Protection Off
Data release:	Disable

LAN channel BMS IP Confirmation

BMS Serial Port Server DIO Module

2. Manually stop the PCS via the PCS control interface;



Energy management system 2025.05.08 17:24:22

Current user: R&D

PCS Control

Cell voltage upper limit protection:	3550	mV
Cell Voltage Discharge Lower Limit Protection:	2800	mV
Cell Voltage Backup Lower Limit Protection:	2800	mV
SOC upper limit protection:	100.0	%
SOC Discharge lower limit protection:	1.0	%
SOC Backup Lower Limit Protection:	1.0	%
PCS Fan start temperature:	45.0	°C
PCS Fan stop temperature:	35.0	°C
Active power setting:	0.0	kW

On-grid mode

Start

Shutdown

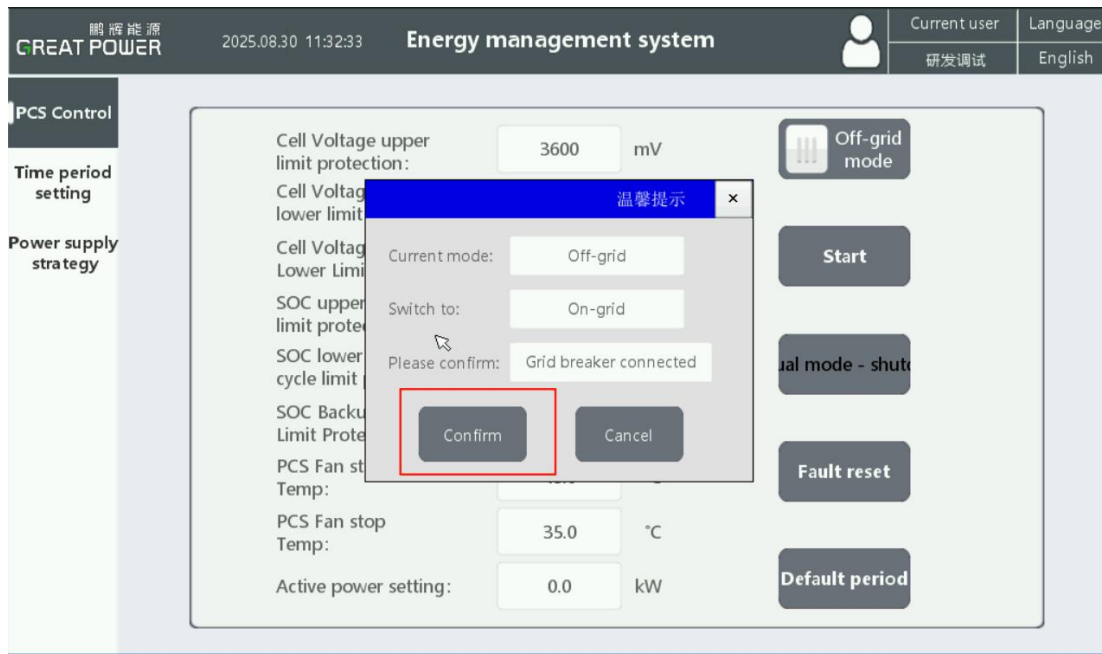
Fault reset

Default period

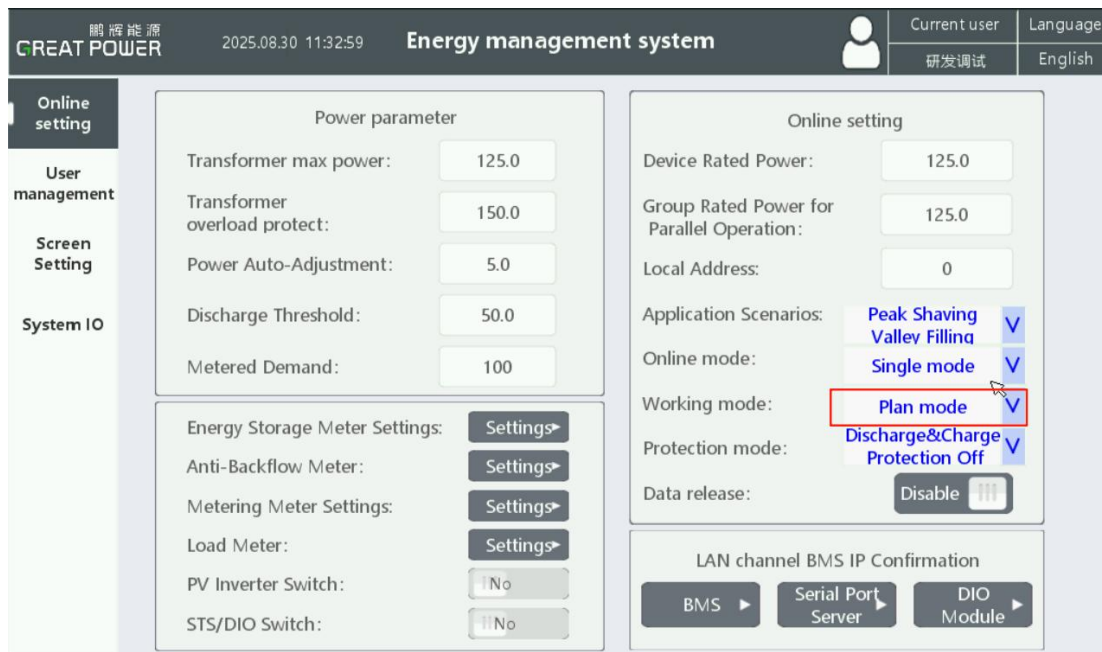
3. Close the grid circuit breaker and confirm that the energy storage cabinet is receiving grid power.

4. Press and hold the grid-connection switch button on the PCS control interface until the confirmation screen appears, then switch the PCS to Grid-Connected Mode;

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5. Change the system setting from "Manual Mode" to "Scheduled Mode" in the system information menu;



6. Grid-connection switching is complete.

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6 Troubleshooting

The liquid-cooled outdoor cabinet is equipped with comprehensive protection functions and warning alerts. In the event of a malfunction, relevant fault information can be retrieved via the EMS (Energy Management System).

Before requesting service, users can perform self-inspection based on the prompts in the following table to analyze the cause of the fault and identify a solution. If the issue persists, please contact your distributor or reach out to our company directly.



Do not disassemble any machine components during self-inspection.

Fault Severity Levels

- **Fault:** Indicates abnormal conditions in the liquid-cooled cabinet, power grid, battery, or other external factors, triggering an automatic shutdown. Immediate intervention is required to resolve the issue.
- **Warning:** Indicates abnormal conditions in the liquid-cooled cabinet, power grid, battery, or other external factors, but the system continues operating. Prompt action is needed to address the anomaly.

Fault Reset Methods

Fault reset can be performed either automatically or manually:

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- Automatic Reset: The system issues a warning (without shutdown or with power limitation). Once the abnormal parameter returns to normal, the warning resets automatically.
- Manual Reset: After a fault-triggered shutdown, press the Reset button on the display screen to restore operation.

6.1 Fault Reference Table

6.1.1 PCS Faults

NO.	Description	Possible Causes	Recommended Actions
1	Reverse Battery Polarity	Battery connected with reverse polarity to the converter.	Check that the battery polarity is connected correctly
2	Abnormal Battery Voltage	Battery voltage too high or too low at power-up	Check that the battery voltage is within the normal range
3	DC Side Half-Bus Overvoltage	• Half-bus voltage is too high • Positive and negative half-bus voltages are not equalized	• Check that the battery voltage is within the normal range • Check that the grid voltage is within the normal range
4	AC Hardware Overcurrent	• There is a short circuit on the AC side • Shock load terminals are disconnected	Please contact after-sales service
5	Phase A IGBT Fault	A phase IGBT DESET protection	Please contact after-sales service
6	Phase B IGBT Fault	B phase IGBT DESET protection	Please contact after-sales service
7	Phase C IGBT Fault	C phase IGBT DESET protection	Please contact after-sales service
8	AC Phase A Hall Sensor	Wiring terminals are disconnected	Please contact after-sales service

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	Disconnection		
9	AC Phase B Hall Sensor Disconnection	Wiring terminals are disconnected	Please contact after-sales service
10	AC Phase C Hall Sensor Disconnection	Wiring terminals are disconnected	Please contact after-sales service
11	DC Side Switch Fault	Wiring terminals are disconnected	Please contact after-sales service
12	DC Side Switch Fault	- Switch contacts stick - Switch feedback signal line is disconnected - Switch control signal line is disconnected	- Check that the switch contacts are not sticking - Check that the switch control signal and feedback signal are connected properly
13	IGBT Fan Fault	- The fan is blocked - Fan disconnected	- Check that the fan blades operate normally - Check that the fan power cord is connected properly
14	DC Full-Bus Software Overvoltage	- Grid voltage too high - Battery voltage too high	- Check that the battery voltage is within the normal range - Check that the grid voltage is normal
15	DC Full-Bus Software Undervoltage	- Bus voltage too low during operation - Battery voltage too low.	- Check that the battery voltage is within the normal range - Check that the grid voltage is normal
16	Half-Bus Voltage Imbalance	- Deviation in positive and negative half bus voltages - Bus capacitor aging	Please contact after-sales service
17	Grid AC Overvoltage	Grid voltage exceeds overvoltage threshold	Check that the grid voltage is normal
18	Grid AC Undervoltage	Grid voltage falls below undervoltage threshold	Check that the grid voltage is normal
19	Off-Grid AC Overvoltage	Off-grid AC voltage exceeds overvoltage threshold	Please contact after-sales service
20	Off-Grid AC Undervoltage	Off-grid AC voltage falls below undervoltage threshold	Please contact after-sales service

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21	Grid AC Overfrequency	The grid frequency is above the overfrequency point	Check that the grid voltage is normal
23	AC Software Overcurrent	- AC software overcurrent - AC load is too large	Please contact after-sales service
24	Output Phase Loss	- Output phase loss fault - Main circuit output shorted to ground	Check that the three-phase output wiring is normal
25	Surge Protector Fault	The lightning protector is faulty	- Check that the lightning protector is wired properly - Check that the lightning protector is not damaged
26	Excessive Current Control Deviation	- Wiring terminals are disconnected - The control loop is saturated - Abnormal main loop voltage	Please contact after-sales service
27	Grid Voltage Imbalance	- Three-phase grid voltage amplitude exceeds allowable range - Grid input phase loss	- Check that the grid voltage is normal - Check that the grid voltage is not out of phase
28	AC Current DC Component Exceeded	- Three-phase current has excessive DC component - Current sampling has DC bias	Please contact after-sales service
29	Ambient Over-Temperature	- Ambient temperature exceeds protection threshold - Fan fault - Water cooling system abnormal	- Check that the fan is operating normally - Check that the water cooling system is operating normally. - Check that the temperature sensor is working properly
30	Ambient Low-Temperature	Ambient temperature falls below protection threshold	Check that the temperature sensor is working properly
31	IGBT Module Over-Temperature	- Ambient temperature too high - Current too large	- Check that the fan is operating normally - Check that the water cooling system is operating normally - Check that the current is within the normal range

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			Check that the temperature sensor is working properly
32	IGBT Low-Temperature	Ambient temperature too low	Check that the temperature sensor is working properly
33	AC Switch Closing Voltage Mismatch	- Battery voltage incompatible with grid voltage - Grid-side voltage present in off-grid mode	Contact the after-sales service for details
34	AD Zero Drift Too Large	Zero drift too large	Contact the after-sales service for details
35	Insulation Resistance Too Low	Insulation resistance resistance value is low	- Check that the main circuit is grounded - Contact the after-sales service for details
36	Insulation Detection Failure	Inconsistent insulation detection switch command and feedback	Check that the insulation detection circuit is wired properly
37	BMS Communication Failure	The control board is disconnected from the BMS unit communication cable	Check that the communication cable connection between the control board and the BMS unit is normal
38	Parallel Communication Failure	The control board failed to communicate with the other PCS	Check that the communication cable connection between PCS and other PCS is normal
39	SPI fault	SPI fault	Please contact after-sales for details
40	IoT Communication Failure	The control board is disconnected from the IoT unit communication cable	Check that the communication cable connection between the control board and the IoT module is normal
41	Customer Backend Communication Fault	The control board is disconnected from the customer's backend communication line.	Check that the communication cable connection between the control board and the customer's back office is normal
42	CBC Overcurrent	Current too large	- Check for short circuits in the system wiring - Use a clamp meter to measure the current is within the normal

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			range
43	Equipment Overload	The converter overcurrent runs for too long.	Ensure the converter operates within the allowed power range
44	Grid Voltage Reverse Sequence	Grid wiring reversed	Swap any two phases in the three-phase wiring
45	Bus Soft Start Failure	- Pre-charge contactor fault - Check that the pre-charge circuit breaker is closed - Bus undervoltage - Sampling wire break	- Check that the pre-charge circuit breaker is closed. - Check that the pre-charge contactor is normal - Check the bus voltage - Check the sampling wire
46	AC Side Switch Fault	- Switch contacts stick. - Switch feedback signal line is disconnected. - Switch control signal line disconnected	- Check that the switch contacts are not sticking. - Check that the switch control signal and feedback signal are connected properly
47	Carrier Synchronization Failure	Carrier synchronization wire disconnected	Check the carrier synchronization wiring
48	EMS Communication Fault	EMS communication disconnected	Check that the EMS communication line is properly connected
49	Product Version Mismatch	Product version number mismatch	Product version number mismatch
50	Battery Voltage Too High	Product version number mismatch	Product version number mismatch
51	Battery Voltage Too Low	Battery voltage exceeds overvoltage threshold during operation	Check that the battery voltage is within the normal range
52	Host Abnormal Shutdown	Slave detects host	Please contact after-sales service
53	Phase Lock	Grid voltage phase lock	Check that the grid voltage is normal

6.1.2 Malfunction of Electric Meter

Malfunction Content	Possible Causes	Troubleshooting
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No display after power-on	Voltage terminal clamped on wire insulation	Reconnect voltage terminals;
Measurement data is inaccurate or shows 0 after adding a signal	Voltage measurement error	Check that the voltage signal is correctly connected to the device; Check that the voltage measurement signal is within the measurement range of the device;
	Current measurement error	Check that the voltage signal is correctly connected to the device; Check that the voltage measurement signal is within the measurement range of the device;
The host computer cannot communicate with the device	Incorrect communication wiring	Check whether the equipment communication line is connected correctly;
	Communication parameters are incorrect	Check whether the mailing address is correct; Check whether the communication baud rate is correct; Check whether the communication check bit is correct;
	Communication link affected	Check whether there are devices with the same parameters on the same communication link; Check whether the communication shielding layer is well grounded; Check whether the communication cable is disconnected;
	Communication conversion device does not match	Try changing a computer or adapter;

6.1.3 Liquid Cooler Failure

Fault Codes	Fault content	Cause	Failure level
0	No trouble	--	---
1	Lost Level 1 Failure BMS&TMS CAN communication abnormality	The unit is out of control	Level1

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2	HVRL Level 1 Fault High voltage contactor failure	HVRL high voltage contactor adhesion and disconnection failure	Level1
3	PTC Level 1 Fault K2 relay failure	PTC high voltage contactor adhesion and disconnection failure	Level1
4	ACDC_A Level 2 Fault ACDC_A overvoltage and undervoltage fault	ACDC_A output voltage is higher than 32V or the output voltage is less than 18V and greater than 6V	Level2
5	ACDC_A Level 2 Fault ACDC_A Self-fault	High voltage power is not supplied; ACDC_B itself is faulty	Level2
6	ACDC_B Level 2 Fault ACDC_B overvoltage and undervoltage fault	ACDC_B output voltage is higher than 32V or output voltage is less than 18V and greater than 6V	Level2
7	ACDC_B Level 2 Fault ACDC_B self fault	High voltage power is not supplied; ACDC_B itself is faulty	Leve12
8	Fan Level 2 Fault Fan failure	Fan overvoltage, undervoltage, overload, stall, overtemperature	Level2
9	HP Level 2 Failure High pressure sensor failure	High voltage sensor short circuit or open circuit	Level2
10	HPH Level 2 Failure High pressure	The condensation core is blocked and the heat dissipation is too little	Level2
11	HPL Level 2 Failure High pressure too low	Compressor refrigerant leakage	Level2
12	LP Level 2 Fault Low pressure sensor failure	Low voltage sensor short circuit or open circuit	Level2
13	LPH Level 2 Failure Low pressure too high	Too much refrigerant added	Level2
14	LPL Level 2 Fault Low pressure too low	Compressor refrigerant leakage, ambient temperature is too low	Level2
15	OL Level 2 Fault Outlet water temperature sensor failure	The outlet water temperature sensor is short-circuited or open-circuited	Level2
16	IL 2 Fault Inlet water temperature sensor failure	The water inlet temperature sensor is short-circuited or open-circuited.	Level2
17	P 2nd level fault Water pump failure	Pump no-load protection; light-load protection; reverse connection protection; stall	Leve12

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		protection; over-voltage and under-voltage protection; self-failure protection	
18	IF level 3 fault Water inlet pressure sensor fault	The water inlet pressure sensor is short-circuited or open-circuited.	Level3
19	AT level 3 fault Ambient temperature and humidity sensor fault	The ambient temperature and humidity sensor is short-circuited or open-circuited	Level2
20	AC Level 2 Fault AC communication loss fault	AC communication lost	Level2
21	AC Level 2 Fault AC compressor controller fault	AC controller itself is faulty	
22	PTC Level 2 Fault PTC Over-Temperature Fault	PTC internal temperature is too high	Level2
23	OF Level 3 fault Water outlet pressure sensor fault	The water outlet pressure sensor is short-circuited or open-circuited.	Level3
24	PE 3 level fault Inlet and outlet water pressure difference fault	The difference in water inlet and outlet pressure is less than 50kpa	Level3
25	PS 2 level fault High pressure switch fault	The pressure difference on the high-pressure side is greater than 2700kpa	Level2

BMS only responds to fault levels, and fault handling is as follows:

Level 1 fault handling method: send shutdown command, cut off high voltage, and forward fault to BMS;

Level 2 fault handling method: send shutdown command, cut off high voltage, and forward fault to BMS;

Level 3 fault handling method: no handling, forwarding the fault to BMS.

6.1.4 Fire Failure

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Fault Type	Fault Name	Possible Causes	Troubleshooting
Aerosol	Abnormal resistance (normal resistance value (1.5 ~ 3Ω))	1、Cable damage and short circuit 2、Internal wiring fault 3. Internal ignition head failure	Product Replacement
Sound and light alarm	Flashing frequency and volume or no action	The working voltage does not meet the standard and 24V DC is required	Replace the product or use 24V DC
Detector	Relay is not working normally, CAN has no signal transmission	The working environment is disturbed by external factors such as smoke and temperature, or the relay is damaged. CAN is not customized.	1、Improve the working environment without external interference. 2、The detector performs a logic update to AND logic. Increase the temperature alarm value for smoothing

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7. Daily Care and Maintenance

Due to the influence of environmental temperature, humidity, dust and vibration, the components inside the liquid cooling outdoor cabinet may age.

It can cause potential failure of the liquid-cooled outdoor cabinet or reduce the service life of the cabinet. Therefore, it is necessary to perform daily and regular maintenance on the liquid-cooled outdoor cabinet.



- Only qualified personnel can perform maintenance on the liquid-cooled outdoor cabinet.
- There is strong electricity in the cabinet, so necessary safety precautions must be taken before starting maintenance.
- Before maintenance, make sure the power supply is disconnected.
- During maintenance, correct operating procedures must be strictly followed.
- There are energy storage capacitors inside the liquid-cooled outdoor cabinet. After power is turned off, you must wait for more than 35 minutes to confirm that the converter is in a power-free state before maintenance can be performed.
- After the power is disconnected, a warning sign must be hung at the disconnection point to prevent someone from powering on during maintenance.
- To avoid unexpected dangers, maintenance personnel should wear insulating

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protective equipment during maintenance.

7.1 Daily Inspection Item

Daily inspection items are implemented according to the following points:

Table 7-1 List of daily inspection items

NO.	Daily Inspection Items	Confirm
1	The input and output voltage and current as well as the operating status of the liquid-cooled outdoor cabinet need to be monitored in real time, and designated personnel should be assigned to observe at designated locations. If any abnormal operation or voltage and current are found, maintenance should be carried out in a timely manner.	
2	Listen for any abnormal noise inside the liquid-cooled outdoor cabinet.	
3	Smell the inside of the liquid-cooled outdoor cabinet to see if there is any peculiar smell.	
4	Read the system internal temperature and observe that the temperature is within the normal range.	
5	Check the chassis surface for damage, clean the dirty surface with water or alcohol, and repaint the damaged surface. For detailed steps, please refer to 7.3 Repainting Operation Guide	

7.2 Regular Inspection items

Regular inspections are mainly aimed at areas that are difficult to inspect during daily inspections and daily operations:

Table 8-2 List of regular inspection items

NO.	Regular Inspection Items	Confirm
1	Check the appearance of the equipment for damage and rust.	

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2	Use a temperature measuring instrument to check the internal temperature of the equipment and find no abnormalities.	
3	Check whether the ventilation, ambient temperature, humidity, dust and other conditions around the equipment meet the requirements.	
4	Check whether the insulating layer of the cable is aging or damaged. If any such damage occurs, appropriate insulation measures should be taken or the cable should be replaced.	
5	Check that there are no signs of aging or burning on the connecting bolts, and shake them by hand to confirm that they are tightened.	

7.3 Repainting Operation Instructions

- When only the outer surface is dirty

Use a cloth dampened with water or 97% alcohol to clean.

- When the topcoat is damaged

1. Use sandpaper to smooth the surface of the damaged part.
2. Use 97% alcohol to clean the surface.
3. After the surface is dry, repaint the damaged parts, and try to make the repaint evenly and beautiful.

- When the paint surface is damaged and the base material is exposed

1. Use sandpaper to smooth the surface of the damaged part.
2. Use 97% alcohol to clean the surface.
3. After the surface is dry, spray the damaged area with zinc-rich primer.
4. After the primer is dry, apply the topcoat, and try to make the touch-up paint even and beautiful.

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7.4 Liquid Cooling Unit Maintenance Instructions

7.4.1 Exhaust Operation

Prerequisite: The external monitor has been connected.

Background information: After the injection is completed, the water pump is turned on to perform the exhaust operation to facilitate the subsequent liquid filling operation.

Procedure

Step 1 : Turn on the system.

Click the "ON/OFF" button and then click "Confirm" to switch the current working state of the liquid cooling unit. After startup, the liquid cooling unit is updated from shutdown state to running state. On any interface, if there is no keyboard operation for 180 seconds, the control system automatically returns to the interface.

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Figure 7-1 System startup diagram

Step 2 , turn on the exhaust function.

Click the "Maintenance" button and set the "Water Pump Exhaust" parameter value to "On" to turn on the exhaust function.

When the exhaust is completed, "Water Pump Exhaust" will automatically switch to "Off" and the unit will shut down.

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Figure 7-2 Schematic diagram of exhaust setting

7.3.2 Fluid Refilling Operation

Background Information

Add coolant when the coolant is insufficient during the operation of the chiller or when the coolant is changed regularly.

Procedure

Step 1 Open the exhaust valve at the highest point of the pipe connecting the unit and the client.

Step 2 Use a pipe to connect the liquid outlet of the refill pump to the liquid refill port of the liquid cooling unit, and then connect the outlet to the external liquid storage tank.

Step 3 Power on the liquid cooling unit and open the liquid replenishing device to

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inject coolant.

Step 4 Turn on the liquid injection pump. When the return water pressure display value gradually increases to 0.9 bar, stop injecting liquid.



Figure 7-3 Schematic diagram of exhaust setting

Step 5 After the injection is completed, turn off the power to the unit, close the maintenance ball valve at the injection port, and then remove the injection pump.

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8 Product Storage Instructions

1. Storage Conditions

- 1) The system should be stored within the temperature range specified in the product specifications, otherwise loss of characteristics, leakage or corrosion may occur.

2. Storage Requirements

- 1) The system should be used within a short time after charging, as long-term storage may cause capacity loss due to self-discharge.
- 2) If the system is stored for more than 3 months, it should be placed in a ventilated, dry and cool place, and the system storage SOC should be kept within the range of $40\% \pm 5\%$, and the voltage should be checked monthly. If the voltage drop continues and the single cell voltage is not lower than 3.1V, it can be stored; if it is lower than 3.1V, it needs to be recharged.

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