User Manual

MF-SCS-261KWH-UE

Contents

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About This Manual

This manual gives an introduction to the transport and storage, mounting, electrical connection, powering on/off, troubleshooting, and maintenance of the Energy Storage System ("ESS").

Target Group

This manual is intended for operators of the energy storage plant and qualified technical persons. The installation and operation must be performed only by qualified technical persons, who must:

- Have received professional training
- Have read through this manual carefully and have a good understanding of the relevant safety instructions
- Be familiar with applicable local standards and the relevant safety code for electrical system.

How to Use This Manual

Read the manual and other related documents before performing any operation on the product. Documents must be properly kept and be available at all times.

To increase customer satisfaction, the product and its manual will be updated and improved constantly. If the manual you have received is slightly inconsistent with the real product, it is probably owed to a product update. In such a case, the real product should take precedence. You can find the latest manual at reach your sales for the manual.

The figures in this manual are for reference only. The real product may differ.

Symbols in the Manual

To ensure the safety of life and property for users when using the product and to improve the efficiency of product use, the manual provides relevant safety information, which are highlighted by the following symbols.

Symbols that may appear in this manual are listed below. Please read carefully for better use of this manual.

⚠ DANGER
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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WARNING
Indicates a moderately hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION
Indicates a slightly hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE
Indicates a potential hazard which, if not avoided, will result in device malfunction or property damage.

Indicates supplementary information, emphasis on specific points, or tips related to the use of the product that might help to solve your problems or save your time.

Signs on the Product

Observe the safety signs on the product at all times, which include:

Sign	Explanation
	Hot surface! Do not touch. Otherwise, it may cause personal injuries.
	Disconnect the equipment from all the external power sources before maintenance!
	High voltages inside! Touching it may result in an electric shock.
	Danger of death due to high voltages! After the equipment is disconnected from the external power source, wait at least 5 minutes before touching any of its internal conductive parts.
	Beware of heavy weights! Lifting the heavy object directly may cause back injury. Please lift it with the assistance of proper tools.
	Beware of explosion.

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	Beware of corrosion.
	Do not dispose of it together with household waste.
	No fires.
	A medical facility should be set up nearby.
	If it gets in your eyes, flush your eyes immediately with running water or saline, and seek medical advice in time.
	Protective earthing (PE) terminal. This terminal should be connected for reliable grounding, to ensure the safety of the operator.
	Read the instructions before performing any operation on the product.
	Wear safety goggles.

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Terms and Abbreviations

Terms/Abbreviation	Explanation
BMS	Battery Management System
BAMU	Battery Management Unit
BCMU	Battery Cluster Management Unit
BMU	Battery Management Unit
PCS	Power Conversion System
EMS	Energy Manage Syster
ESS	Energy Storage System
EMU	Energy management unit
BESS	Battery Energy Storage System
PE	Protective conductor
SOC	State of Charge
SOH	State of Health
SCADA	Supervisory Control and Data Acquisition
LCS	Liquid Cooling System
FSS	Fire Suppression System
TMS	Temperature Management System
S/G	Switch Gear

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1. Safety Instructions

Please strictly adhere to all safety regulations outlined in this product manual. To avoid potential personal injury, property damage, and to enhance the product's service life and operational efficiency, carefully read all safety instructions.

- Keep the product away from heat sources and high-voltage areas. Prevent children from accessing the product.
- Do not short-circuit the positive and negative terminals of the product. Avoid disassembling or exposing the product to moisture to prevent potential dangers during use.
- If the product is severely damaged or emits an abnormal smell during the first use, discontinue use immediately and return the product to the seller.
- Do not expose the product to high temperatures exceeding the conditions specified in Section 2.2 of this manual for an extended period. Doing so may cause a fire. Under normal usage and storage, the cell temperature of the battery unit must not exceed 55°C. If it exceeds this limit, the Battery Management System (BMS) will activate protection and shut down the system. Charging and discharging of the battery are prohibited in such cases.
- Do not immerse the battery unit in water, place it in fire, microwave ovens, or pressure vessels.
- If electrolyte leakage occurs, avoid contact with skin and eyes. If contact occurs, rinse thoroughly with water and seek medical assistance immediately. Do not ingest any part of the battery.
- When designing or manufacturing a battery system, avoid mechanical vibrations, collisions, or pressure impacts that could puncture the cell casing, causing internal short circuits, thermal runaway, fire, or explosions.
- During charging and discharging, avoid incorrect practices such as exceeding allowable voltage or temperature limits. Such incidents may activate the BMS protection mechanism. Disconnect the load immediately and investigate the root cause before continuing usage. Forcibly continuing to charge or discharge can result in severe damage, leakage, or fire. Contact the manufacturer for professional maintenance and inspection. If the battery exhibits leakage, odor, or abnormal sounds, immediately cease use and contact the manufacturer. Do not disassemble or modify the battery unit yourself.

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The manufacturer will not be liable for quality guarantees if the unit is tampered with.

- Do not dispose of discarded batteries carelessly to avoid environmental pollution. Contact certified recycling organizations or the manufacturer for proper disposal.
- No unauthorized disassembly: Unauthorized disassembly or modification of the product or internal battery is strictly prohibited. The internal protection mechanisms and circuits prevent dangerous incidents. Improper handling may damage these features, leading to overheating, smoke, deformation, or fire.
- No short circuits: Avoid short-circuiting the system by connecting the positive and negative terminals with metal or storing the product with metal objects. Short circuits result in large current flows, potentially causing overheating, smoke, deformation, or fire.
- Avoid heat or burn: Heating or burning the battery may melt separators, disable safety mechanisms, or ignite the electrolyte, resulting in overheating, smoke, deformation, or fire.
- Avoid water exposure: Do not expose the product to rain or submerge it in water. Doing so may disable internal protective circuits and cause abnormal chemical reactions, leading to overheating, smoke, deformation, or fire.
- Avoid physically damage: Avoid puncturing, hammering, or dropping the battery or product. Damaging the product may cause overheating, smoke, deformation, or fire.

  No reverse charging: Reverse charging can severely damage the battery and lead to overheating, smoke, deformation, or fire.

Master Battery shall not be held responsible for the following situations or resulting consequences:

- Damage to equipment caused by earthquakes, floods, volcanic eruptions, landslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or other acts of nature.
- Operating the product under conditions not specified in this manual.

  Installation and usage environments that fail to meet relevant international, national, or regional standards.
- Installation or operation by unqualified personnel.

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- Failure to follow operational instructions and safety warnings provided in the product documentation.
- Unauthorized disassembly, alteration of the product, or modification of software code.
- Damage caused during transportation by you or a third party commissioned by you.
- Storage conditions that do not comply with the requirements specified in the product documentation.
- Use of materials or tools provided by you that fail to meet local.
- 1 laws, regulations, or relevant standards.
- Damage resulting from negligence, intentional misconduct, gross errors, improper operation, or other causes unrelated to the company by you or a third party.

1.1. Personnel Requirements

The hoisting, transportation, installation, wiring, operation, and maintenance of the equipment must be carried out by qualified electrical technicians in accordance with local regulations. Qualified technicians must:

- Have certain electrical wiring, electronic, and mechanical expertise, and be familiar with electrical and mechanical schematics.
- Be familiar with the composition and working principles of the equipment and its up-stream and downstream equipment.
- Have received professional training in the installation and commissioning of electrical equipment.
- Be able to respond quickly and effectively to dangers or emergencies that may occur during the process of installation and commissioning.
- Be familiar with applicable local standards and specifications of the country/region where the project is located.

To ensure the safe and efficient use of this product, operators must meet the following requirements:

- Only qualified electricians (including professionals and trained personnel) are allowed to operate and maintain this product.
- Be able to evaluate assigned tasks and identify potential hazardous events.

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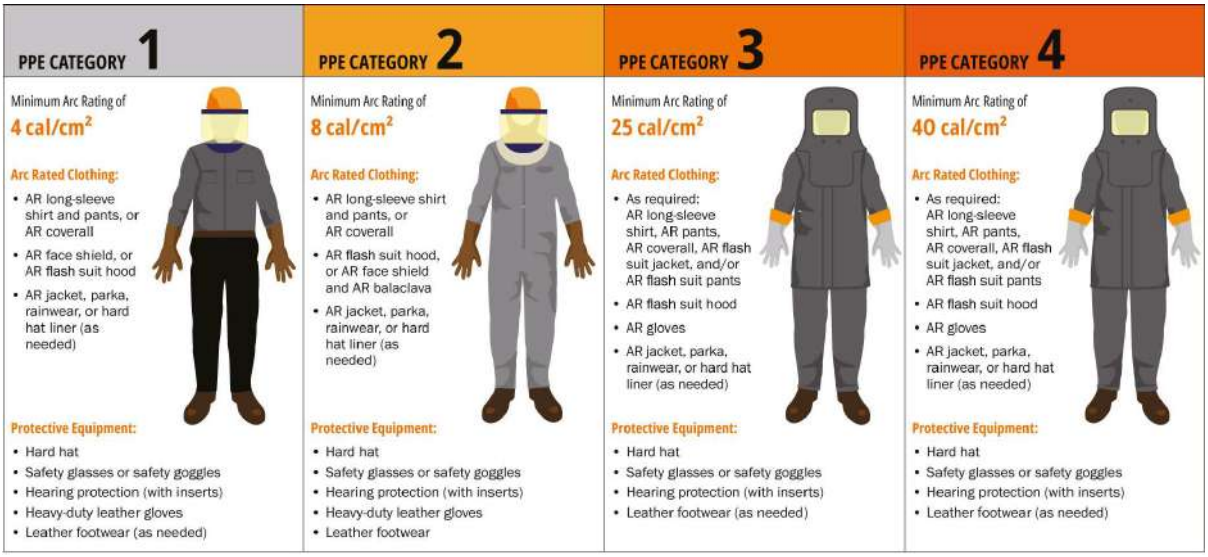
- Be capable of providing immediate assistance to injured personnel.
- Understand the relevant maintenance standards for the product.
- Comply with local laws, regulations, ordinances, and standards.
- For special scenarios, such as electrical operations, working at heights, or operating specialized equipment, personnel must possess special operation qualifications as required by local national/regional regulations.

1.1.1. Personal Protective Equipment (PPE)

According to the "Maximum Power Law" in NFPA 70E, the estimated DC arc flash incident energy can be calculated at the point of maximum power, which then determines the hazard boundary.

The PPE is determined by the incident energy, which is the temperature produced by the arc flash (measured in cal/cm^2) at a standard distance of 18 inches. If the incident energy is less than 1 cal/cm^2, the PPE requirement for operating on the battery rack falls under Category 1.



1.1.2. First Aid Measures

Contact Methods and Appropriate Actions:

- Inhalation: Evacuate the contaminated area, immediately move to fresh air, and seek medical assistance immediately.
- Eye Contact: Rinse eyes thoroughly with plenty of clean water for at least 15 minutes. Do not rub the eyes, and seek medical assistance immediately.

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- Skin Contact: Wash the affected area immediately with plenty of water and soap, and seek medical assistance immediately.
- Ingestion: Seek medical assistance immediately.

1.2. Electrical Safety

DANGER

- Touching the power grid or the contact points and terminals in the devices connected to the power grid may lead to electric shock!
- The battery side or the power grid side may generate voltage. Always use a standard voltmeter to ensure that there is no voltage before touching.

DANGER

- Lethal voltages are present inside the product!
- Note and observe the warnings on the product.
- Respect all safety precautions listed in this manual and other pertinent documents.
- Respect the protection requirements and precautions of the lithium battery.

DANGER

- Electricity may still exist in the battery when the power supply of the equipment is disconnected. Wait 10 minutes to ensure the equipment is completely voltage-free before any operation.

WARNING

- All hoisting, transportation, installation, wiring, operation, and maintenance must be carried out complying with the relevant codes and regulations of the country where the project is located.

WARNING

- Always use the product in accordance with the requirements described in this manual. Otherwise, equipment damage may occur.

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NOTICE
To prevent misuse or accidents caused by unrelated personnel, observe the following precautions: • Post prominent warning signs around the product to prevent accidents caused by false switching. • Place necessary warning signs or barriers near the product.

1.2.1. General Requirement

- Installation, operation, and maintenance must be performed strictly in accordance with the steps outlined in the manual. Unauthorized modifications, additions, or changes to the equipment or installation order are strictly prohibited.
- Grid connection must be approved by the relevant power authority of the country or region.
- Comply with power station safety regulations, including the implementation of operation ticket and work ticket systems.
- Install temporary barriers or warning banners in the work area, and hang "No Entry" warning signs. Unauthorized personnel are strictly prohibited from entering.
- Disconnect the equipment and its upstream/downstream switches before installing or removing power cables.
- If foreign liquid enters the equipment, immediately shut off the power and discontinue use.
- Before operating the equipment, carefully check that the tools meet the required standards and register them. After the operation, retrieve all tools to prevent leaving any inside the equipment.
- Before installing power cables, verify that the cable labels are correct and ensure that cable terminals are properly insulated.
- After installation, ensure that all electrical components' protective covers, insulation sleeves, and similar devices are securely in place to avoid electric shock risks.
- If the equipment has multiple inputs, disconnect all inputs and wait for complete power-down before performing any operation.
- When maintaining downstream electrical or distribution equipment, disconnect the corresponding output switch of the power supply equipment.

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- During equipment maintenance, hang "Do Not Switch On" signs on the upstream/downstream switches or circuit breakers and post warning signs to prevent accidental reconnection. Power must only be restored after faults are completely resolved.
- When troubleshooting faults requiring power shutdown, the following safety measures must be completed: Power Off > Voltage Verification > Grounding Installation > Posting Warning Signs and Installing Barriers.
- Regularly check the terminal screws of equipment connections to ensure they are tightened and secure.
- If a cable is damaged, it must be replaced by qualified professionals to avoid risks.
- Unauthorized alteration, damage, or obstruction of equipment labels and nameplates is strictly prohibited. Replace worn or unclear labels promptly.
- Do not clean internal or external electrical components of the equipment using water, alcohol, oil, or similar solvents.

1.2.2. Electrostatic Discharge (ESD) Protection Requirements

Accumulation of static electricity can cause electric shocks, fires, explosions, electronic component failure, and damage. Energy storage systems contain circuit boards and other electrostatically sensitive components. To prevent or mitigate the hazards of static electricity, proper ESD protection must be implemented to suppress static generation, accelerate discharge, and neutralize static buildup. Static electricity generated by the human body can damage electrostatically sensitive components on circuit boards. Preventive measures include, but are not limited to:

1. Before contacting equipment, handling circuit boards, exposed circuit modules, or specialized integrated circuit chips:
    - Follow ESD protection protocols.
    - Wear anti-static work clothes.
    - Use anti-static gloves or wrist straps, ensuring the wrist strap is properly grounded.
2. During component replacement:
    - Uninstalled components must be kept in anti-static shielding bags.
    - Temporarily removed components should be placed on anti-static foam pads.

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- Removed circuit boards or modules must be packaged with anti-static materials before storage or transportation.

3. Do not touch components, solder joints, pins, or exposed circuits with bare hands.

1.2.3. Environmental Requirements

DANGER	It is strictly prohibited to place equipment in environments with flammal explosive gases, or smoke, and no operations should be performed in such environments
DANGER	It is prohibited to store flammable or explosive materials in the equipment area.
DANGER	It is prohibited to place equipment near heat sources or flames, such fireworks, candles, heaters, or other heating devices. Exposure to heat may damage the equipment or cause a fir
WARNING	Equipment should be installed in areas away from liquids and must not be placed under water pipes, air outlets, or other areas prone to condensation. Installation under air conditioning vents, ventilation openings, or windows from which water could leak is prohibited to prevent liquids from entering the equipment and causing failures or short circu
WARNING	During operation, do not block ventilation or cooling systems, or cover th with other items to avoid damage or fire caused by high temperatures.

- The temperature and humidity conditions for storing equipment should be appropriate, stored in a clean, dry, and well-ventilated area, and protected from dust and condensation.
- Equipment must not be installed or operated beyond the specified technical parameters, as doing so could affect performance and safety.
- It is prohibited to install, use, or operate outdoor equipment or cables during extreme weather conditions, such as thunderstorms, rain, snow, or wind speeds exceeding level 6 (including but not limited to moving equipment, operating equipment, connecting or disconnecting outdoor signal interfaces, high-altitude work, outdoor installations, opening doors, etc.).
- Equipment must not be installed in environments with dust, smoke, volatile gases, corrosive gases, infrared radiation, organic solvents, or excessive salt content.
- Equipment must not be installed in environments with conductive metal dust or magnetic dust.
- Equipment must not be installed in areas where fungi, mold, or other microorganisms may grow.

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- Equipment must not be installed in areas with strong vibrations, loud noise sources, or high electromagnetic interference.
- Site selection must comply with local laws, regulations, and relevant standards.
- The installation site should have a solid ground without soft or sinking soil, such as rubberized or weak soil, and areas prone to water accumulation or snow. The site should be above the highest historical water level for the region.
- Equipment must not be installed in areas that may be flooded.
- If the equipment is installed in areas with dense vegetation, in addition to regular weeding, the ground beneath the equipment should be hardened, such as by laying cement or gravel.
- Before installation, operation, or maintenance, clear any accumulated water, snow, or debris from the top of the equipment before opening doors to prevent debris from falling inside.
- When installing the equipment, ensure that the installation surface is firm and meets the equipment's weight requirements.
- After installation, remove all empty packaging materials from the equipment area, such as cartons, foam, plastic, and cable ties.

1.3. Battery Safety

⚠ WARNING

Do not leave the product in a low voltage or low SOC (State Of Charge) condition for a long period of time. Loss of capacity due to the following conditions is not covered by the warranty.

- Battery discharge cell voltage is below 2.7V for 120 consecutive hours.
- Any cell cluster SOC is 0% for 120 consecutive hours.
- Battery discharge cell voltage ≤2V.

⚠ WARNING

Over or under voltage fault & alarm (detailed information can be found in the "Communication protocol CMU (Battery Cluster Management Unit) fault word and CMU alarm word").

- Fault: "Cell over voltage fault", "Cell under voltage fault", "Total over voltage fault", "Total under voltage fault".
- Alarm: "Cell over voltage alarm", "Cell under voltage alarm", "Total over voltage alarm",

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"Total under voltage alarm".
End users must assign a high priority to above listed faults and alarms reported by the Upower When an alarm or fault is triggered, the user interface should prominently highlight these issues. Furthermore, end users should promptly contact Master Battery for timely resolution to prevent battery warranty loss due to over-discharge or overcharge.

NOTICE

- In order to avoid triggering the warranty expiration condition, when the "Cell Under-voltage Fault" or "Cell Over-voltage Fault" is triggered, the user must contact the local team of Master Battery within 24 hours and follow the requirements of Master Battery to carry out the next operation.
- If the system is configured with the "Active power up" function, When the battery container minimum rack SOC reaches the threshold for this function (the threshold can be set from 0 to the lower SOC protection value, and the threshold does not exceed 5%SOC), the system will charge the battery with low power until the SOC reaches a safe threshold (5% SOC) automatically, The recharging power can be set within the range of 100 kW to 150 kW. During Active power up, when the EMS (Energy Management System) issues a charging instruction, the LC controller will prioritize the EMS charging instruction. When the EMS issues a discharging instruction, the LC controller will respond according to the specific system SOC value. Master Battery will enable this function by default when the device is shipped from the factory, In order to minimize the risk of undervoltage of the battery that may void the warranty, Master Battery recommends that users do not turn off the "Active power up" function.

NOTICE

- If the system will not be in operation for an extended period (7 days or more), it's recommended to increase the SOC lower limit protection value to above 10% SOC. Additionally, it is important to regularly monitor the system's SOC to avoid the risk of over discharge which will cause warranty expiration.
- During maintenance or shutdown, if the SOC of any battery cluster is 0%, the SOC needs to be charged to 15% and above within 120 hours.
- If the SOC of any battery cluster is 0% during operation, the SOC needs to be charged to 5% and above within 2 hours. Or when the SOC reaches 0%, a command can be issued by the host computer EMS to change the system mode to recharge mode.

For safe use of the product, the technician should carefully read and strictly observe the safety requirements. UPOWER shall not be liable for product functional abnormality, component damage, personal safety accident, property loss, or other damage caused by the following reasons:

- Batteries are not charged as required, thus resulting in battery capacity loss or irreversible damage.

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- Batteries are damaged or dropped, or have leaked, due to improper operations or failure to perform operations as required.
- Batteries are damaged due to overdischarge as they have not been powered on in time.
- Batteries are damaged due to the use of improper equipment for charging and discharging.
- Batteries are frequently overdischarged due to improper maintenance; battery capacity is incorrectly expanded; or batteries have not been fully charged for a long time.
- Battery operation parameters are not correctly set.
- Batteries are damaged because their operating environment does not meet the requirements.
- The customer uses the batteries beyond the scenarios specified in this manual, including but not limited to, connecting extra loads.
- Batteries are not maintained in compliance with the requirements specified in the system manual.
- The product is damaged due to the customer's continued use of batteries beyond the warranty period.
- The product is damaged due to the use of defective or deformed batteries.
- Use the batteries provided by Master Battery together with other batteries, including but not limited to batteries of other brands or batteries of different rated capacities.
- Product damage or property loss are caused due to storing or installing batteries together with flammable/explosive materials.
- Personal safety accidents and property loss are caused by battery-related operations performed by non-qualified personnel, or by personnel not wearing qualified protective equipment during operations.
- Batteries are damaged due to improper behaviors, such as eating, drinking, and smoking near the battery.

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1.4. Hoisting and Transportation

WARNING

When walking on the top of the equipment, be sure to follow the standard procedure for working at heights.

1.5. Installation and Wiring

WARNING

In the whole process of mechanical installation, the relevant standards and requirements of the project location must be strictly observed.

WARNING

Only equipment designated by Master Battery can be used. Failure to use equipment may cause damage to the protection function and injury to personnel.

1.6. Operation and Maintenance

DANGER

Dismantling or burning the battery may cause it to catch fire.

WARNING

Personal protective equipment is required for maintenance and service of the equipment. Maintenance personnel must wear protective equipment such goggles, helmets, shoes, gloves, etc.

WARNING

There are no user-maintainable parts inside the battery unit.
Only personnel approved by GPT can remove, replace and dispose of the batteries. Users are not allowed to maintain batteries without guidance.

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WARNING

To avoid electric shock, do not perform any other maintenance operations beyond those described in this manual.
If necessary, contact Master Battery Customer Service for maintenance.

WARNING

To ensure continuous fire protection, replacement of internal components should only be performed by professional personnel.

WARNING

Protective tools such as goggles are required when carrying out coolant (glycol solution) or liquid cooling pipeline maintenance.

NOTICE

Do not spray paint any internal or external component of the product.
Do not use cleaning agents to clean the product or expose it to harsh chemicals.

1.7. Product Disposal

When the equipment or its internal components reach end-of-life, do not dispose of it together with household wastes. Some components inside the equipment can be recycled, while some may pollute the environment.

Contact an authorized local facility for collection.

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2. Product Description

2.1. Product Overview

The electrical equipment, communication device, temperature control device, and fire suppression system of the ESS all adopt an integrated design. For electrical equipment, the LFP battery system is designed with a liquid cooling system, while the PCS adopts forced air cooling for heat dissipation. The battery system and the PCS are integrated into an all-in-one outdoor-type cabinet. For communication devices, the LC integrates the functions of BSC, and the CMU is built into the PCS. The integrated design makes the entire system more compact in structure and easy to maintain.

With an all-in-one design, the ESS allows flexible configuration and easy installation and O&M, with only a small space required. It also supports ancillary service functions such as demand control, gaining revenue from peak-to-trough price spread, demand response, and virtual plant.

This product is a cold Plate Full Integrated Energy Storage System, including an 832V/314Ah lithium iron phosphate battery unit, PCS, temperature control system unit, distribution unit, built-in EMS module. mainly used in commercial & industrial user-side energy storage application scenario.

Product Model: MF-SCS-261KWH-UE
Battery Cell Specification: Lithium iron phosphate, 3.2V314Ah
Battery Configuration: 1P260S
Cooling Method: Liquid cooling + Air cooling.

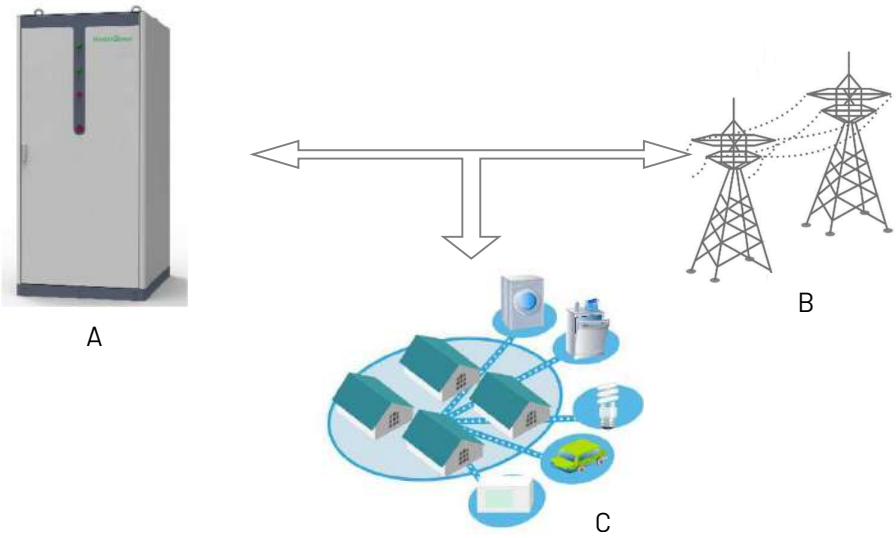

Figure 3-1 System diagram

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NO.	Description
A	PCS+ Battery Storage System
B	Utility grid
C	Load

The diagram below shows the electrical topology of the product.

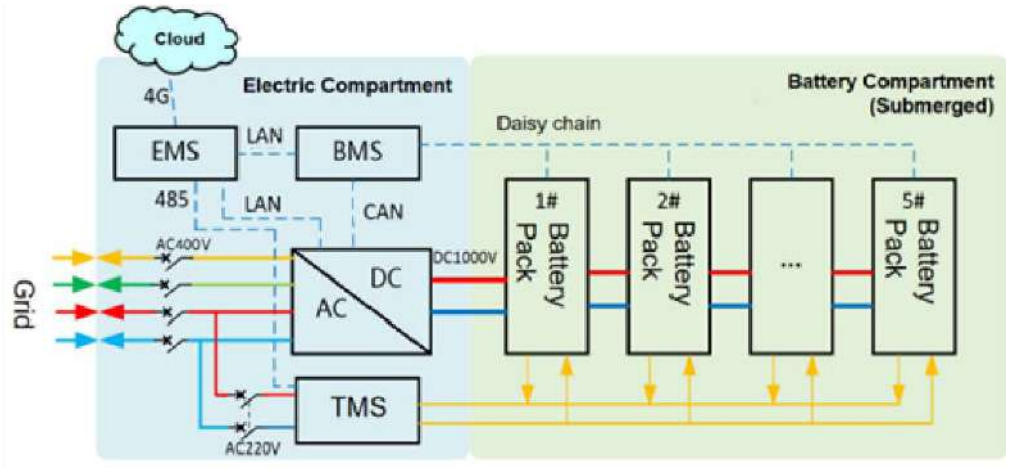

Fig 2.1 System topology diagram

Product topology diagram system communication description:

Sr	Communication	Start	End
1	Daisy Chain	Slave Control BAMU	Master BCMU
2	RS485	Auxiliary electricity meter, liquid cooling unit, water immersion sensor, battery cabinet barometer, Dehumidifier	EMS
3	CAN	Master BCMU	PCS
4	LAN	PCS	EMS
		Master BCMU	
6	Hard Contact	cabinet door travel switch contacts and auxiliary contacts of AC circuit break	EMS Devices
		BCU fault alarm interface	PCS
7	DO	Operation indicator light, fault indicator light SOC status light	EMS
8	4G/5G	EMS	Cloud Platform

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2.2. Technical Specification

Tab 2.1 Product Specification

Product Name		MF-SCS-261KWH-UE
Product Type		Liquid-cooled Energy Storage Cabinet
AC Side		
Sr.	Item	Specification
1	Rated Power	125kW
2	Rated Grid voltage	AC 400V
3	Grid Voltage range	AC 340V~460V
4	Power Distribution	AC 220V
5	AC Access Method	Three-phase four wire system
6	Grid Frequency Range	50±2.5Hz
7	Grid Voltage Range	-15% ～ +15%
8	Total Harmonic Distortion Rate of Curren	≤3% Full Load
9	Power Factor	-1～+1
DC Side		
Sr.	Item	Specification
10	Battery Cell Type	LFP 314Ah
11	System Configuration	5×1p52s
12	Installed Energy	261.248kWh
13	Voltage Range	DC 728V ～ 923V
14	Nominal Voltage	832V
15	Rated DC Current	157A
16	Maximum DC Current	179.4A
17	Operating Temperature Range	0ºC~55ºC (Charge) -30ºC~55ºC (Discharge)
System		
Sr.	Item	Specification
18	Overall Dimension (W×D×H)	1100mm×1400mm×2350mm
19	Maximum Charge/Discharge Eficien cy	Under Rated ≥90%
20	Operating Temperature	-30ºC~5ºC
21	Allowable Relative Humidity	≤95% Free of condensatio
22	Noise	≤75dB
23	Cooling Method	Battery system cold plate liquid coolin PCS Air-cooled
24	Protection Grade	IP55 (Battery Rack IP66)
25	Altitude	≤2000 m.a.s.l. ①
26	Weight	2.5t
27	Communication Protocol	MODBUS TCP, IEC104, 4G (MQTT)
28	Compliance	IEC 62619, IEC63056, IEC 62477-1 IEC 61000-6-2/4, UN38.3 CE-RED

Note: Derating is required if operate above 2000 meters.

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2.3. Appearance and Structure

WARNING

High Voltage Electricity Danger

- When pressing the emergency shutdown button, the AC/DC connection terminal of the energy storage inverter is still live!
- There is still a fatal high voltage inside the energy storage inverter!

WARNING

The emergency shutdown button can be used to turn off the energy storage inverter only in a fault scenario!
If the emergency shutdown button is not properly used, it can cause damage to the energy storage inverter.

The cabinet is designed with excellent corrosion resistance, fire protection, waterproofing, dustproofing (sand-resistant), shock resistance, UV resistance, and anti-theft functions. These features ensure the cabinet remains fault-free despite exposure to corrosion, fire, water, dust, and UV factors.

- Cabinet Dimensions: 1100mm × 1400mm × 2350mm (W × D × H) ;

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- Fire Protection: The cabinet's external shell structure, insulation materials, and interior/exterior decorative materials are all made of flame-retardant materials.
- Protection Level:

a. The overall protection rating of the cabinet is IP55.

b. Cabinet door and its interfaces with the external environment are equipped with sealing strips, preventing dust or rain from entering during outdoor exposure to sandstorms or rainfall.

c. Cabinet's top surface is designed to ensure no water accumulation, leakage, or seepage.

d. The side panels prevent rainwater intrusion, and the bottom ensures no seepage of water.

- Dustproofing (Sand-resistant): The cabinet's air inlets, outlets, and equipment air inlets are equipped with replaceable standard ventilation filters, effectively preventing dust from entering the cabinet during strong winds or sandstorms.
- Shock Resistance: The cabinet and its internal equipment are designed to meet mechanical strength requirements under transportation and seismic conditions, ensuring no deformation, functional abnormalities, or failures during or after vibrations.
- UV Resistance: The cabinet's internal and external materials are resistant to ultraviolet radiation, ensuring no material degradation or deterioration under UV exposure and preventing absorption of UV heat.

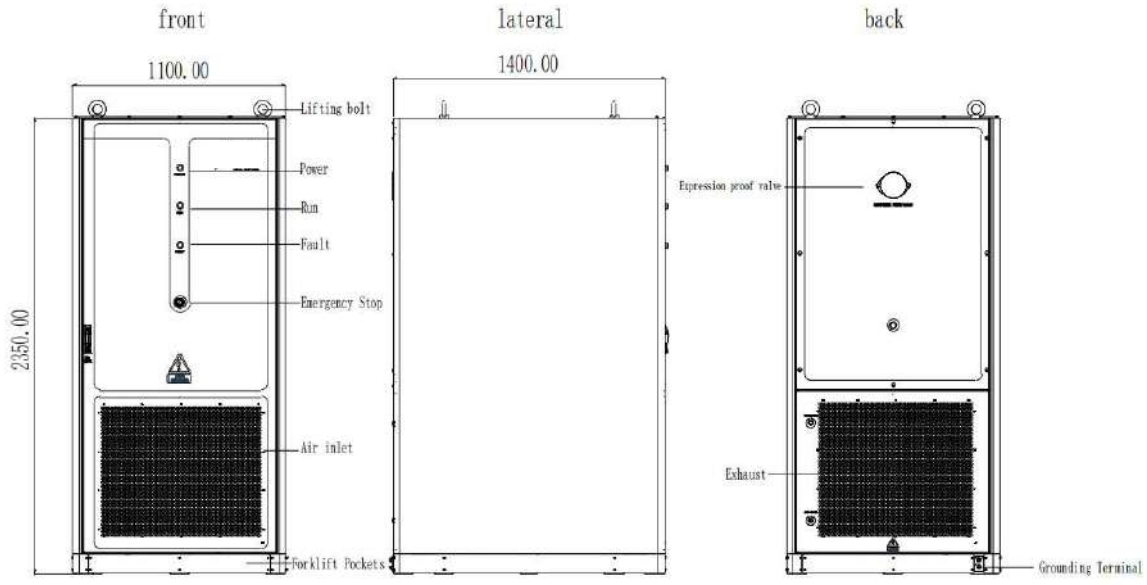

Fig 2.2 Product Appearance Diagram

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2.4. Internal structure

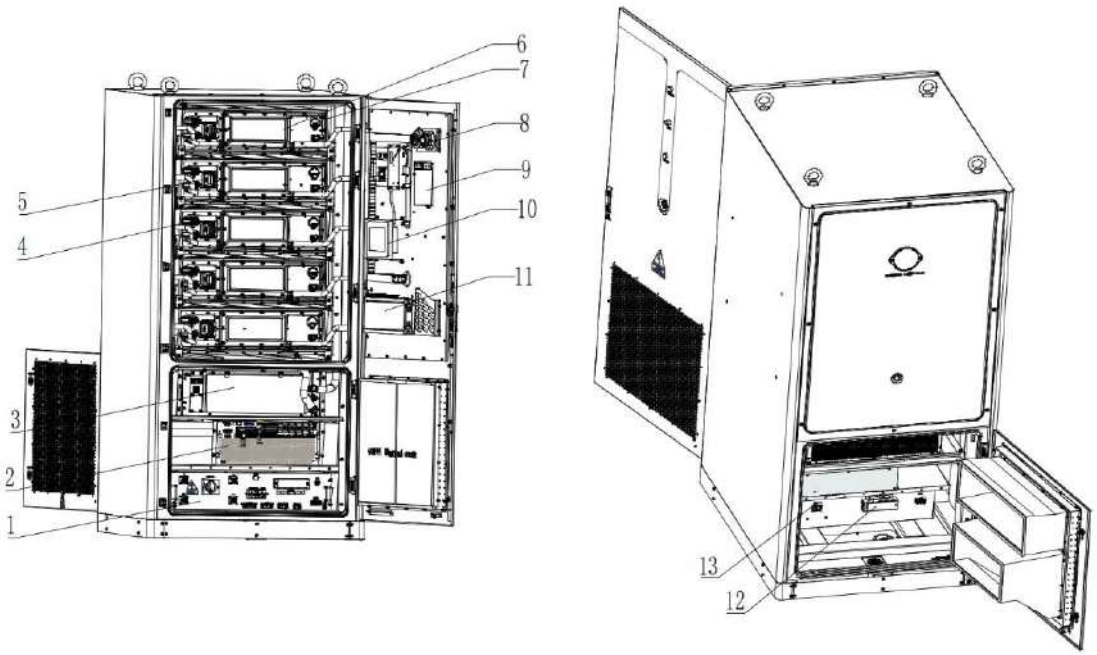

Fig 2.3 Product Structure Diagram

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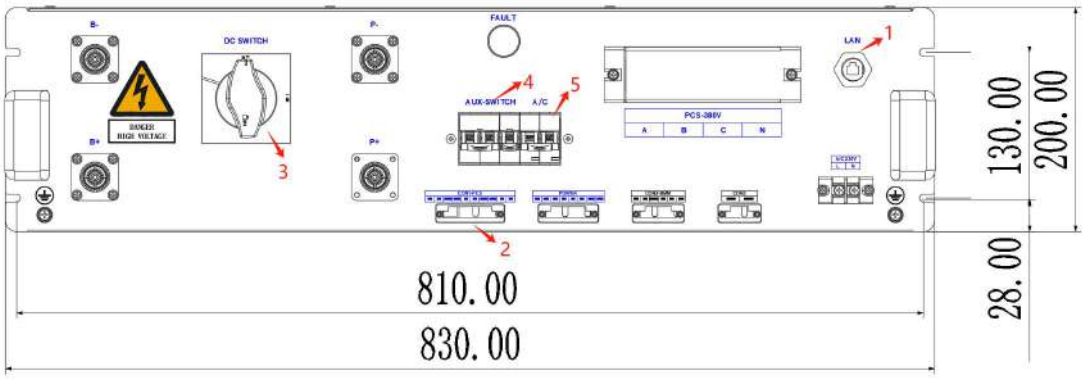
Table 2.2 Internal device description table

No.	Name	Remark
1	High voltage distribution bo x	High voltage protection for a ll-in-one and load distribution
2	PCS	Integrated battery unit high voltage box function
3	Liquid Cooling Unit	Intelligent temperature control
4	Power interface	Battery unit positive and negative terminals
5	Battery pack MSD	Manual Maintenance Switch for Power Battery Pack
6	Battery	The battery is cooled by a liquid-cooled baseplate
7	Battery pack Explosion-proof valve	Balanced pressure of battery pack Explosi o-proof
8	Smoke/temperature senso	Collect smoke and temperature data from the cabin
9	Fire extinguishing agents	Cutting off the air will extinguish the flames
10	Dehumidifier	Maintain the air humidity inside the cabine
11	EMS + Monitor	View and control the energy storage cabine
12	AC inlet interface	AC 400V incoming cable port
13	AC SWITCH	AC input switch

2.5. High Voltage Box

Tab 2.3 High Voltage Box Specification

No.	Lable	Function
1	LAN	LAN Communicatio interface （BMS to EMS）
2	CON1-PCS	CAN Communication interface （BMS to PCS）
3	DC SWITCH	DC circuit breaker switch handle, on the left side of the panel
4	AUX-SWITCH	Provide a stable power supply for the energy storage system
5	A/C SWITCH	Liquid cooling unit micro switch
6	AC400V	AC 400V incoming cable port
7	AC SWITCH	AC 400V input circuit breaker switch



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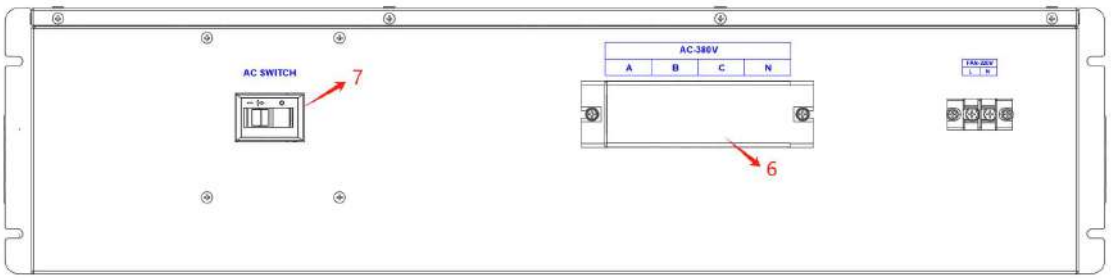


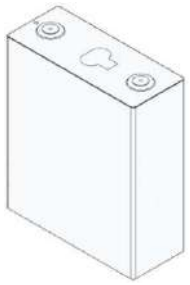
Fig 2.4 Communication & Power Distribution Port Diagram

2.6. Battery

Cell

The exterior and technical data of the cell are shown as follows.

Table 2-4 Cell Data

Cell	Parameter	Value
	Type	PC-0B1-72174L4-BE
	Rated capacity	314 Ah
	Rated energy	1004.8 Wh
	Rated voltage	3.2 V
	Voltage range	2.5V – 3.65V(cell temperature T > 0 ºC) 2.0 V – 3.65 (cell temperature T ≤ 0 ºC)
	Dimensions (thickness*height* width)	(71.72 ± 2) mm * (204.76 ± 2) mm * (174 ± 2) mm
	Weight	(5.6 ± 0.3) kg

PACK

The PACK (battery module) is mainly composed of cells connected in series and features functions including battery voltage and temperature sampling and balancing control.

Designed with a chip dedicated to battery management, it receives control commands and uploads collected data through daisy chain communication.

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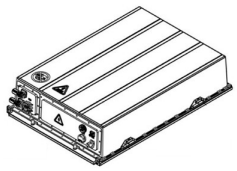
Table 2-5 PACK Data

PACK	Parameter	Value
	Type	MB-BAT166314B12-V1
	Dimensions (W * H * D) (not including wiring terminals and faucets)	790mm*245mm*1145mm
	Weight	341± 5 kg
	Charge/ discharge rate	≤ 0.5P
	Cell type	Prismatic cell with aluminum shell, LFP
	Configuration (series and parallel)	1P52S
	Key components	52 cells, 1 BMU, 1 fuse (1P52S)
	Ingress protection rating	IP67

RACK

RACK is mainly composed of several PACKs and fuse.

RACK data is shown in the table below.

Table 2-6 RACK Data

RACK Model	DC output voltage range	Rated power	Rated voltage
GPT-R0261B12	728V ～ 949V	125KW	832V

2.7. Energy Management System

Built-in EMS module with LAN/4G communication function can be used to view and control the equipment through the cabinet control panel, mobile application, and can also be accessed to the high-level SCADA center to achieve local or remote monitoring.

Built-in EMS includes features:

- Status Management (SOC, SOH, Voltage, Current, Temperature, etc);
- Operation Management (Charging, Discharging, Strategy Setting);
- Strategy Management (Including scheduled operation, peak shaving, load shifting, dynamic capacity increase, demand control, power tracking, anti-reverse current);
- History (Operating logs, Fault logs);

The EMS supports cloud platform access via a built-in 4G module and utilizes communication protocols MQTT.

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Master Battery has connected its products to the cloud, allowing monitoring and control via the cloud platform.

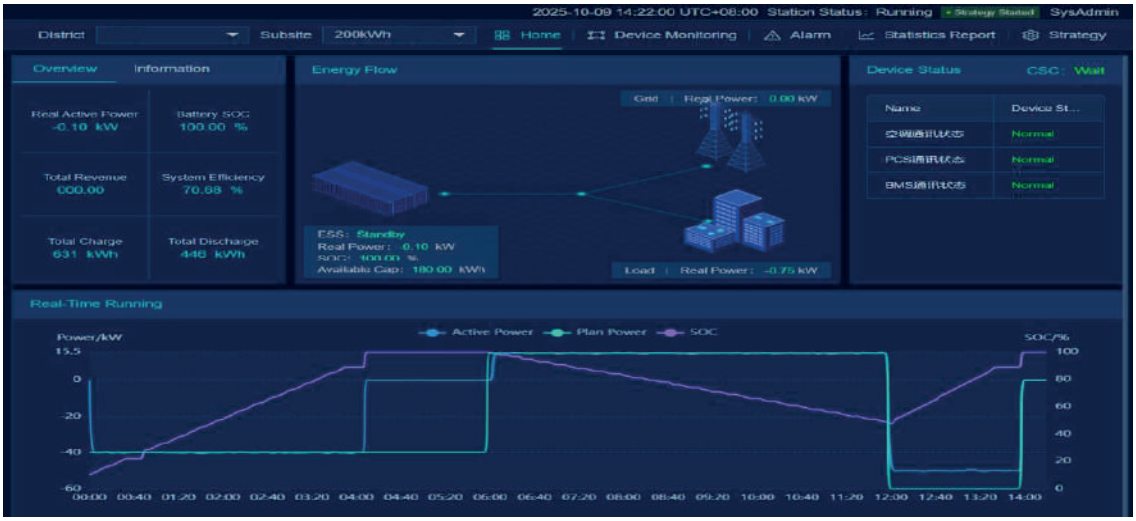

Fig 3.5 EMS Interface

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3. Transport and Storage

3.1. Precautions

CAUTION

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

3.2. Transport Methods

The ESS can be transported by land and sea. It adopts an integrated and easy-to-lift design that facilitates transport. Currently, permission has not been granted to transport the ESS by air, and no relevant guide for rail transport is available.

The ESS can be transported by truck within the country.

NOTICE

In most cases, the total weight of the truck that carries the ESS will exceed the general weight limit on the road. Therefore, you may need to acquire an overweight permit from the relevant local agency in that area.

3.3. Transport Requirements

The ESS leaves the factory with most of its internal components secured inside its body. You may lift or move the ESS as a whole directly during transport.

WARNING

In the whole process of loading, unloading, and transport, follow strictly the applicable safe operation procedure for outdoor-type cabinets in the country/region where the project is located.

- All the tools used on the ESS, or during operation, must have undergone proper maintenance.
- All personnel engaged in loading, unloading, and anchoring operations should have received relevant training, especially in safety.

During the whole process of loading, unloading, and transport, always keep in mind the mechanical parameters (overall dimensions and weight) of the ESS.

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To transport and move the ESS, make sure the below requirements are met:

- All the doors of the ESS are locked.
- Select an appropriate crane or lifting tool according to the on-site conditions. The tool used must have a sufficient load capacity, boom length, and swing radius.
- It is recommended to use one crane to lift the ESS.
- Extra traction may be required to move the ESS along a slope.
- Remove all obstacles that exist or may exist along the route, such as tree branches and cables.
- Transport or move the ESS in good weather, whenever possible.
- Be sure to set up warning signs or fence off warning zones to prevent irrelevant personnel from entering the operating area, thus avoiding accidents.
- The ESS must stand upright during transport.
- Ensure the base of the ESS remains level throughout the whole transport process, with a maximum allowable tilt of 15°.
- Avoid collision or strong shock during transport.
- If the ESS is transported by land, use ropes to secure the lifting rings at the top of the ESS to the transport vehicle, to prevent it from getting overly tilted during transport.

After the ESS arrives at the project site, remove the diagonal fixing pieces at the top four corners, and store them properly.

3.4. Storage Requirements

NOTICE
Store the product according to the storage requirements. Damage resulting from failure to meet the storage requirements will not be covered by the warranty.

- During storage, properly archive all documentation demonstrating compliance with product storage requirements, including ambient temperature and humidity logs, photos, and inspection reports.
- The base of the ESS must be elevated off the ground to a certain height, to avoid internal condensation and also to prevent the ESS bottom from getting soaked by rain water in

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rainy seasons. The height shall be decided according to the on-site geological and meteorological conditions, etc.

- Store the ESS on a dry, flat, solid, and hard ground surface that is not covered by any vegetation. Requirements for the surface are as follows:
  - The surface must have sufficient load-bearing capacity to support the equipment.
  - The surface must be level, with a levelness deviation of 0–10 mm, and the slope must be less than 5°.
  - The surface must provide good drainage to prevent water accumulation or submersion of the ESS.
- Before storage, ensure that the doors of the ESS and all internal equipment are locked. During storage, avoid opening the doors, unless it is necessary.
- Maintain a clearance of 200 cm in front and 60 cm behind the ESS during storage.
- The ambient temperature range for system storage is -30°C to +50°C. Since battery degradation (SOC and SOH) is related to temperature, the optimal storage temperature is -30°C to +25°C.

Long-term storage of the battery is not recommended as it may lead to battery capacity degradation. Even if the battery is stored at the recommended optimal storage temperature, irreversible capacity degradation will still happen during the period of rest, and such degradation will become more severe as the storage time lengthens. Please refer to the technical agreement for the specific amount of degradation.

- The UPS that is not put into operation needs to be charged every six months.
- The relative humidity for storage is 0%–95%, non-condensing.
- Use effective protections for the air inlets and outlets of the ESS. During storage, make sure the protective films on the air inlets and outlets are intact. Meanwhile, take effective measures to prevent the ingress of rainwater, dust, and sand.
- It is recommended to replace the desiccant every six months. Use montmorillonite desiccant, 200 g per bag. Place eight bags of desiccant at the collection tray area under each cabinet. Remove all desiccant from the cabinet before operation.
- Perform regular inspections at least every half a month. Check for signs of damage caused by pests or animals, and inspect the ESS and its packaging, wiring terminals, cables, and internal components for damage or aging. Promptly address any issues

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found or replace parts as necessary.

- Before installing an ESS that has been stored for more than six months, open its doors and perform a visual inspection. Ensure that the ESS and all internal components are intact and free of damage. Additionally, conduct inspections after powering on and startup. If necessary, request qualified personnel to test it before installation.
- Avoid storing the ESS in areas containing flammable or explosive materials. Ensure there is no fire hazard.
- Avoid storing the ESS in dusty environments with a large amount of dust, smoke, or floc. These particles may cling to the air inlets and outlets or heat sink of the equipment, thus impairing its heat dissipation performance or even getting it damaged.
- Avoid storing the ESS in places where corrosive gas or dust may be produced or accumulated, or in places within 30 km of saline-alkaline land or pollution-generating industrial complex such as chemical plants and power plants (chemical gas class: 1C1, solid particle level: 1S2).
- Do not store the ESS in environments contaminated with halogen or sulfur pollutants.
- Do not store the ESS in places with vibration or a magnetic field strength of over 30 A/m.
- When storing PACKs separately, in addition to the ESS storage requirements, observe the following:
  - Store PACKs indoors in a clean and dry place, avoiding direct sunlight or rain.
  - Keep the storage area free of hazardous gases, flammable or explosive materials, and corrosive chemicals. Avoid mechanical shock, heavy pressure, and strong magnetic fields.
  - Protect PACKs from harsh environmental conditions, such as sudden temperature changes or collisions, to avoid damage.
  - Do not tilt the packing case or turn it upside down.

If the ESS has been stored for over six months (from the date it is delivered from Master Battery) under the required conditions mentioned above, perform charging-discharging once until the system SOC reaches 30%–40%. Make sure the SOC values are consistent after recharging.

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3.5. Lifting Operation

3.5.1. Precautions for Lifting

DANGER	In the process of lifting, it is necessary to operate in strict accordance with the safety regulations.
DANGER	No one is allowed to stand within 10 meters of the operation area, especially under the lifting arm and under the lifting or moving machine.
WARNING	Lifting should be stopped in case of bad weather conditions, such as heavy rain, fog, strong winds and so on.
WARNING	Obstacles in the operating area should be cleared or managed before operating, such as trees, cables, etc.
WARNING	The lifting and transporting area must be clearly marked with warning signs or tape to prohibit entry by unauthorized persons.
ATTENTION	Cabinet doors should be closed and locked.
INSTR.	In case of moving on slope, additional traction devices may be required.
INSTR.	It is recommended to use a forklift for lifting during installation.

3.5.2. Preparation Before Lifting

1. Forklifts Preparation: maximum lifting capacity shall be greater than 3.5 tons.
2. Crane Preparation:
   - Maximum lifting capacity shall be greater than 10 tons.
   - Steel Wire Ropes, Lifting Shackles, etc.

3.5.3. During Lifting

1. Forklifts Lifting
   - Conduct a trial lift to ensure proper positioning.
   - Adjust the forklift's position to ensure stability before lift and transport it.
   - Maintain a tilt angle of less than 5°during transport.
   - Keep the lifting height as low as possible to ensure stability.
   - Handling the equipment gently to avoid impacts or vibrations.

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- Ensure personnel safety when lowering the forklift.
- Due to the equipment's height, the forklift operator's view may be obstructed.Assign personnel to guide the operator for safe navigation.

2. Crane Lifting

- Use 4-point lifting with shackles and lifting slings, each with a load-bearing capacity of no less than 3 tons.
- The length of a single sling shall not be less than 1.5m, and the lifting angle shall not exceed 60°.
- Ensure all lifting connections are secure and stable.
- Conduct the lifting operation carefully to avoid impacts or vibrations.

Fig 4.1 Crane Lifting Schematic Diagram

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4. Mechanical Installation

> **WARNING**
>
> During the whole process of mechanical installation, the relevant standards and requirements of the project site must be strictly observed.

The internal equipment of the product has been reliably connected and tested before leaving the factory. On-site installation includes fixing the system, connecting power cables, external signal cables, and grounding connections. The installation process is as follows:

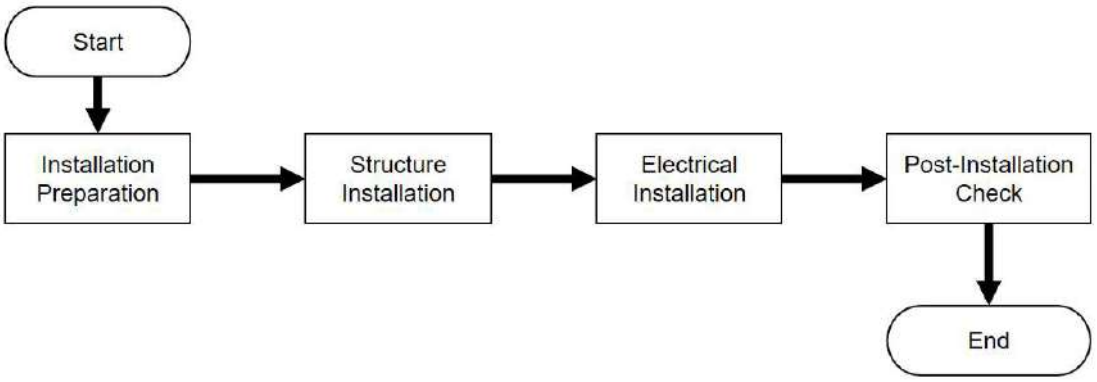

Fig 4.1 Installation procedure

Steps	Details
Installation Preparation	Check the appearance free from damages. Check for damaged or detached components inside the cabinet. Confirm that all components are intact and not missing. Confirm that the installation environment meets the requirements. Confirm whether there is equipment for lifting the container on site
Structure Installation	Lift/move the product to the prefabricated foundation. Fixit to the foundatior.
Electrical Installation	Connect the grounding points. Connect power cables and external communication cables.

4.1. Inspection Before Installation

4.1.1. Deliverables Inspection

Check whether deliverables are complete against the attached packing list.

4.1.2. Equipment Inspection

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- Check whether the product you have received matches the order you have placed.
- Inspect the equipment and its internal components, and make sure there is no damage.
- Before commissioning, ensure the gateway meter and electricity meter used in conjunction with EMS are properly installed.

In case of any problem or doubt, contact your transport service provider or Master Batteyry in time.

WARNING

Proceed with installation only if the ESS is intact without any signs of damage! Before installation, ensure that:

- The ESS is in good condition, without any damage.
- All the components inside the ESS are intact without any signs of damage.

NOTICE

Before installing an ESS that has been stored for more than six months, open the door and conduct a visual inspection first. Make sure the ESS and its internal components are all intact without any damage. Meanwhile, perform inspections after powering on and starting up. If necessary, ask qualified personnel to test the equipment before installation.

NOTICE

Inspect the equipment for paint damage. If damage is found, it is suggested to repair the paint to prevent rusting. For detailed instructions, see "Appearance Repair"

4.2. Installation Environment Requirements

4.2.1. Installation Site Requirement

- The climate environment and geological conditions, such as stress wave emission and underground water level, should be fully considered when selecting the installation site.
- The environment around the installation site should be dry and well ventilated.
- There should be no trees around the installation site to prevent branches or leaves blown off by heavy winds from blocking the door or air inlet of the energy storage system.
- The installation site should be away from areas where toxic and harmful gases are concentrated, and free from inflammable, explosive and corrosive materials.
- It is suggested the product be installed in a place away from the residential area. Ensure the

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distance and noise requirements specified by the local laws and regulations are met. If the requirements cannot be met due to geographical restrictions, use noise mitigation measures. For detailed solutions, consult with the designer or Master Battery.

- Avoid installing the battery container in dusty environments with a large amount of dust, smoke, or floc. These particles may cling to the air inlets/outlets or heat sink of the battery container, thus impairing its heat dissipation performance or even getting it damaged.
- Avoid installing the battery container in places where corrosive gas or dust may be produced or accumulated, or in places within 30km (20 miles) of saline-alkaline land or pollution-generating industrial complex such as chemical plants and power plants (chemical gas class: 1C1, solid particle level: 1S2).
- Do not install the battery container in environments contaminated with halogen or sulfur pollutants.
- There are no underground facilities at the site.

NOTICE
Do not install the device in an environment with vibration and strong electromagnetic field. Strong-magnetic-field environments refer to places where magnetic field strength measures over 30 A/m.

4.2.2. Foundation Requirements

⚠ WARNING
Considering the equipment's heavy weight, before foundation building, perform a thorough inspection on the installation site first (from the aspects of geology, environment, and climate, etc.). You can only proceed with foundation design and construction after confirming that the installation site meets all relevant requirement.

An improperly built foundation may lead to difficulties or troubles in equipment mounting, opening and closing of cabinet doors, and the future operation of the equipment. Therefore, the foundation must be designed and constructed in compliance with certain standards, to meet the requirements of support structure, cable laying, and future maintenance.

Make sure at least the below requirements are met during foundation building:

- The bottom of the foundation pit must be compacted, filled and made even.
- The foundation must be built in compliance with the foundation drawing provided, or approved, by Master Battery. The tolerance for the upper surface of the foundation is ± 5 mm.

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- The foundation must provide sufficient and effective support for the equipment.
- The equipment must be positioned in a higher place, to protect its base and interior from rain erosion. It is recommended to build a foundation about 300 mm higher than the horizontal ground.
- Set up a proper drainage system based on the local geological conditions.
- Build a cement foundation with sufficient cross-sectional area and height. The foundation height shall be determined by the constructor based on the on-site geological conditions.
- Take cable laying into consideration when building the foundation.

> In the process of foundation building, remove the muck immediately after excavation, to avoid affecting the hoisting and transport of the equipment.

- Build a maintenance platform around the foundation to facilitate future maintenance.
- During the foundation building, reserve sufficient space for the AC side cable trench according to the position and size of the cable inlet and outlet on the equipment, and embed the cable conduit in advance.
- Determine the specifications and quantity of the perforating gun according to the model and quantity of cables used.
- Both ends of each embedded conduit must be temporarily sealed off to prevent the ingress of foreign objects. Otherwise, it may lead to difficulties in wiring.
- After all the cables are connected, seal off the cable inlet and outlet and the connectors with fireproof mud or other suitable materials, to prevent rodents from entering the equipment.

> Pre-bury the grounding unit according to the applicable standards of the country/region where the project is located.

4.2.3. Installation Space Requirements

For effective heat dissipation and ease of maintenance, it is recommended to reserve sufficient space around the ESS during installation.

NOTICE
The clearance here refers to the clearance between cabinets, not foundations.

1. Site Conditions

- The equipment must be installed on a concrete or other non-combustible surface.

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- Ensure the installation surface is level, firm, and has sufficient load-bearing capacity.
- Avoid surfaces with depressions or slopes.
- When constructing the foundation, consider the cable entry requirements for the system.
- Reserve cable trenches, ducts, or outlets for power and signal cables.
- The surface inclination must not exceed 1°.

2. Environmental Requirements

Item	Requirement
Temperature	-20~+45ºC
Humidifier	＜95% Free from condensation
Altitude	≤ 2000m

3. Space Requirements

The Product can be operate independently or in Parallel.

For Single-Cabinet Installation

- Rear Clearance (Back to Wall): ≥1100mm
- Front Clearance (Front to Wall): ≥3000mm
- Side Clearance (Side to Wall): ≥600mm

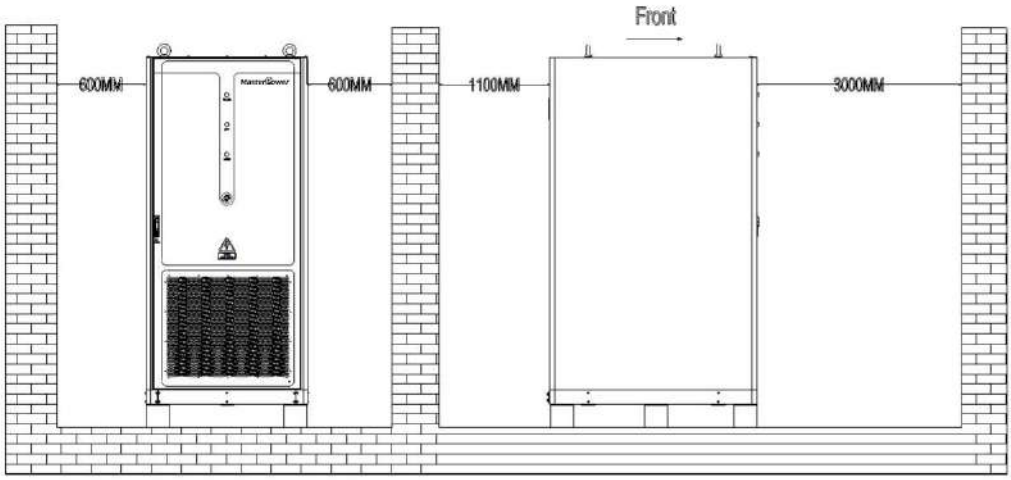

Fig 4.2 Site layout reference

For Multi-Cabinet Installation

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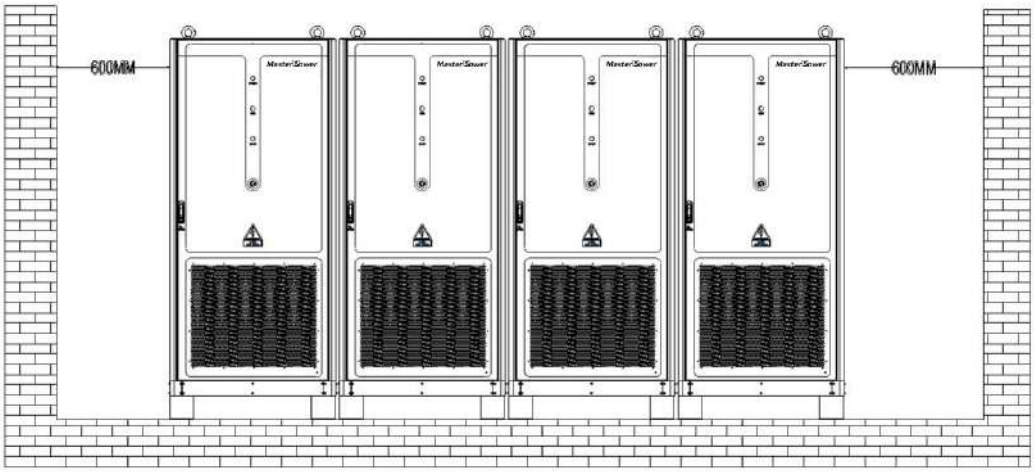

Fig 4.3 Multi-Cabinet layout reference

- Cabinet-to-Cabinet Clearance (Side-by-Side): ≥20mm
- Face-to-Face Clearance: ≥3000mm
- Rear Clearance (Back to Wall): ≥1100mm
- Front Clearance (Front to Wall): ≥3000mm

Notes

- Ensure adequate clearance for ventilation, maintenance, and safe operation.
- Maintain sufficient space to avoid mechanical or thermal interference between cabinets.
- The built-in EMS supports parallel operation of up to 16 ESS products. For scenarios requiring more units to operate in parallel, please consult Master Battery Support for further assistance.

NOTICE
Ensure a ventilation rate of ≥ 2500 m^3/h and a cooling capacity of ≥ 7 kW at the rear air outlet of each ESS.

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4.3. Structure Installation

1. The product should be installed on a concrete base or steel frame, ensuring adequate load-bearing capacity. The base surface must be flat, free from excessive moisture and high-temperature sources, and devoid of corrosive gases.
2. Site Requirements:
   - Flatness:After the foundation is completed, measure the surface level. The horizontal deviation should not exceed 3 mm.
   - Grounding Requirements: Use grounding flat steel or yellow-green grounding wire to connect the cabinet to the ground. Ensure the grounding connection is secure, and the grounding resistance in a dry environment is less than 4Ω .
3. Safety Precautions:
   - Avoid placing the cabinet near flammable or explosive materials.
   - The installation location must comply with fire safety requirements.
4. Fixing Steps:
   - Embedded M12×30 bolts in the foundation according to the cabinet's bottom installation hole layout.

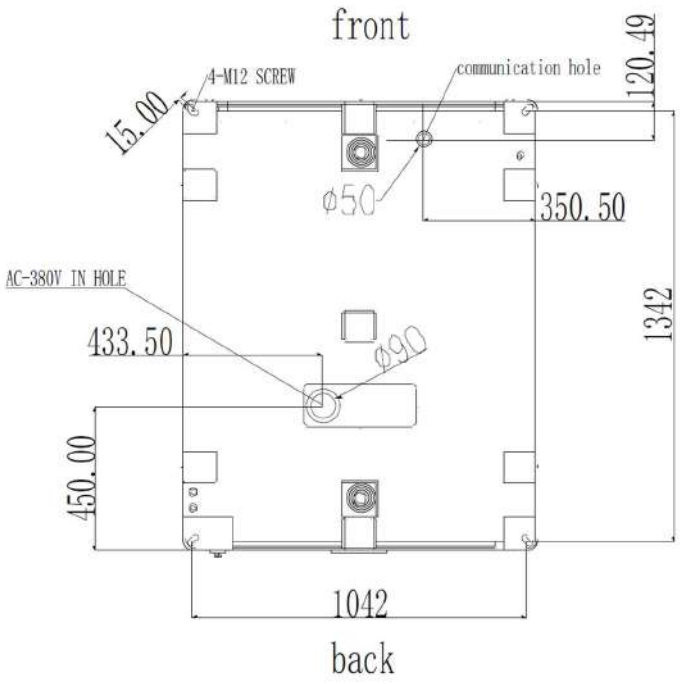

Fig 4.4 Cabinet's bottom installation hole layout

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- Move the cabinet to the installation position, align it with the embedded bolts, and secure it to the foundation using M12 nuts with large flat washers and spring washers.
- Alternatively, weld the cabinet onto channel steel or a metal base on the foundation. Ensure the welding process avoids excessive heat and apply anti-rust treatment.

5. Electrical Installation

5.1. Electrical Safety Precautions

DANGER	High Voltage Hazard! Risk of Electric Shock! • Do not touch live parts! • Ensure that both AC and DC sides are de-energized before installation. • Do not place the equipment on flammable surface
CAUTION	Wind and moisture intrusion may damage the electrical components of product or affect its performance! • During windy and sandy seasons or when the ambient relative humidity exceeds 95%, avoid electrical connection work. • Only proceed with connection tasks under dry, clear weather conditions without wind or sand.
WARNING	Before wiring, all input cable polarities must be checked to ensure correct polarity for each input. • During electrical installation, do not pull or stretch cables or wires forcefully, as this may damage their insulation. • Take necessary auxiliary measures to reduce the stress on cables or wires. • After completing each step of the wiring process, carefully inspect to ensure connections are correct and secur
WARNING	When an external short circuit occurs in the RACK circuit or the fuse in th high-voltage box is triggered, the fuse in the high-voltage box must be replaced simultaneously.

5.2. Preparation Before Wiring

Preparation of Installation Tools

Sr	Tools	Illustrate Example	Sr	Tools	Illustrate Example
1	Forklift (>3.5 ton) or Crane (>10 ton)		9	Wire stripper	
2	Insulated gloves		10	Crimping tool	

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3	Safety goggles		11	Hydraulic crimping tool	
4	Insulated shoes		12	Heat gun	
5	Work clothes		13	Multimeter	
6	Safety helmet		14	Marker pen	
7	Screwdriver		15	M12 nuts with flat and spring washers	
8	Socket wrench				

5.3. Cable Preparation

DANGER

Before electrical connection, check and ensure that the cables are all intact and well-insulated. Poor insulation or cable damage may result in safety hazards. If necessary, replace the cable immediately .

The cables must meet the following requirements:

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- The current carrying capacity of the cable meets requirements. Factors affecting the current carrying capacity of a conductor include but are not limited to:
  - Environmental conditions;
  - Type of the insulation material of the conductor;
  - Cabling method;
  - Material and cross-sectional area of the cable.
- Select cables with a proper diameter according to the maximum load, and the cables should be long enough.
- Ensure that all cables and wires have su icient space for any bends.
- During electrical connection, do not forcibly pull any wires or cables, as this may diminish their insulation performance.
- All DC input cables must be of the same specifications and materials.
- AC output cables of three phases must be of the same specifications and materials.
- Only flame retardant cables can be used.
- Keep a sufficient distance between the cables and the heat-generating components, to prevent the cable insulation layer from aging or getting damaged due to high temperature.
- After completing each connection, carefully check that the connection is correct and secure.
- Adopt necessary auxiliary measures to reduce the stress applied to cables and wires.
- Select cables with appropriate cross-sectional areas, according to the actual environmental conditions for heat dissipation of the cables laid on-site.
- Select communication cables equipped with corresponding shielding protection features according to the requirements of Master Battery.
- Secure the power cables and the communication cables separately. Ensure a minimum space of 10cm between the lines of strong and weak electricity to avoid electromagnetic interference.
- Inspect the connection between the wiring terminal and the copper bar. If any part of the heat-shirk tubing is caught between them, remove it immediately. Otherwise, it may lead to poor contact or even damage due to heat.

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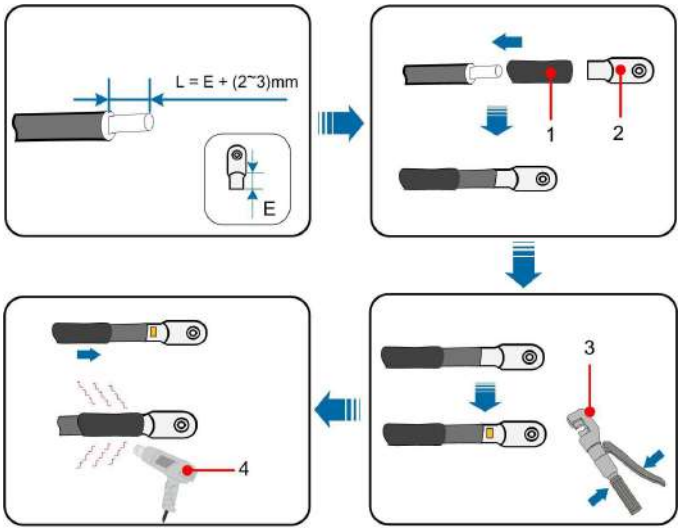
NOTICE
• The cables used should comply with requirements of local laws and regulations. • The cable color in figures in this manual is for reference only. Please select cables according to local standards.

Crimp OT/DT terminals

Follow the steps shown below to crimp terminal.



No.	Name	No.	Name
1	Heat shrink tubing	2	OT/DT terminal
3	Hydraulic pliers	4	Heat gun

NOTICE
• Strip the cables with caution. Avoid scratching the core wires. • After crimping, the conductor crimp barrel of the OT/DT terminal must fully enclose the core wire, forming a closed cavity that ensures a tight and secure connection between the wire and the terminal. • Take appropriate protective measures when using a heat gun to prevent heat damage to the equipment.

Crimp the Ferrule

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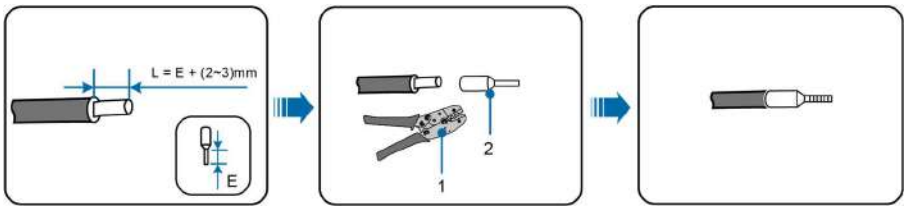

No.	Name
1	Crimping tool
2	Ferrule

5.4. Electrical Interface

There are two types of external wiring interfaces:

1. AC380V three-phase four-wire AC input, which must be connected to the corresponding circuit breaker terminals.
2. Local EMS-LAN interface (LAN1) of the distribution unit.

Connection	Items	Specification	Remarks
AC Side (A, B, C)	Copper Cable	AC380V/250A, Recommended 70mm^2	01 cable for each phase, length should be same.
N Line	Copper Cable	Recommended 70mm^2	
PE Line	Copper Cable	Recommended 35mm^2	
EMS-LAN	Network Cable	Recommended Cat5e Shielded Cable, RJ45	For communication with upper-level monitoring system host. The cable cross-section should generally not be less than 0.5mm^2.

Users can configure the appropriate communication cables according to their needs.

If other types of cables are used, they must comply with local wiring regulations and meet the requirements of the specific application environment (such as temperature and physical support medium).

5.5. Cable Connection

DANGER

- When fastening the product and terminals, tighten the fasteners at the specified torques using proper tools and leave marks accordingly. Failure to do so may damage the product, and such damage will not be covered by the warranty. Unreliable connection may cause fire or even burn the product.
- During electrical connection, do not forcibly pull any wires or cables, as this may diminish their insulation performance.
- Do not connect aluminum terminals directly to the copper bar, as this may cause galvanic corrosion and compromise the reliability of the connection.

NOTICE

- When using copper-aluminum bimetallic washers, the outer profile of the washer must be no smaller than that of the OT/DT terminal. Pay attention to the correct orientation, ensuring that the aluminum side of the washer contacts the aluminum terminal, and the copper side contacts the copper bar.
- It is recommended to source the washers and terminals from the same manufacturer. The bolts must be securely tightened, with at least two exposed threads remaining.
- Use screws of an appropriate length for wiring. The screw shall protrude 2–3 threads (approximately 3 mm) through the mounting hole in the copper bar. Using overly long screws may compromise insulation performance or even cause short circuits.

Main Power Supply Wiring

To prevent loosening of the cable lugs due to mechanical stress, which may cause poor contact, increased contact resistance, overheating, or even fire, ensure that the screws securing the cable terminals are tightened according to the torque requirements listed in the table below:

Bolt Specification	Recommended Torque (N·m)	
	For Device/Cabinet	For Electrical
M5	3	6
M6	5	10
M8	15	15
M10	30	50
M12	46	80

Main power supply wiring can use copper cables, copper-clad aluminum cables, or aluminum alloy cables.

- When using copper-core cables or copper-clad aluminum cables, select copper terminals, and complete the connections by referring to the figure below.

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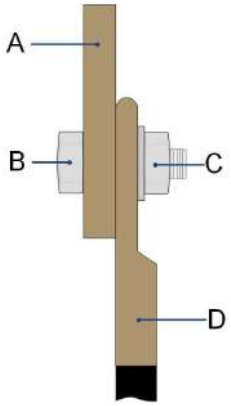

Figure 4-5 Connection Using Copper Terminal

Item	Name	Item	Name
A	Copper bar	C	Flange nut
B	Bolt	D	Copper terminal

When selecting aluminum alloy cables, use copper-aluminum bimetallic terminals, or aluminum terminals in combination with copper-aluminum bimetallic washers. Please complete the connections by referring to the figure below.

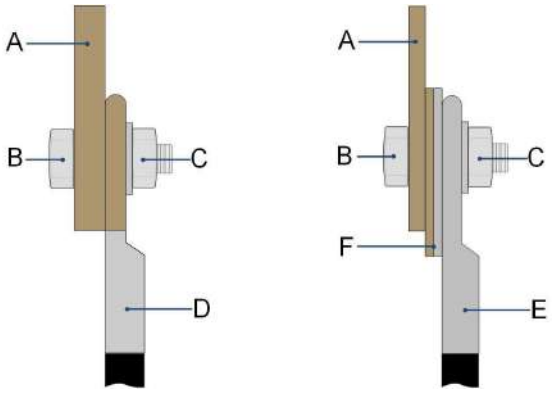

Figure 4-6 Connections Using Copper-Aluminum Bimetallic Terminal (Left) and Aluminum Terminal (Right)

Item	Name	Item	Name
A	Copper bar	D	Copper-aluminum bimetallic terminal
B	Bolt	E	Aluminum terminal
C	Flange nut	F	Copper-aluminum bimetallic washer

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Auxiliary Power Supply Wiring

Auxiliary power supply wiring can use copper cables, copper-clad aluminum cables, or aluminum alloy cables.

- When using copper-core cables or copper-clad aluminum cables, select copper terminals, and complete the connections by referring to the figure below.

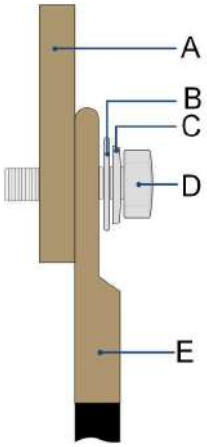

Figure 4-7 Connection Using Copper Terminal

Item	Name	Item	Name
A	Copper bar	D	Bolt
B	Flat washer	E	Copper terminal
C	Spring washer		

- When selecting aluminum alloy cables, use copper-aluminum bimetallic terminals, or aluminum terminals in combination with copper-aluminum bimetallic washers. Please complete the connections by referring to the figure below.

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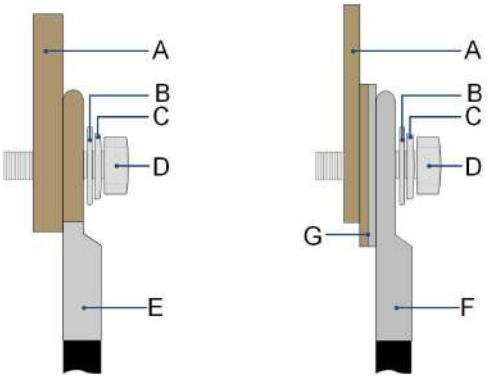

Figure 4-8 Connections Using Copper-Aluminum Bimetallic Terminal (Left) and Aluminum Terminal (Right)

Item	Name	Item	Name
A	Copper bar	E	Copper-aluminum bimetallic terminal
B	Flat washer	F	Aluminum terminal
C	Spring washer	G	Copper-aluminum bimetallic washer
D	Bolt		

5.6. Cable Inlet Design

Cables connecting the ESS to the external devices can be led through the cable inlet/outlet at the bottom of the ESS. Take protective measures for the cables, such as routing cables through conduits, to avoid damage caused by rodents. After wiring is completed, seal off the cable inlet/outlet using fireproof mud or other appropriate materials.

The cable inlet/outlet design is illustrated in the figure below.

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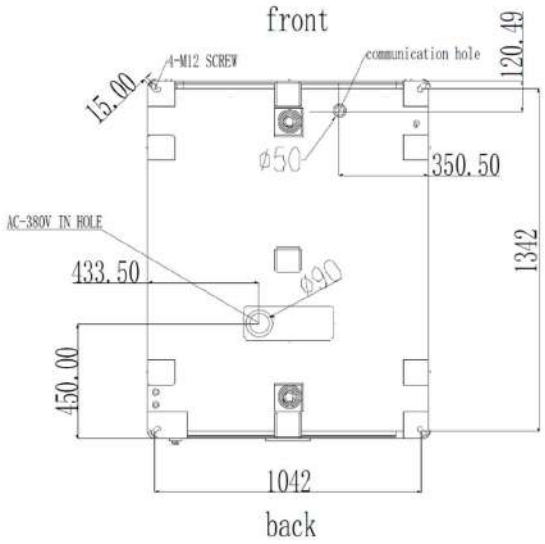

Figure 4-9 Cable Inlet

*The figure is for reference only; the actual product may differ.

NOTICE
If it is required to pre-bury cable conduits in the cable inlet/outlet area during construction, please confirm the specific position with Master Battery.

NOTICE
After wiring, seal off the cable inlet/outlet by filling the gaps around the cables with fireproof/ waterproof materials, such as fireproof mud, to prevent the ingress of foreign objects or moisture, thus avoiding affecting the product's long-term operation.

5.7. Ground Connection

NOTICE
Grounding must be completed by strictly following the applicable local standards and regulations.

NOTICE
• Before grounding, clean the surface and threads of the grounding point to avoid compromising the grounding performance. • After grounding is complete, apply anti-corrosion treatment to the ground connection area to avoid rust.

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Overview

Grounding can be made in the following two ways: welding a grounding flat steel, or connecting a grounding cable.

Grounding Flat Steel (Recommended)

Remove the protective tape from the grounding point and weld the hot-dip galvanized flat steel to the grounding point (the area where the flat steel and the ESS are joined together should be 40 mm x 70 mm). Spray paint the whole welding area after completing welding.

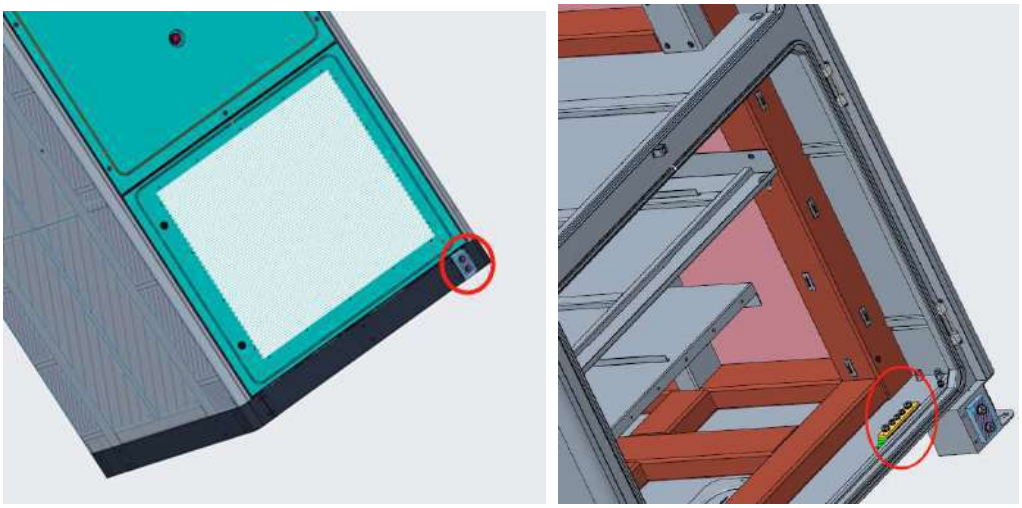


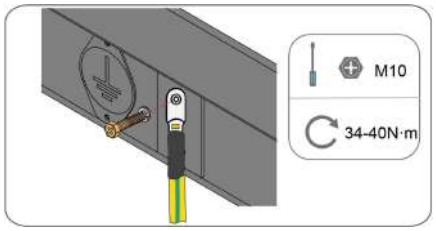
Figure 4-10 ESS Grounding Diagram

*The figure is for reference only and the actual product shall prevail.

Grounding Cable

Use a 70 mm2–95 mm2 copper grounding cable to connect the grounding point on the ESS to a designated grounding point properly and reliably (the grounding point is covered with protective tape upon delivery, which should be removed before wiring).

Crimp the DT terminal. Secure the DT terminal to the wiring hole with an M10 bolt at a tightening torque of 34–40 N·m.



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*The figure is for reference only and the actual product shall prevail.

Carry out external ground connection in compliance with the actual on-site conditions and the instructions by the plant staff.

Measure the ground resistance after completing the grounding. Make sure the resistance does not exceed 4 Ω.

The specific ground resistance must comply with the applicable national/local standards and regulations.

5.8. Steps for Electrical Connections

DANGER	To avoid personal injury and equipment damage, strictly prohibit wiring operations when the system is powered: Ensure the PCS DC switch is in the off position. Use a multimeter (range ≥ 1000V) to confirm there is no power on the DC wiring side.

1. Verify that the AC side is powered off and the PCS DC switch is disconnected. Use a multimeter to confirm.
2. Follow the wiring diagram to connect the cables. Check the correctness of the connections, confirm the phase sequence of the cables, and label them properly.
3. Connect the external electrical wiring and communication cables to the cabinet according to the diagram or manual.

5.9. Cable Protection

Cable protection includes both communication cables and power cables. The protection methods are as follows:

1. Communication Cable Protection:

- Communication cables are relatively thin and prone to being pulled off or disconnected during construction. Therefore, it is recommended to complete the power circuit wiring first, and then connect the communication cables.
- Whenever possible, route cables through wiring ducts. If no ducts are available, use cable ties to secure the cables.

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- Avoid running communication cables near heating components or strong electric field return cables.

2. Power Cable Protection:

- During installation, avoid any damage or abrasion to the insulation sheath of power cables, as this may result in a short circuit.

5.10. Post-Installation Verification

After installation, to avoid equipment damage and property loss, the following items must be rechecked and measured:

- Before measurement, disconnect the PCS DC switch and the grid input circuit breaker to ensure that both the DC side and AC side of the converter are de-energized.
- Confirm the correct polarity connections between the battery unit and the converter. Verify that the AC phase sequence is correct and all connections are properly tightened. Measure the resistance between the three phases, which should be in the mega-ohm range. If the resistance is in the kilo-ohm range or lower, inspect the wiring.
- Ensure that external control cables, grounding cables, and communication cables are securely fastened.
- Verify that the grounding resistance is less than 4Ω. Confirm that all cables are intact, with no damage or cracks.
- Clean the installation area and ensure no tools or foreign objects are left behind.
- Seal cable gaps with fire-resistant clay to prevent small animals from entering.

WARNING

- Moisture may get in if the equipment is not properly sealed.
- Rodents may get in if the equipment is not properly sealed.

NOTICE

After closing the cabinet door, make sure the sealing strip around the door does not curl.

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6. Battery Connection

6.1. Precautions

Always follow the safety instructions in this manual. In order to avoid personal injury and property damage that may occur during installation or operation, and extend the service life of this product, please carefully read all safety instructions.

Improper or incorrect use may result in:

- A threat to the life and personal safety of the operator or third parties;
- Damage to the energy storage system or other property of the operator or third party.

- The safety precautions in this manual do not cover all specifications to followed, and all operations should be performed based on the site conditions.
- Master Batteryshall not be liable for any loss arising from failure to follow the safety precautions in the manual.

WARNING

- While installing the device with hazardous voltage, follow relevant regulations and local installation safety guidelines.
- Please observe the regulations on the correct use of tools and personal protective equipment.
- All connections must be carried out with distinctive guidance. Any guess and ambiguous attempts must be prohibited.
- Tools with an insulating protective coating must be used.

- Connecting cables should meet the voltage and current requirements.
- All connectors must be safe and reliable to avoid loosening or virtual contact. They must be corrosion-resistant, wear-resistant and shock-proof.
- All connections must comply with the requirements of relevant national standards to prevent arc discharge in any form.
- The connections of internal batteries must be equipped with anti-vibration and antiloosening devices. Temperature, voltage and current sensors must be connected safely and reliably, to prevent loosening, ageing and extrusion. All sensor cables must be free of metal exposure.
- Any type of short circuit should be prevented in the connection process.
- Operators must use this product with personal protective equipment.

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- All connections must be carried out with distinctive guidance. Any guess and ambiguous attempts must be prohibited.
- Key connections must be correct, reliable (without loosening) and in good contact, without short-circuits.
- All the finished connections must be measured and confirmed one by one.
- All connections must not be in contact with the casing or other components or shortcircuited.
- If there are other uncertain factors, please consult the after-sales technicians of Master Battery before any operation.

6.2. Cable Connection

Tools

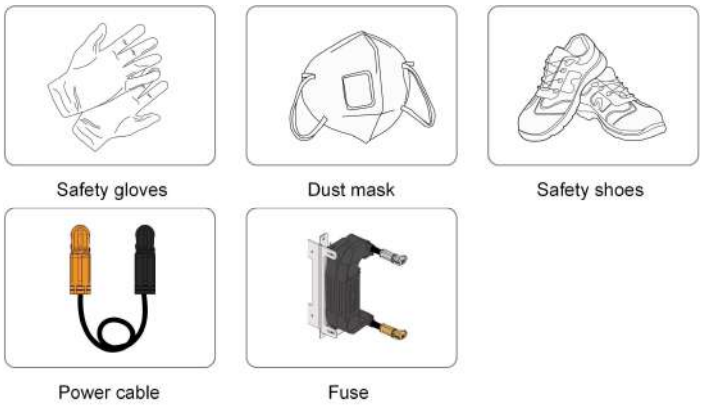

Figure 5-1 Installation Tools

Step 1 Before connecting the power cable, put on insulated shoes and safety gloves. Before connecting the power cable between PACKs, disconnect the wiring between the PACK and the DC/AC power converter unit first.

Step 2 Install the fuse. Open the cabinet door, and remove the sponge separators that hold the fuse plugs.

Step 3 Insert the plugs that come with the fuse into the PACK bases properly.

WARNING

Once the aviation plug is connected in place, you will hear a "click". Ensure that the connection is secure.

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- Insert the positive aviation plug into the designated positive terminal on the PACK base, and the negative plug into the designated negative terminal on the base. Note that the negative aviation plugs are pre-connected at the factory; only the positive plugs need to be connected on-site. Orange indicates positive, and black indicates negative. Once the aviation plug is connected in place, you will hear a "click".
- When connecting the power cables, you can adjust the position of the fuse properly.

Step 4 Connect the power cables between the PCAKs. The positive connector of the power cable between PACKs is secured on the RACK, and the negative connector is secured on the side bracket with a quick-connect clip and cable tie.

WARNING

Once the aviation plug is connected in place, you will hear a "click". Ensure that the connection is secure.

NOTICE

When connecting the power cables between the PACKs, remove the negative connector of the power cable from the quick-connect clip on the side bracket, and then insert it into the designated negative terminal on the base.

a. Connect the BAT- of PACK1# to the BAT+ of PACK2#.
b. Connect the BAT- of PACK2# to the BAT+ of PACK3#.
c. Connect the BAT- of PACK3# to the BAT+ of PACK4#.
d. Connect the BAT- of PACK4# to the BAT+ of PACK5#.

Step 5 Connect the power cable between the PACK and the DC/AC power converter unit:

a. Connect the BAT+ of PACK1# to the BAT+ of the DC/AC power converter unit.
b. Connect the BAT- of PACK5# to the BAT- of the DC/AC power converter unit.

WARNING

Once the aviation plug is connected in place, you will hear a "click". Ensure that the connection is secure.

-End

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7. Powering up and Shutdown

7.1. Powering up

> **WARNING**
>
> - The equipment can only be put into operation after confirmation by a professional and approval of the local energy department.

> **WARNING**
>
> - For equipment that has a long shutdown time, inspect it thoroughly and carefully and make sure all the indicators meet the relevant requirements before powering up.

7.1.1. Inspection Before Powering up

Before powering up the equipment, check the following items carefully.

- Check whether the wiring is correct.
- Check whether the protective covers inside the equipment are installed firmly.
- Check whether the emergency stop button is released.
- Check and ensure that there is no grounding fault.
- Check whether the AC and DC voltages meet startup conditions and ensure that there is no over-voltage with a multimeter.
- Check and ensure that no tools or components are left inside the equipment.
- Check all air inlets and outlets for blockage.
- If the equipment has been stored for more than six months, the top radiator fan should be checked for proper rotation, noise or stalling before powering up.

7.1.2. Power-on Procedure

Inspect the equipment thoroughly before powering it on. The equipment can only be powered on after all the inspection items are confirmed to meet the requirements.

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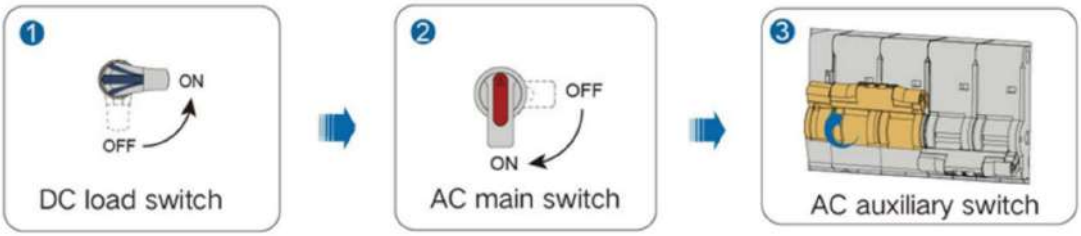
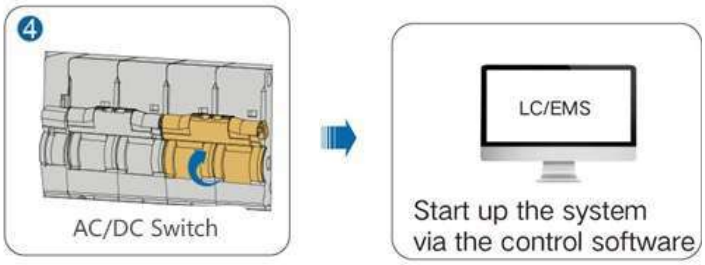
Prerequisite

NOTICE
Before the ESS is powered on for the first time, disconnect the red actuation cable of the aerosol fire extinguishing equipment to prevent accidental activation. The disconnection point is inside the junction box of its accessories. Reconnect the actuation cable once the FSS enters normal operation.

- The power and communication wiring of the ESS have been completed.
- The outdoor temperature is in the range of -30ºC to 50ºC

It is not recommended to power on the equipment at temperatures below -30°C. If the temperature is too low, it will take 24 consecutive hours or more for the system to heat the cells. During this period, the system cannot operate normally.





a) Once the equipment has been verified to be free of issues, you can proceed with the system startup operation. The startup steps are as follows:

b) Open the front door of the cabinet, turn off the DC SWITCH (located on the left side of the PCS panel), and ensure the switch is in the ON position.

c) Turn off AUX-SWITCH and A/C SWTICH. At this time, the direct-cooling unit and the auxiliary battery start supplying power.

d) Open the back door of the cabinet, turn off the AC switch, and ensure the switch is in the on position.

e) Check the operation information, PCS information, and battery information on the controller to confirm they are displayed correctly.

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f) In the EMS interface, verify that.

g) The PCS is in the startup state.

h) The battery operation state is "Standby" or "Charging/Discharging".

i) Close the cabinet door and hand over the key to designated personnel for safekeeping.

- The auxiliary power supply is used to power devices including the switch, LC, and fans.
- The liquid cooling unit may be switched on at factory. Check whether it is switched on when powering on.

7.1.3. PCS terminal panel layout

The PCS panel device description is shown in the table below:

No	Terminal No.	Name	Remark
1	BAT+	DC positive terminal	70mm² EV Cable
2	BAT-	DC negative terminal	70mm² EV Cable
3	A	A phase incoming line	Not less than 70mm²
4	B	B phase incoming line	Not less than 70mm²
5	C	C phase incoming line	Not less than 70mm²
6	N	N phase incoming line	
7	485/CAN/EPO/DRMO/ DI1/DI2/DI3/DO1/DO2/ DO3	Signal Terminal	
8	USB	USB communication interface	
9	ETH/COMM3/TEST	Ethernet communication interface	
10	ADDR/120Ω	Resistor DIP	
11	⏚	PE access	

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7.1.4. Power-on steps

After the equipment is checked and found to be correct, the energy storage system can be started up. The steps for starting up are as follows:

(1) Open the front door of the cabinet, turn off the DC SWITCH (located on the left side of the PCS panel), and ensure the switch is in the ON position;

(2) Turn off AUX-SWITCH and A/C SWTICH. At this time, the direct-cooling unit and the auxiliary battery start supplying power;

(3) Open the back door of the cabinet, turn off the AC switch, and ensure the switch is in the on position;

(4) Check that the “Operation Information”, “PCS Information” and “Battery Information” on the controller are displayed normally.

(5) Check in the controller: the PCS is turned on and the battery operating status is "Standby" or "Charge/Discharge".

(6) Close the cabinet door and hand the key to a designated person for safekeeping;

(7) All the above steps are normal and the power-on is completed.

7.2. Shutdown

7.2.1. Planned Shutdown

Planned shutdown refers to an interruption to the equipment operation that is scheduled in advance for overhaul, test, or maintenance.

Prerequisite

Shut down the system via the control software, and switch off the battery relay (in case of an emergency, you can press the emergency stop button on the ESS).

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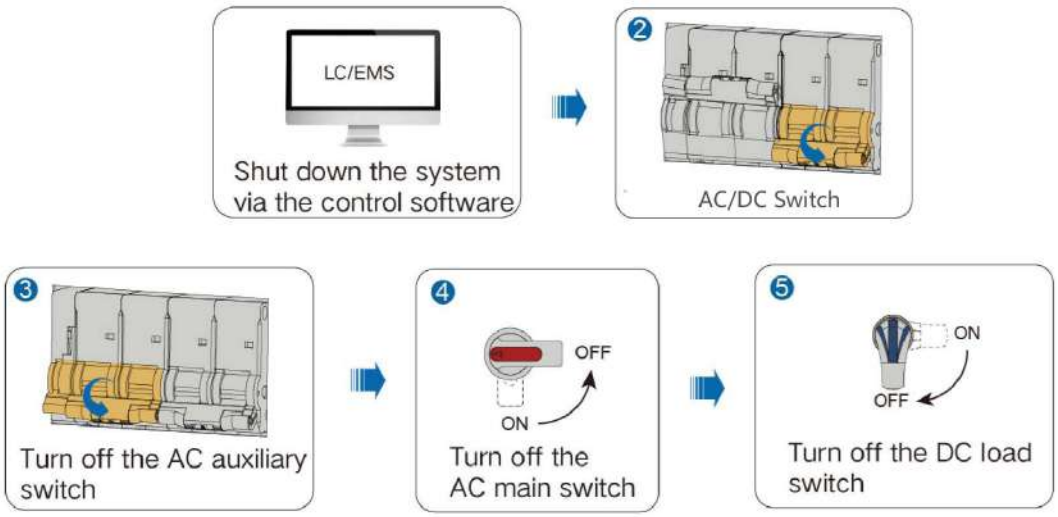

Local/remote actions, perform the shutdown operation as follows:

1. In the EMS interface:
   1) Click the "Stop" button under "PCS Start" .
   2) Confirm on the "Battery Information" and "PCS Information" screens that the PCS is in the shutdown state, and the current on both the battery side and the PCS AC/DC side is 0A.
2. Disconnect the AC SWITCH grid-connected AC input switch (located on the back of the PCS), ensuring the molded case circuit breaker is in the OFF position. At this point, the operation indicator light will turn off.
3. Disconnect AUX-SWITCH and A/C SWTICH, ensuring the miniature circuit breakers are in the OFF position.
4. Disconnect the PCS DC side switch , ensuring the switch is in the OFF position.
5. The system shutdown is now complete.

- Before working on the AC wiring terminals, be sure to turn off the upstream switches of the ESS first.

Proceed with the electricity test after the system self-discharge is completed.

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7.2.2. Emergency Shutdown

NOTICE
The emergency shutdown button should only be used in critical situations. For routine shutdown, please follow the Normal Shutdown procedure.

In emergencies involving safety concerns, perform the following steps:

1. Issue anemergency stop command via the controller or press the emergency shutdown button located outside the product.
2. Disconnect the AUX-SWITCH (molded case circuit breaker).

Contact the local fire department in case of an emergency.

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8. Fire Suppression

- The equipment has an internal automatic fire suppression system. Do not flip the fire suppression switch unless an emergency occurs.

8.1. General Rules

Always comply with the fire laws and regulations of the country/region where the project is located.

Perform regular inspection and maintenance on the fire suppression system regularly to ensure it can function properly.

NOTICE
If an operation and management personnel receives an ESS alarm or fault signal on-site, via the software, or from the plant-level FACP, while ensuring safety, request qualified firefighting personnel to conduct an on-site inspection and then manually clear the alarm or fault.

8.2. Fire Suppression System

Each ESS has a fire suppression system (FSS) that can function independently, without interfering with each other.

The FSS of the ESS includes a detection and alarm system, a fire extinguishing system, and a backup protection system (optional).

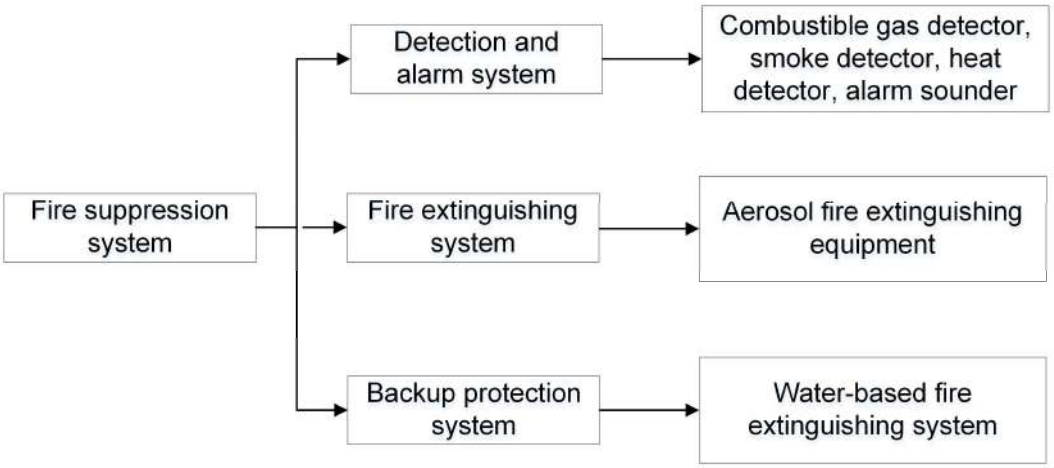

Figure 8-1 FSS Composition

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NOTICE
To ensure its accuracy, the combustible gas detector must be tested for functionality every six months. In case the detector fails the test, investigate the cause, and calibrate the detector if necessary.

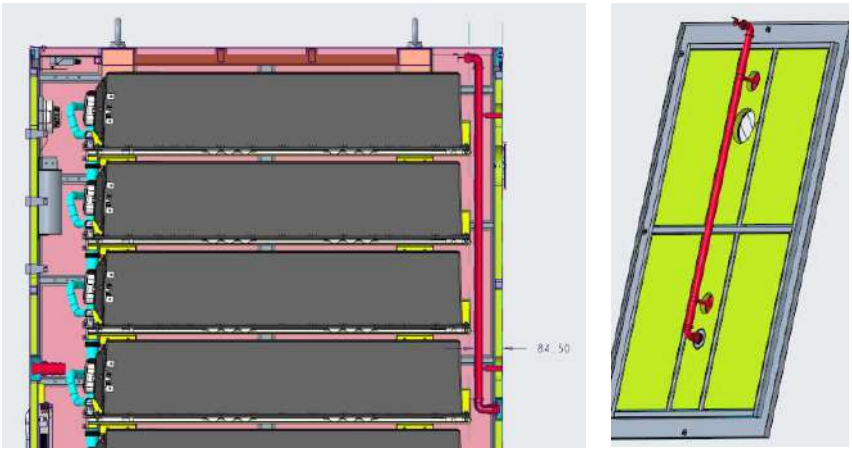

Figure 8-2 FSS Equipment water pipeline

8.3. Detection and Alarm System

The detection and alarm system is able to discover fires early in their development and thus helps to reduce the risk of fire to the minimum.

Each ESS is equipped with a fire detection and alarm system consisting of a combustible gas detector, a smoke detector, a heat detector, and an alarm sunder.

- The combustible gas detector can detect the concentration of combustible gases produced during thermal runaway. When the concentration of combustible gases inside the battery compartment reaches the preset alarm threshold, the detector will trigger an alarm and upload the alarm signal to the LC.
- The smoke detector assesses the smoke concentration based on the scattering of light in smoke. When the smoke concentration in the battery compartment reaches the preset threshold (0.15 dB/m), the smoke detector will trigger an alarm and upload the alarm signal to the LC.
- The heat detector senses the changes of temperature in the battery compartment. If the temperature in the battery compartment reaches the preset threshold (54 °C), the heat detector will trigger an alarm and upload the alarm signal to the LC.

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- In addition, if the LC also receives a cell overtemperature fault signal, the LC will shut down the current ESS.
- When both the smoke detector and heat detector trigger an alarm, under their linkage control, the alarm sounder will trigger an acoustic alarm to alert on-site personnel to the abnormal conditions in the equipment.

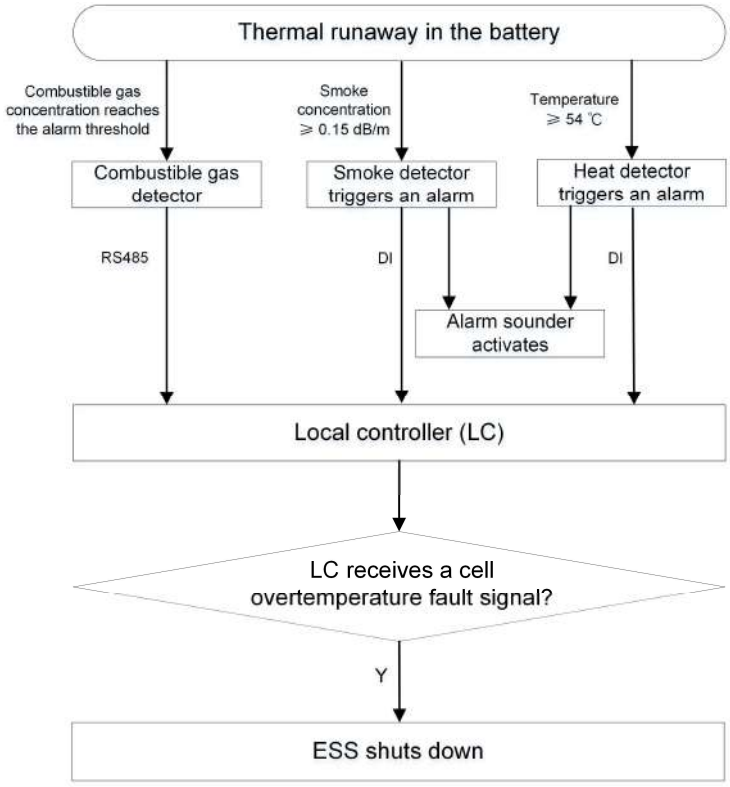

Figure 8-3 Control Logic of the Detection and Alarm System

8.4. Fire Extinguishing System

Each ESS is equipped with a condensed aerosol fire extinguishing system. Its condensed aerosol fire extinguishing equipment consists of an aerosol generator, a feedback element, and an enclosure.

When both the smoke detector and heat detector trigger an alarm, under their linkage control, the aerosol generator will be activated, releasing smoke-like fire extinguishing agent. The fire extinguishing agent will then be discharged into the battery compartment through the nozzle on the enclosure to extinguish the fire. After the fire extinguishing agent is released, the feedback element will send a fire extinguishing agent released signal to the LC. In addition, if the LC also receives a cell overtemperature

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fault signal, the LC will shut down the current ESS.

NOTICE
When both the smoke and heat detector trigger an alarm, triggered by the linkage control mechanism, the aerosol fire extinguishing agent will be discharged. Therefore, before conducting tests, disconnect the activation line of the aerosol fire extinguishing system to prevent accidental activation.

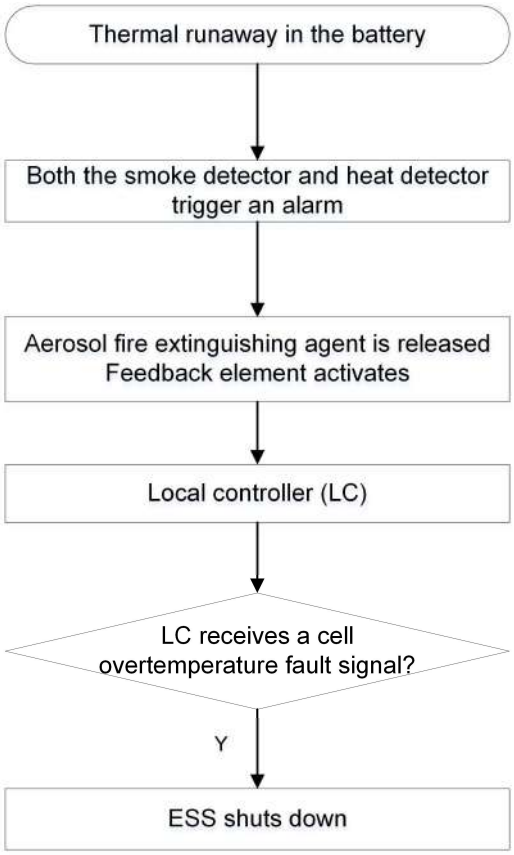

Figure 8-4 Control Logic of the Fire Extinguishing System

8.5. Backup Protection System (Optional)

In addition to the fire extinguishing system, the ESS also has a backup protection system, in case the fire keeps spreading even after the fire extinguishing system has activated.

In case the fire keeps spreading after the fire extinguishing system activates, the customer can activate the backup protection system after the ESS is powered off to extinguish the fire. The backup protection system consists of the sprinkler, water piping system, and reserved interface (pipe connector).

- When the temperature around the sprinkler reaches 93 °C, the glass bulb inside bursts, activating the sprinkler. Water then flows through the external and internal piping into

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the battery compartment, immersing the PACKs, to cool the equipment down and extinguish the fire.

- The reserved interface has a DN25 pipe connector. The external piping system shall be designed and installed by the customer separately and properly connected to the reserved interface on the ESS.

The external piping system can be designed according to the actual situation at the project site. Generally, there are two options: manual fire extinguishing and automatic fire extinguishing.

- Manual: Suitable for scenarios where fire trucks or other movable equipment are available at the site. In this scenario, set up a water supply piping system at the site in advance, with one side connected to the reserved pipe connector of the ESS and the other side to the fire truck or other movable equipment. In case of a fire, people need to manually let the water in to extinguish the flames.
- Automatic: Suitable for scenarios where fire water ponds are available at the site. In this scenario, the water supply piping system is connected to the reserved pipe connector of the ESS on one side and to the pond on the other side. In case of a fire, water from the pond will automatically flow into the piping system for fire extinguishing. A valve must be installed on the pipe connected to the reserved connector on the ESS. Ensure that no water is present in the pipes inside the ESS under normal operating conditions.

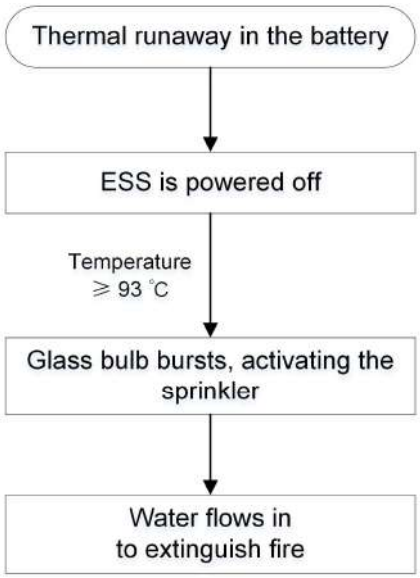

Figure 8-5 Control Logic of the Backup Protection System

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9. Local Operation and Maintenance

9.1. Introduction of Touch Screen

You can view the running information of the energy storage controller and set the running parameters of the energy storage controller on the LCD touch screen. For ease of operation, the following provides the logical structure distribution diagram of the LCD menu.

9.2. Check the running status and main parameters of the energy storage system

9.2.1. Device Monitoring (SCADA) page

1 to 3 minutes after the energy storage system is powered on, the system automatically displays the Device monitoring page (main menu). You can view the running status and main parameters of the energy storage system on this page. Click the function button in the upper right corner of the touch screen, and the system will switch between - Battery system page - Energy storage inverter page -

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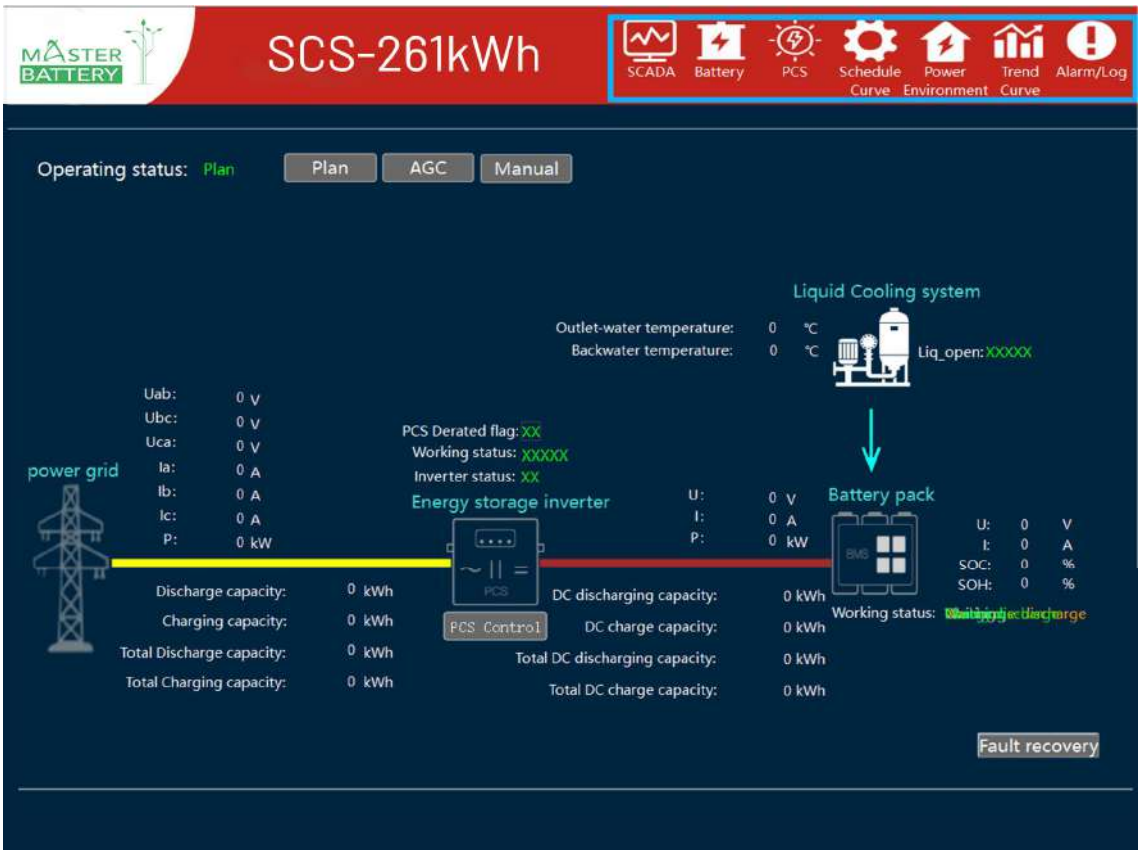
Schedule Curve page - Power Environment monitoring page - Trend Curve page - Alarm/Log page.



9.2.2. Energy Storage Inverter (PCS) page

Click the Energy Storage Inverter (PCS) button on the main menu page, and the system will switch to the energy storage inverter (PCS) page. On this page, you can view the running status, AC part, DC part, and fault alarm information of the energy storage inverter.

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Click the PCS control button in the Device Monitoring (SCADA) page to enter the Energy storage converter (PCS) control and parameter setting page. On this page, you can view the PCS operating status, AC part, DC part and PCS device information. Click the parameter to be modified and enter the parameter press enter on the pop-up keyboard to enter the landing page. Enter the password and click the login button on the page to complete parameter modification.

In the energy storage converter (PCS) control and parameter setting page, click the inverter on or inverter off button. In the pop-up landing page, enter the password and click the login button to complete the inverter on or inverter off operation.

On-site real-time charging and discharging operation of the energy storage system.

- Stop the Schedule Curve on the SCADA page: Click the Stop button next to the schedule status on the SCADA page. On the pop-up login page, enter the password and click the login button to stop the schedule curve. The status next to the planned status shows stop.
- Energy Storage Converter (PCS) Control and Parameter Setting page Set the charging and discharging active power. For details, see Energy Storage Converter (PCS) Control and Parameter Setting.
- Energy Storage Converter (PCS) Control and Parameter Settings Start the inverter: See Energy Storage Converter (PCS) Control and Parameter Settings
- After the inverter is started, the inverter is charged or discharged from shutdown to start-running.

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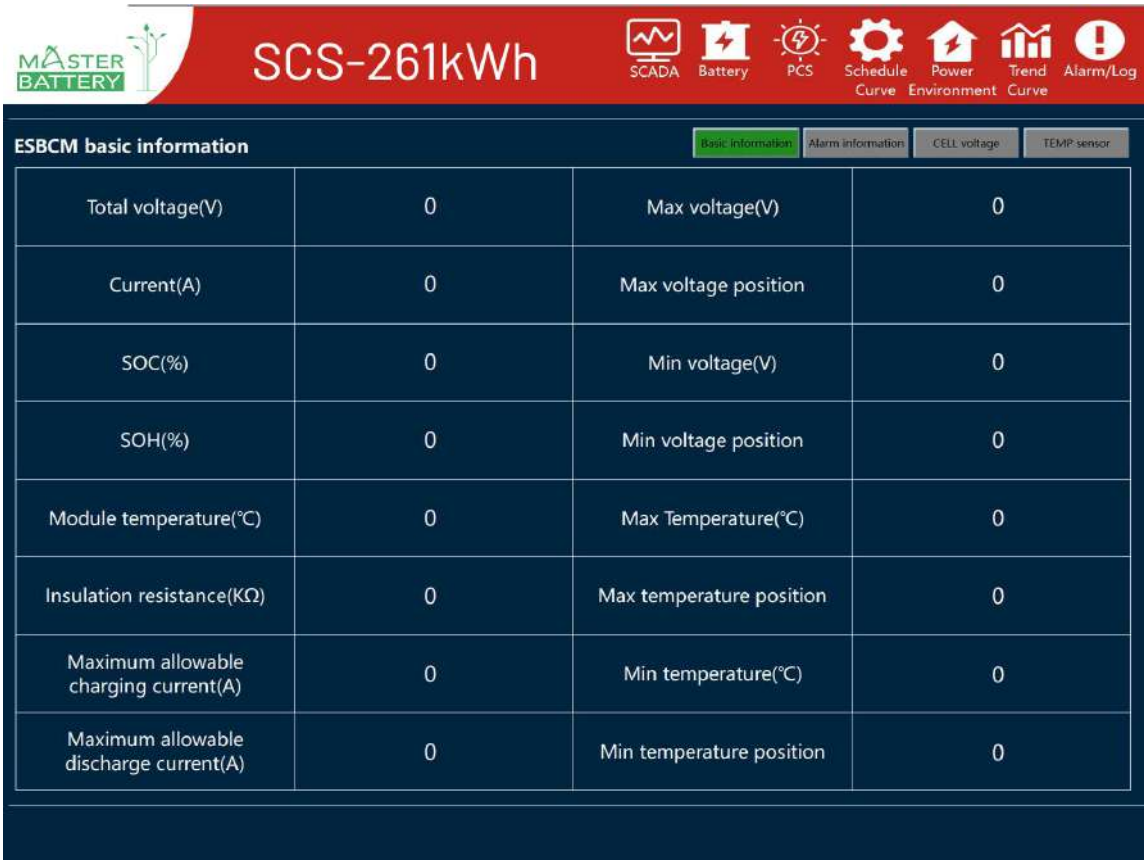
9.2.3. Battery System (BMS) page

Click the Battery System (BMS) button on the main menu page, and the system will switch to the Battery System (BMS) page. This page allows you to view the operating parameters, status, battery voltage, temperature sensor, and fault alarm information of the battery system.



Total voltage(V)	0	Max voltage(V)	0
Current(A)	0	Max voltage position	0
SOC(%)	0	Min voltage(V)	0
SOH(%)	0	Min voltage position	0
Module temperature(℃)	0	Max Temperature(℃)	0
Insulation resistance(KΩ)	0	Max temperature position	0
Maximum allowable charging current(A)	0	Min temperature(℃)	0
Maximum allowable discharge current(A)	0	Min temperature position	0

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PACK1	PACK2	PACK3	PACK4	PACK5
#1cell_Temp1	#1cell_Temp25	#1cell_Temp49	#1cell_Temp73	#1cell_Temp97
#1cell_Temp2	#1cell_Temp26	#1cell_Temp50	#1cell_Temp74	#1cell_Temp98
#1cell_Temp3	#1cell_Temp27	#1cell_Temp51	#1cell_Temp75	#1cell_Temp99
#1cell_Temp4	#1cell_Temp28	#1cell_Temp52	#1cell_Temp76	#1cell_Temp100
#1cell_Temp5	#1cell_Temp29	#1cell_Temp53	#1cell_Temp77	#1cell_Temp101
#1cell_Temp6	#1cell_Temp30	#1cell_Temp54	#1cell_Temp78	#1cell_Temp102
#1cell_Temp7	#1cell_Temp31	#1cell_Temp55	#1cell_Temp79	#1cell_Temp103
#1cell_Temp8	#1cell_Temp32	#1cell_Temp56	#1cell_Temp80	#1cell_Temp104
#1cell_Temp9	#1cell_Temp33	#1cell_Temp57	#1cell_Temp81	#1cell_Temp105
#1cell_Temp10	#1cell_Temp34	#1cell_Temp58	#1cell_Temp82	#1cell_Temp106
#1cell_Temp11	#1cell_Temp35	#1cell_Temp59	#1cell_Temp83	#1cell_Temp107
#1cell_Temp12	#1cell_Temp36	#1cell_Temp60	#1cell_Temp84	#1cell_Temp108
#1cell_Temp13	#1cell_Temp37	#1cell_Temp61	#1cell_Temp85	#1cell_Temp109
#1cell_Temp14	#1cell_Temp38	#1cell_Temp62	#1cell_Temp86	#1cell_Temp110
#1cell_Temp15	#1cell_Temp39	#1cell_Temp63	#1cell_Temp87	#1cell_Temp111
#1cell_Temp16	#1cell_Temp40	#1cell_Temp64	#1cell_Temp88	#1cell_Temp112
#1cell_Temp17	#1cell_Temp41	#1cell_Temp65	#1cell_Temp89	#1cell_Temp113
#1cell_Temp18	#1cell_Temp42	#1cell_Temp66	#1cell_Temp90	#1cell_Temp114
#1cell_Temp19	#1cell_Temp43	#1cell_Temp67	#1cell_Temp91	#1cell_Temp115
#1cell_Temp20	#1cell_Temp44	#1cell_Temp68	#1cell_Temp92	#1cell_Temp116
#1cell_Temp21	#1cell_Temp45	#1cell_Temp69	#1cell_Temp93	#1cell_Temp117
#1cell_Temp22	#1cell_Temp46	#1cell_Temp70	#1cell_Temp94	#1cell_Temp118
#1cell_Temp23	#1cell_Temp47	#1cell_Temp71	#1cell_Temp95	#1cell_Temp119
#1cell_Temp24	#1cell_Temp48	#1cell_Temp72	#1cell_Temp96	#1cell_Temp120

9.2.4. Schedule Cure page

Set daily, monthly, and annual plan curves, set charging and discharging time periods, charging and discharging power, and ESS operates according to the plan curve.

Click the Plan charging and discharging button on the main menu page, and the system will switch to the plan charging and discharging page. This page allows you to view, edit, and copy plan curves.

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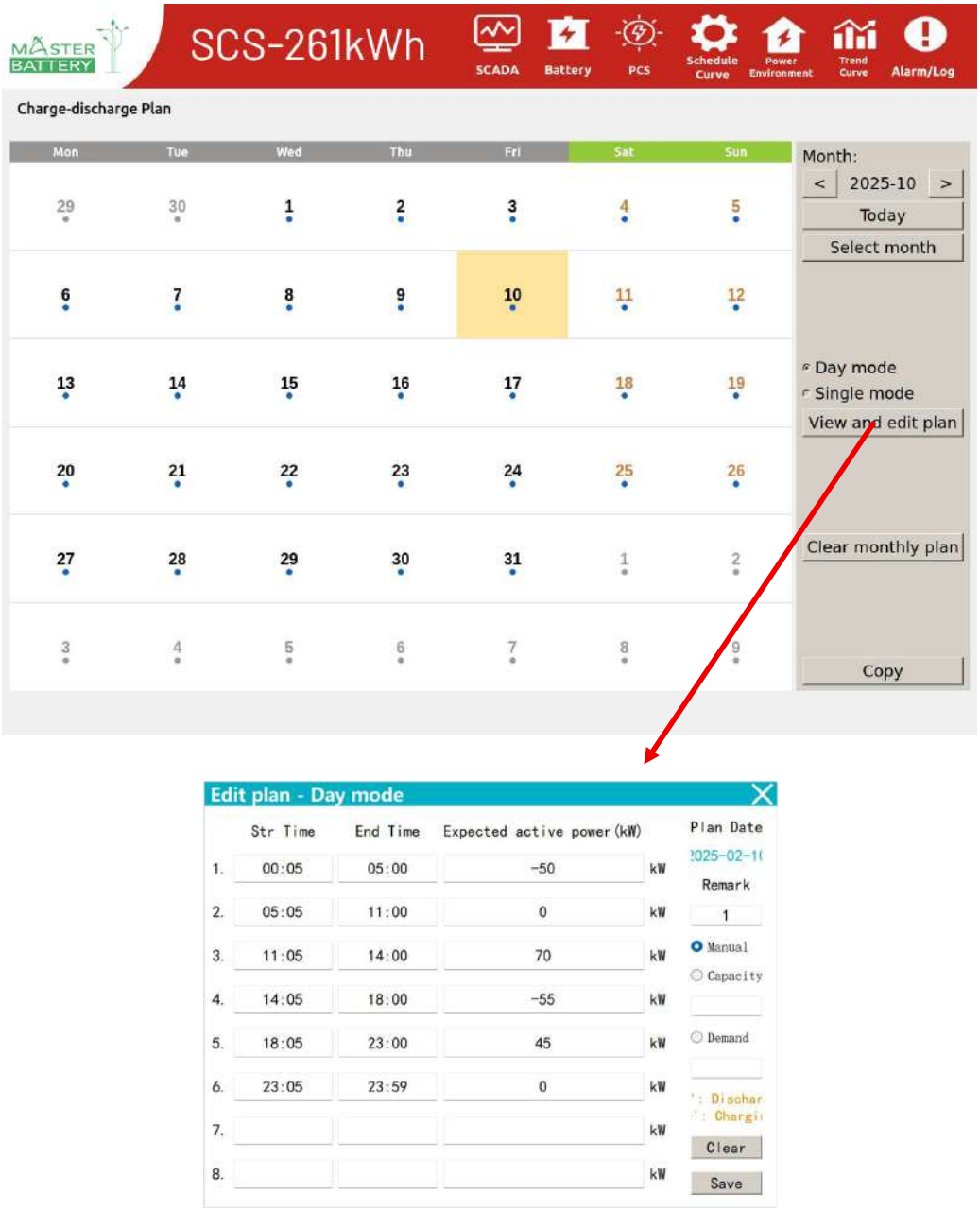

9.2.5. Power Environment page

Click the Power Environment button on the main menu page, and the system will switch to the Power Environment page. On this page, you can view the liquid-cooled unit status, fault information, and telemetry information, such as door status, smoke status, fire solenoid valve status emergency stop status.

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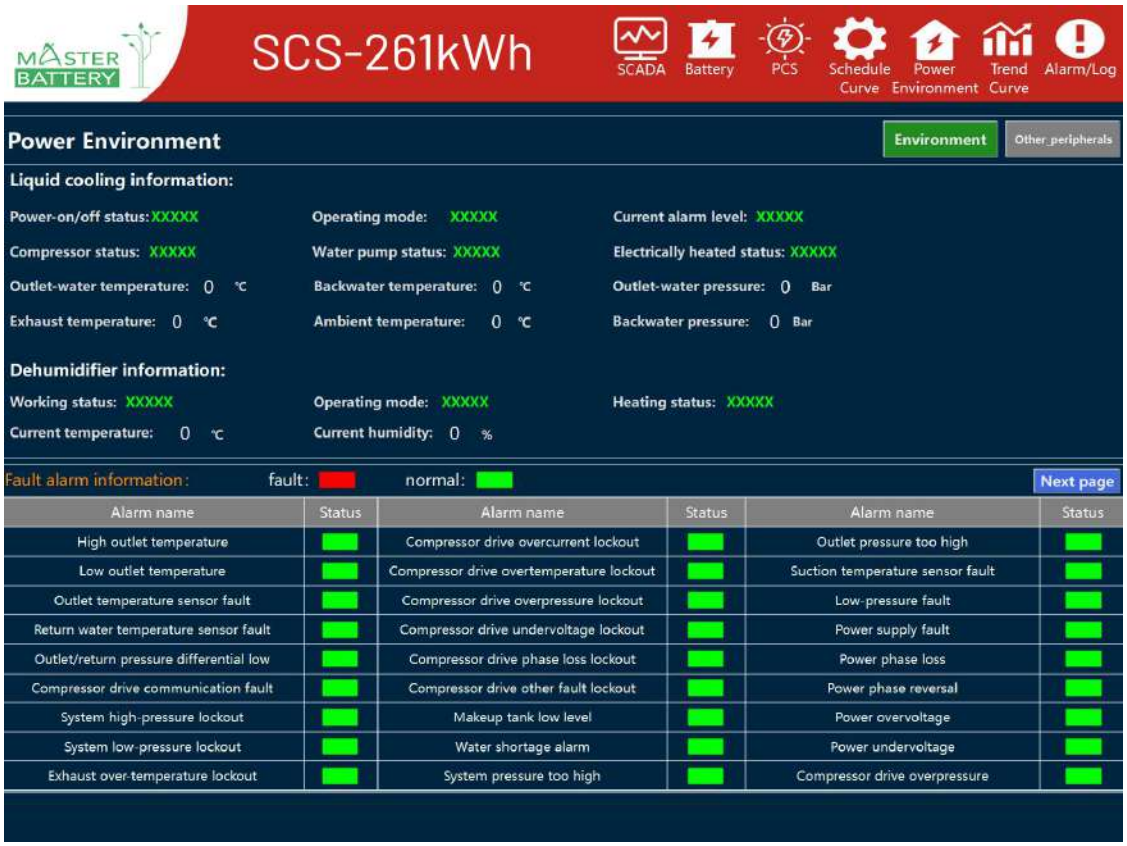

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9.2.6. Trend Curve page

Click the Trend curve button on the main menu page, and the system will switch to the trend curve page. You can view the system running curve on this page.

date	Daily discharge (kWh)	Daily charge(kWh)	date	Daily discharge (kWh)	Daily charge(kWh)
1	0.00	0.00	17	0.00	0.00
2	0.00	0.00	18	0.00	0.00
3	0.00	0.00	19	0.00	0.00
4	0.00	0.00	20	0.00	0.00
5	0.00	0.00	21	0.00	0.00
6	0.00	0.00	22	0.00	0.00
7	0.00	0.00	23	0.00	0.00
8	0.00	0.00	24	0.00	0.00
9	0.00	0.00	25	0.00	0.00
10	0.00	0.00	26	0.00	0.00
11	0.00	0.00	27	0.00	0.00
12	0.00	0.00	28	0.00	0.00
13	0.00	0.00	29	0.00	0.00
14	0.00	0.00	30	0.00	0.00
15	0.00	0.00	31	0.00	0.00
16	0.00	0.00			

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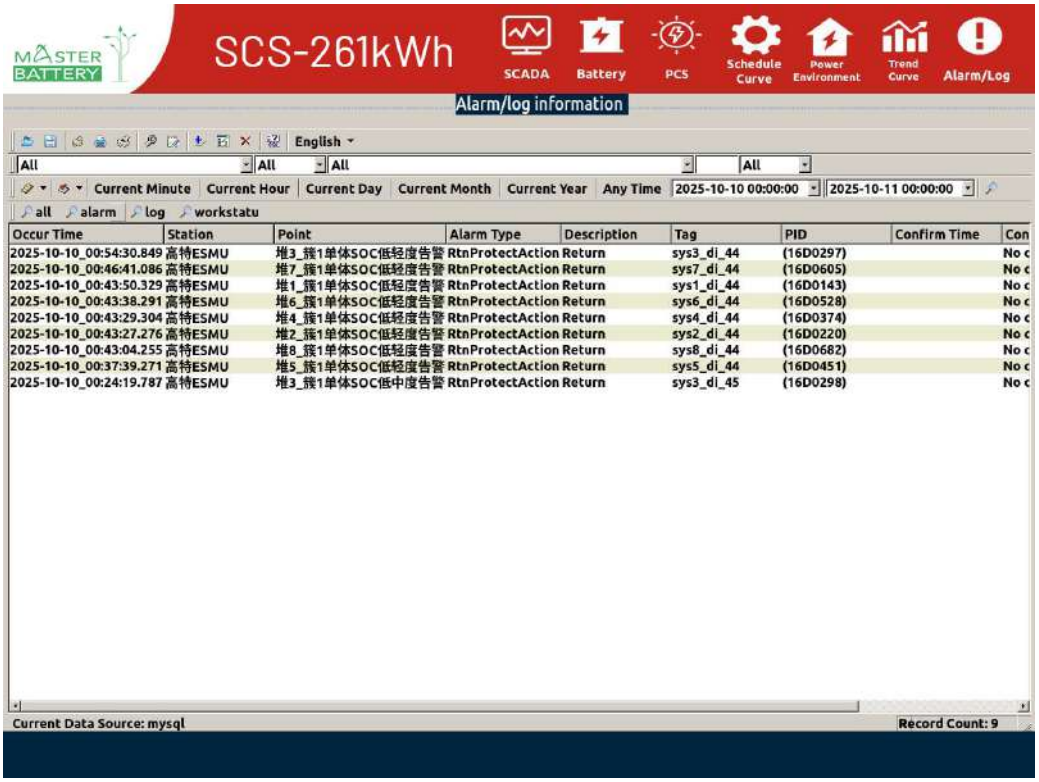
9.2.7. Alarm/Log page

Click the Alarm/Log button on the main menu, and the system will switch to the Alarm/log page. This page allows you to view information about ALL, ALARM, LOG, and WORKSTATUS.



9.3. Work modes

On the home page, we can choose to operate in three modes: manual, automatic, and AGC. Click the any work mode on the home page, and the system will switch to the trend curve page. Enter the password on the pop-up interface and press the Enter key to switch the work mode.

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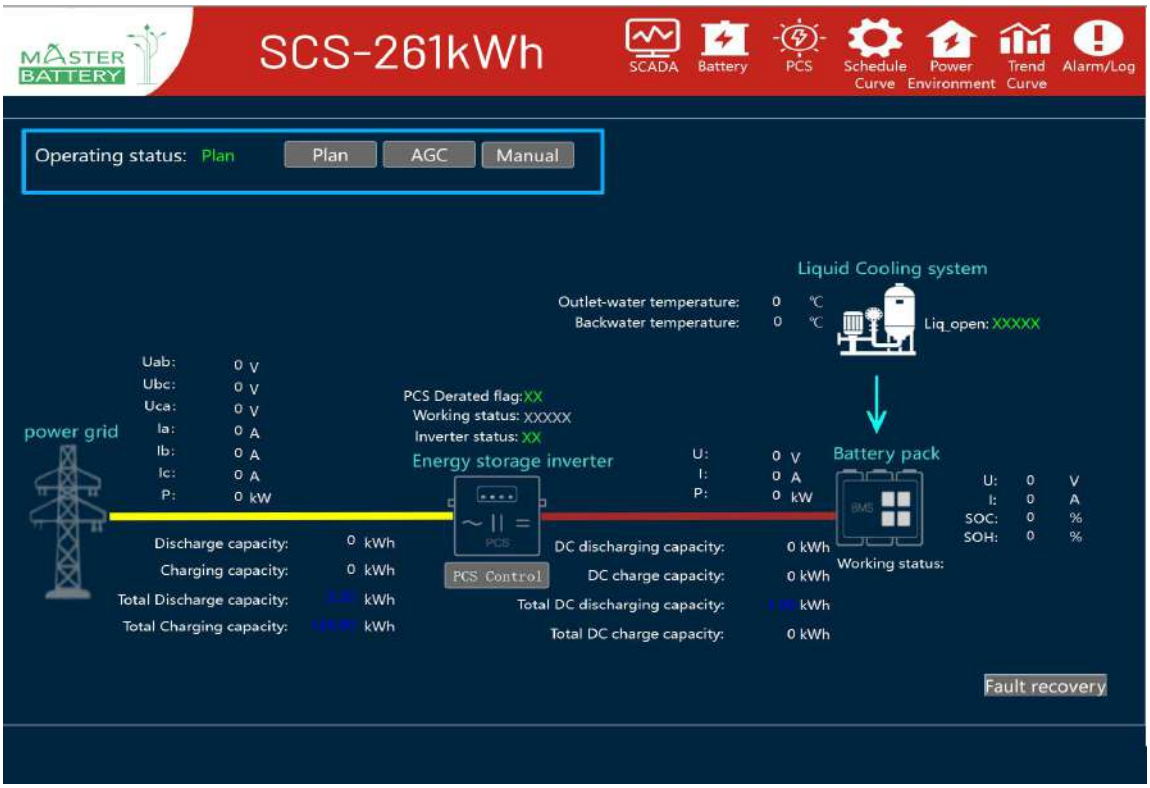

9.3.1. Manual

When the system is in standby mode and there is no alarm, the energy storage system can operate with active power set after PCS is turned on in manual mode.

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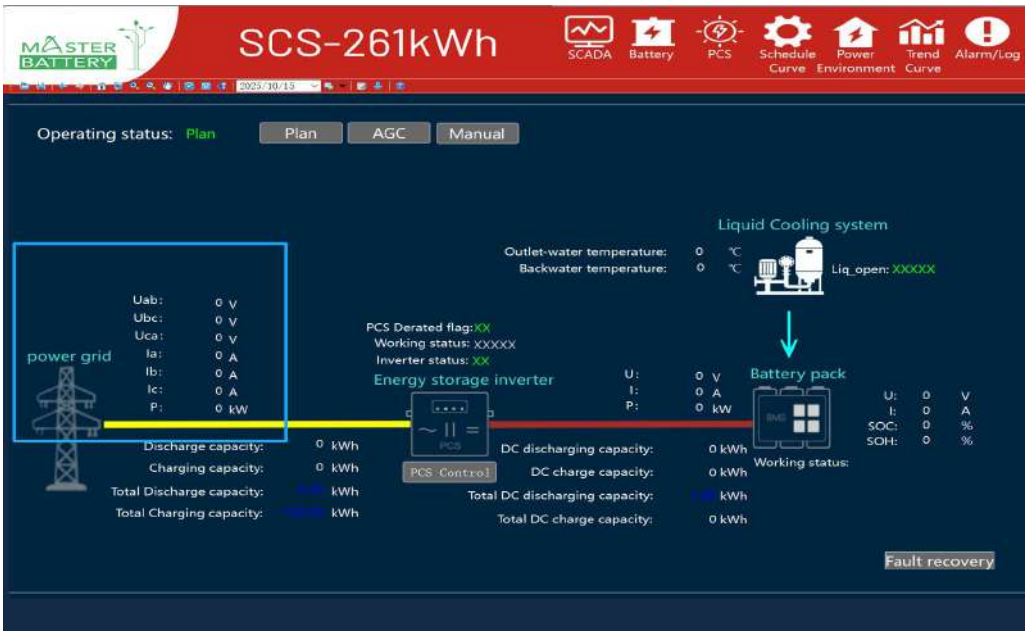
9.3.2. Plan

Once the schedule is set, switching to plan mode will make the system operate according to the set times and power levels.

9.3.3. AGC

After enabling AGC mode, the charging and discharging power of the energy storage system is dynamically adjusted by real-time monitoring of grid frequency and power deviations to maintain grid stability.



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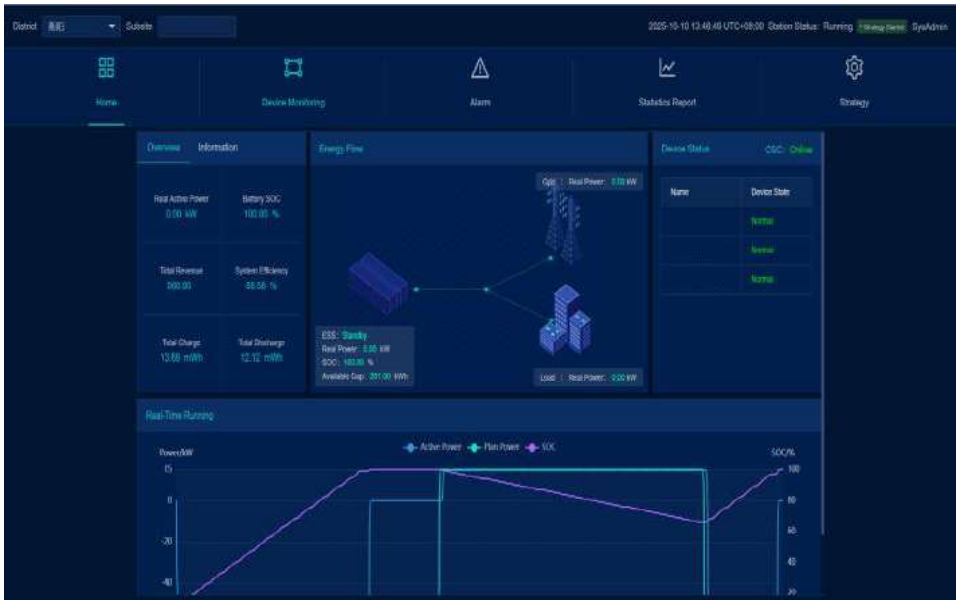
10. Remote Operation and Maintenance

Step 1: Open the cloud platform login page.

Step 2 Click Login to log in to the App successfully and enter the home page.



Serial number	Navigation Bar	Functional Description
1	Home page	Overview data of the operating site, equipment status, and real-time operational data .
2	Device Monitoring	Detailed data of real-time operation, PCS, BMS, liquid cooling units, and fire protection.
3	Alarm	View the currently open faults and historical fault detai
4	Statistics Repor	Yield, electricity, voltage, temperature, et
5	Strategy	Peak shaving and valley filling, planning curves, an-backflow, etc.

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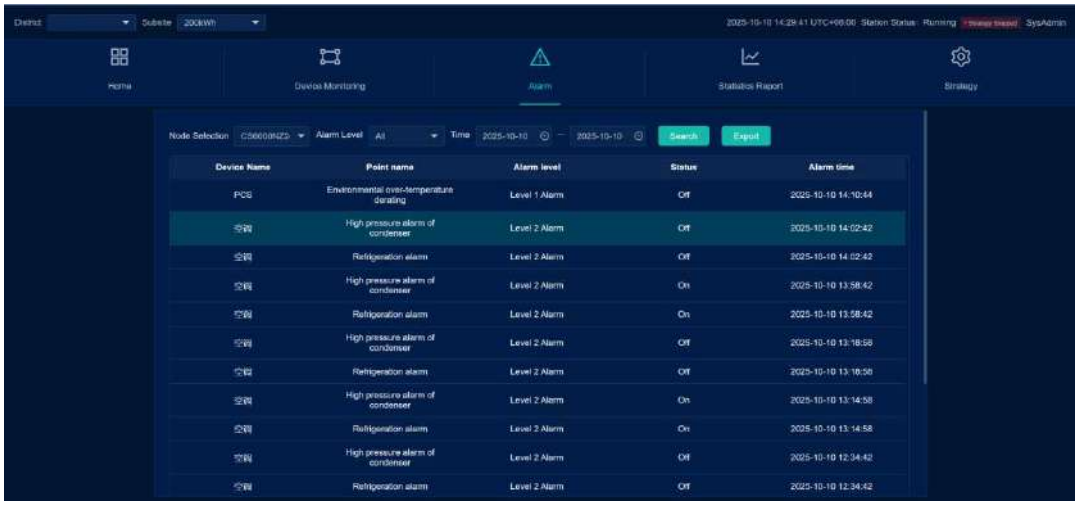
10.1. Abnormal Remote Operation and Maintenance

This section describes how to query exception types and exception details.

Check the device status on the home page to see if there are any malfunctions or offline issues. Exception management information can be classified into first-level alarms, second-level alarms, and third-level alarms.

If the user has verified the abnormal information, contact the corresponding after-sales personnel to fix the issue.



10.2. Remote planning instruction maintenance

Refers to the mode of the energy storage active power scheduling curve sent from the cloud platform to the controller. Refer to the mode of the energy storage active power scheduling curve sent from the cloud platform to the controller. In this mode, the energy storage active power target value is adjusted according to the planning curve. Not only can the month of command execution be flexibly customized according to the month in the industrial and commercial electricity purchase price list of various provinces and cities across the country, but also the energy storage work instructions that fit different working days and holidays can be carefully compiled in close accordance with the actual production, realizing all-round and refined energy storage management and regulation.

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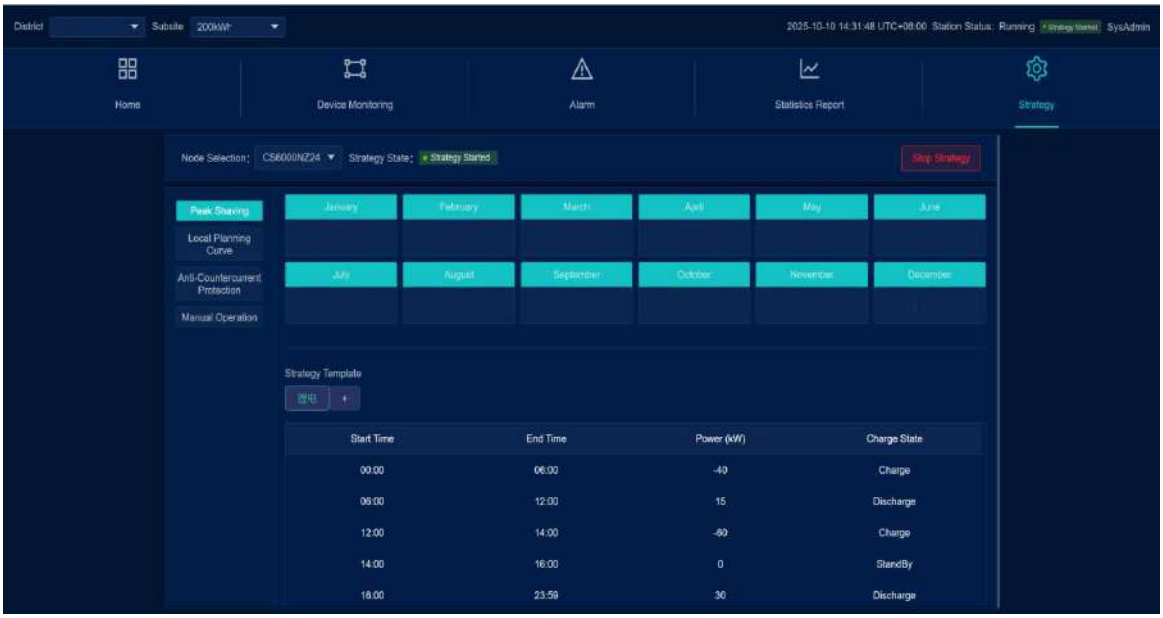

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11. Maintenance & Troubleshooting

11.1. Explain

Due to the influence of environmental temperature, humidity, dust, and vibration, the internal components of energy storage all-in-one machine may age, which can affect product performance and even lead to malfunction.

Therefore, it is necessary to implement daily and regular maintenance on the product to ensure its normal operation and service life. All measures and methods that contribute to the good working condition of the all-in-one machine belong to the scope of maintenance work.

If a malfunction occurs and the problem cannot be solved with the help of this manual, please contact our company. At the same time, provide the following information to provide you with better service:

- Photographs of Fault Site;
- Model and production serial number of energy storage integrated machine;
- Related components connected to the energy storage integrated machine, distributed energy storage power station configuration plan, and grid parameters information;
- Communication connection scheme for energy storage integrated machine;
- Fault information and brief description.

11.2. Precautions Before Maintenance

WARNING

- Do not open the door to maintain the device in rainy, humid or windy days. Master Battery shall not be held liable for any damage caused by violation of the warning.
- Avoid opening the containerdoor when the humidity is high in rain, snow or fog, and make sure that the seals around the containerdoor do not curl when the door is closed.

WARNING

- To avoid electric shock, do not perform any other maintenance operations be-yond this manual.
- If necessary, contact Master Battery customer service for maintenance.

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WARNING

Live reminder:

- There is a lethal high voltage inside the device, and if accidentally touched, there is a risk of fatal electric shock.
- Do not operate the control cables when the outdoor cabinet or external control circuit is powered on. Even if the power supply of the outdoor cabinet has been disconnected, the control circuit of the external power supply may still generate dangerous voltage inside the outdoor cabinet.

WARNING

Power off inspection requirements:

- Set up clear warning signs at the disconnection point to ensure that accidental reconnection is not possible.
- During normal operation of the machine, it is strictly prohibited to directly disconnect the AC and DC side switches to avoid the risk of arc damage to the switches. In severe cases, it may also cause damage to outdoor cabinets.
- Disconnect all external connections to the external cabinet of the account, as well as the connection to the internal power supply of the equipment.
- Ensure that all disconnected points are not accidentally reconnected.
- Use a multimeter to ensure that the relevant maintenance parts inside the equipment are completely de energized.
- Implement necessary grounding and short-circuit connections.
- Cover the adjacent potentially live parts of the operating section with insulating fabric.
- After shutdown, please wait for at least 20 minutes before opening the cabinet door.
- Some equipment inside outdoor cabinets may have heating components, which can still have high temperatures even after the equipment stops working. When operating such devices, it is recommended to wear burn resistant gloves or other protective equipment.

NOTICE

In the event of heavy snowfall at the project site, please clear the snow from the top of the equipment and the surrounding area in a timely manner.

In fair weather, it is recommendedto open the containerdoor to dehumidify the equipment.

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11.3. Maintenance Item and Interval

- This section is the recommended maintenance cycle. The actual maintenance should be adjusted according to the specific installation environment of this product.
- The power station scale, installation location and on site environment affect the maintenance cycle of this product. In sandy or dusty environments, it is necessary shorten the maintenance cycle and increase the frequency of maintenance.

11.3.1. First Grid Connection

Inspection Item	Inspection Method
Electrical connection	Check the following items. If any item does not meet the requirements, take corrective measures immediately: • Check the materials and specifications of the input and output cables • Check the materials, specifications, and orientations of the wiring terminals. • Check the sizes of bolts and the orientation of their washers.

11.3.2. Once a Month

Inspection Item	Inspection Method
ESS cabinet	• Check the cabinet for oxidation and rust. • Check the cabinet and its internal components for deformation and damage. • Check whether there are flammables on the top of the cabinet. • Check whether the welding points between the cabinet and the foundation steel plate are firm and secure, and whether there is rust or corrosion. • Check whether the lock of the cabinet door can operate smoothly and properly, • Check whether the sealing strip is fixed properly. • Check whether there are foreign matters, fallen screws, dust, dirt, or condensation inside the cabinet.
Air inlet and outlet	Check whether the air inlet and outlet of the ESS cabinet are blocked.
Cables	Check the cables for damages.
System status	• Check whether the internal devices make abnormal noises during operation. • Check whether the temperature inside the ESS cabinet is too high. • Check whether the humidity inside the ESS cabinet is within the normal range.

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11.3.3. Once Every Six Months

Inspection Item	Inspection Method
Safety function	• Check whether the emergency stop button can function properly. • Simulate a shutdown. • Check whether the warning signs and other marks on the ESS are all legible and free from dirt. Replace them in time if the signs or marks are indistinct or damaged.
Internal components	• Check the cleanliness of the circuit board and other elements and components. • Check whether the fans can operate normally and whether there is abnormal noise during operation. • Check the temperature of the heat sink and the amount of dust accumulated. Clean heat-dissipation modules with a vacuum cleaner if necessary. • Replace the air filter screen at the air inlets/outlets if necessary.
Component maintenance	• Inspect all metal components for rust and corrosion regularly (once every six months). • Perform annual inspection on contactors (auxiliary switches and miniature circuit breakers) to ensure they can operate properly. • Check the operation parameters (especially voltage and insulation). • Check whether there is a UPS that is not running. A UPS in rest needs to be charged once every six months.

11.3.4. Once a Year

Inspection Item	Inspection Method
Grounding of the cable shielding layer	Check whether the cable shielding layer is in good contact with the insulating bushing, and whether the grounding copper bar is firmly fixed.
SPD and fuse	Check whether the SPD and fuse are firmly secure d.
Wiring and cable arrangement	Check whether the cables are laid and arranged properly, and wehther there is a short circuit or other abnormal symptoms. In case of anything abnormal, take corrective measures immediately. • Check whether the cable inlet and outlet holes of the ESS cabinet are all sealed off properly. • Check if the power cables are loose. If so, fasten the cable at the specified torque. • Check the power cables and control cables for damage. In particular, check the area where the cable comes in contact with the metal surface for signs of cuts. • Check whether the insulating tapes wrapped around the power cable wiring terminals have peeled off.
Grounding and equipotential bonding	• Check whether the ground connection has been completed properly. Make sure the ground resistance does not exceed 4Ω.

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	• Check whether the equipotential bonding inside the ESS has been properly completed.

11.4. 9.4 Maintenance of Liquid CoolingSystem

The following provides the recommended maintenance periods. The actual maintenance period shall be adjusted reasonably in consideration of the specific installation environment of the product.

Factors like the power plant scale, the location, and the site environment can affect the maintenance period of the product. It is necessary to shorten the maintenance period and in- crease the maintenance frequency in the event of heavy sandstorm or dust in the operation environment.

Item	Content	Check method	Maintenance tools
Fan	Check whether the fan blades cannot rotate or are damaged. If so, replaces the fan.	1. The fan blade rotates moothly without abnormal noise; 2. No damage to fan blade. Note: Check this item at least half a year. Blade damage inspection is not mandatory.	Screwdriver with long handle
Water pump	1. Check whether over 5% of the cooling air inlet hole of the water pump is blocked. If so, clear it with a brush; 2. Visually inspect the pump body (not the joint parts) and check whether there is obvious water dripping (except condensate). If so, replace the sealing ring of the pump.	1. The water pump runs smoothly without abnormal noise; 2. There is no obvious dripping on the pump body (except condensate).	Brush
Water system	Check the high and low pressure of the water system through HMI. The high pressure should be 2.8bar and the low pressure should be 0.2 bar. 1. If the high pressure is higher than 2.8 bar, check whether the filter of the water system is dirty and blocked; 2. If the low pressure is lower than 0.2 bar, replenish the water in the system.	High pressure < 2.8bar; Low pressure＞0.2 bar	Slotted screwdriver, Phillips screwdriver, water pump, water pipe, clamp

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> **WARNING**
>
> If the BESS has a "communication failure or failure of the liquid-cooled unit", please contact the after-sales service personnel in time to ensure the functional integrity of the system.

11.5. Container Maintenance

11.5.1. Cleaning Container Appearance

Clean the top and then the sides. Wash it directly, or wash and flush with water simultaneously. Check the container appearance:

Case 1：Dirt on surface caused by water spots and dusts can be cleaned.

Case 2：Surface dirt and damaged finish, which cannot be cleaned.

Case 3：Primer is damaged, and the base material is exposed.

Maintenance Steps for Case 1:

Material:

- Cleaning cloth
- Water
- Alcohol or other non-corrosive detergent

Graphics	Description
	1. Wet the cleaning cloth (or other scrubbing tools) with water, and scrub the dirty parts on surface. 2. If the dirt cannot be cleaned with water, scrub with 97% alcohol till the surface is acceptable. (Or try to use non-corrosive detergents that are generally used locally)

Maintenance Steps for Case 2:

Material:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol

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- Brush
- Paint

Graphics	Description
	1.Polish the paint surface with blistering or scratches with an abrasive paper for a smooth surface.
	2.Wet the cleaning cloth with water or 97% alcohol, and scrub the damaged parts to remove surface stains.
	3.Perform paint repair for the scratched parts with a soft brush after the surface is dried; brush the paint as uniform as possible.

Maintenance Steps for Case 3:

Material:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Zinc primer
- Brush
- Paint

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Graphics	Description
	1. Polish the damaged parts with an abrasive paper to remove rust and other burrs for a smooth surface.
	2. Wet the cleaning cloth with water or 97% alcohol, and scrub the damaged parts to re- move surface stains and dust.
	3. Spray the parts with base material exposed with zinc primer for protection after drying of the surface. Ensure to spray to cover bare the base material completely.
	4. Perform paint repair for the damaged parts with soft brush after the primer is dried, and brush the paint uniformly.

Check whether the protective paint sprayed on casing of the product is fallen off or peeled off; if so, repair it timely.

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11.5.2. Checking Door Locks and Hinges

Check whether the door locks and hinges of the container can be used normally after cleaning. Lubricate the door lock holes and hinges properly when necessary.

11.5.3. Checking Sealing Strips

If the sealing strip is in good condition, it can effectively prevent water seepage inside the container. Therefore, carefully check the sealing strip and replace it immediately if there is any damage.

11.6. Battery Maintenance

11.6.1. Regular Maintenance and Maintenance Cycle

Below is the recommended maintenance cycle. The actual maintenance cycle should be adjusted according to the specific installation environment of this product.

The power station scale, installation location and on-site environment affect the maintenance cycle of this product. In sandy or dusty environments, it is necessary to shorten the maintenance cycle and increase the frequency of maintenance.

WARNING

Do not leave the product in a low voltage or low SOC condition for a long period of time. Loss of capacity due to the following conditions is not covered by the warranty.

- Battery discharge cell voltage is below 2.7V for 120 consecutive hours.
- Any cell cluster SOC is 0% for 120 consecutive hours.
- Battery discharge cell voltage≤ 2V.

WARNING

Over or under voltage fault & alarm (detailed information can be found in the "Communication protocol → CMU fault word and CMU alarm word".

- Fault: "Cell over voltage fault", "Cell under voltage fault", "Total over voltage fault", "Total under voltage fault".
- Alarm: "Cell over voltage alarm", "Cell under voltage alarm", "Total over voltage alarm", "Total under voltage alarm".

End users must assign a high priority to above listed faults and alarms reported by the Master Battery local controller. When an alarm or fault is triggered, the user inter- face should prominently highlight these issues. Furthermore, end users should promptly contact Master Battery for timely resolution to prevent battery warranty loss due

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to over-discharge or overcharge.

NOTICE

- In order to avoid triggering the warranty expiration condition, when the “Cell Under-voltage Fault” or “Cell Over-voltage Fault” is triggered, the user must contact the local team of Master Battery within 24 hours and follow the requirements of Master Battery to carry out the next operation.
- If the system is configured with the "active power replenishment" function, Master Battery will enable this function by default when the device leaves the factory. When the SOC is too low, the system will automatically charge the battery with a small current through this function until the SOC reaches the safety threshold (which can be set). To reduce the risk of warranty failure caused by battery undervoltage,Master Battery recommends that users do not disable the "active power up" function.

NOTICE

- If the system does not operate for a long time (7 days or more), it is recommended to increase the SOC lower limit protection value to 10% SOC or above. Please regularly monitor the SOC of the system to avoid excessive discharge that may cause warranty expiration.
- During maintenance or shutdown, if the SOC of any battery cluster is 0%, it must be charged to 15% or above within 120 hours.
- During operation, if the SOC of any battery cluster is 0%, it must be charged to 5% or above within 2 hours. Alternatively, when the SOC reaches 0%, the upper computer EMS can issue instructions to switch the system mode to the power replenishment mode.
- If the system is stored for a long time (six months or more) without running, it needs to be fully charged at least once to activate the battery before the system is used for the first time.

Maintenance performed once every two years

Inspection Item	Inspection Method
Battery cluster status and cleanliness	Check the following items. In case of nonconformity, take corrective actions immediately: • Check the battery cluster and internal devices for damage or deformation. • Check the internal devices for abnormal noise during operation. • Check whether the temperature inside the battery cluster is too high. • Check whether the internal humidity and dust of the battery cluster are within the normal ranges. If necessary, clean the battery cluster. • Check whether the air inlet and outlet of the battery cluster are blocked.
Warning sign	Check whether the warning sign and label are legible and dirty. If necessary, replace them.
Wire and cable	Check whether the switch gear and bat tery module are connected correctly and whether the battery modules are also connected correctly.
Corrosion	Check the battery cluster for internal oxidation or rust.

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Maintenance performed once a year

Inspection Item	Inspection Method
Switch gear and battery module box	Check the following items. In case of nonconformity, take corrective actions immediately: • Check whether there are flammable objects at the top of the battery cluster. • Check whether the battery cluster is secured at the fixing point on the foundation plate and whether there is rust. • Check the box for damage, paint peeling, oxidation, etc. • Check whether there are foreign objects, dust, dirt and condensate inside the battery cluster.
Wire and cable layout	The inspection must not be carried out until all internal devices of the battery cluster are powered off! In case of nonconformity found in inspection, take corrective actions immediately: • Check the cable layout for short circuit and compliance with the specifications. If case of any abnormality, take corrective actions immediately. • Check whether all wire inlets and outlets of the battery cluster are sealed properly. • Check the battery cluster for internal seepage of water. • Check whether the power cables and copper busbars are loose, and tighten them according to the aforesaid torque. • Check the power cable and communication cable for damage, especially cut marks on the surface exposed to the metal surface.
Grounding	Check whether the grounding is correct. The grounding resistance should not be greater than 4Ω.
Fan	• Check the fan for faults (e. g. locked rotor and stalling). • Check the fan for abnormal noise during operation.
Screw	Check whether screws inside the battery cluster fall off or are rusted.

Maintenance performed once every six months

Inspection Item	Inspection Method
Ambient temperature and humidity inspection	• Check whether the temperature in the ambient temperature record is within the operating range. • Check whether the humidity in the ambient humidity record is within the operating range.
Function inspection	• Check the operating status of the DC contactor: Send the Start/Stop command in the power-off status and check whether the system works properly. • Measure whether the 24V output voltage is within the range in the

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	specification. • Check whether the current, voltage and temperature in the operation record of the battery cluster are within the operating ranges.

The lifespan of lithium iron phosphate batteries depends on the conditions under which they are used, and improper usage conditions will shorten the battery's service life. During use, the battery needs regular maintenance. The maintenance process should pay attention to the following points:

1) Ambient Temperature: Keep the operating ambient temperature of the battery as much as possible between 10°C and 40°C.

2) Charging and Discharging Power: The charging and discharging power of the battery system should not exceed the maximum power designed or allowed by the project.

3) Regular Maintenance (Recommended: once every three months) of the battery system can maintain the battery system in optimal working condition and extend its actual service life. Please regularly check the system inspection and maintenance indicators. If the maintenance period is exceeded, please promptly contact professional personnel for system inspection and maintenance.

Basic Inspection Requirements (Reference):

- Voltage and temperature points are normal;
- Wiring harness has no wear, connectors are securely connected.
- During battery unit storage, a supplementary charge should be performed every three months:
- Each battery unit should be fully charged (SOC reaches 100%) at least once a week for SOC calibration.
- To achieve the best use effect of the battery system, it is recommended to perform a full charge (SOC reaches 100%) once a day.
- Starting from the most recent full charge record, the battery unit should be fully charged (including balancing) and discharged once every three months.
- Routine Inspection: Check the instrument readings or backend monitoring and battery SOC every two weeks. If SOC is below 25%, arrange charging immediately to ensure the battery SOC is between 25% and 50%.

4) Keep the battery and battery management system away from hazardous substances or materials.

5) Do not disassemble, compress, puncture, or burn the battery; short-circuiting is prohibited.

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6) Do not charge without a protection circuit or using equipment not approved by the battery manufacturer.

7) Do not dispose of batteries randomly.

8) Do not arbitrarily connect batteries of different models or different ratings in series or parallel.

9) Battery units must be charged and discharged within the specified voltage range; stop operation immediately if the range is exceeded.

10) Avoid severe vibration when loading, unloading, or transporting the integrated machine.

11) Operating Environment Requirements: The working environment of the integrated machine should be free of corrosive, explosive, and insulation-damaging gases and conductive dust, and away from heat sources.

12) If the user finds that battery power supply time is greatly shortened or the system frequently malfunctions, professional personnel should be contacted promptly for system diagnosis and maintenance.

11.6.2. Maintenance Precautions

For safe and efficient maintenance of the system, maintenance personnel must carefully read and observe the following safety requirements:

1. Have the electrician certificate issued by the Work Safety Supervision Bureau, and receive professional training before assuming their work.
2. Follow relevant safety precautions, use necessary tools, and wear personal protective equipment.
3. Do not wear metal accessories such as jewelry or watches.
4. Never touch the high-voltage positive and negative electrodes of the energy storage system by both hands at the same time under all circumstances.
5. Prior to the maintenance of the energy storage system, disconnect all high-voltage and low-voltage switches.
6. Do not clean this product directly with water. If necessary, use the vacuum cleaner to clean it.
7. Plug and remove cables in accordance with the specifications, without brute force or violent operation.
8. After maintenance is completed, clean tools and materials in time and check whether there are

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metal objects left inside or at the top of the product.

9. In case of any doubt on operation and maintenance of this product, contact the Customer Service Center of Master Battery instead of operation without permission.

11.6.3. Maintenance

1. PACK operating temperature: The working temperature should be kept between -30ºC ~ 50ºC temperature charging and discharging should be 15ºC~30ºC and typically 25ºC
2. The RACK should not be charged or discharged with high magnifying power. The continuous charging and discharging current of a single rack should not exceed the rated current.
3. When the energy storage system is not used in a long time, it should be charged once every six months, until its SOC is 30%–40%.
4. When the system is used after long-term storage, it should be fully charged at least once to restore the best performance of the battery.
5. Regularly check whether the air duct of the cooling system is blocked and clean the system. In particular, clean the air inlet and outlet of the fan and use a vacuum cleaner if necessary, to maintain free air circulation inside the cabinet. Before dust removal, the power supply must be cut off. It is forbidden to rinse the system with water.
6. Regularly check whether the fastening bolts of the high-voltage cables and connecting busbars of the energy storage system are loose, whether the contacts are in good conditions, and whether the terminal surfaces are severely corroded or oxidized.
7. Regularly check the protective covers of high-voltage positive and negative electrodes of the PACK for ageing, damage and missing.
8. Regularly check cables for loosening, ageing, damage and fracture and inspect whether the insulation is in good conditions.
9. Regularly check the battery container for pungent odor and high-voltage connections for burning odor.
10. Regularly check whether the voltage, temperature and other data of the monitoring upper computer are correct and whether there are fault alarms in the alarm column.
11. Regularly check whether the status and alarm indicators of the energy storage system are in good

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conditions and whether they work properly.

12. Regularly check whether the emergency stop button of the energy storage system can be used, in order to quickly shut down the system in an emergency.
13. Regularly check whether the fire extinguishers are in good conditions and within the validity period.
14. Never use different types of battery modules in series or parallel.
15. PACK A and PACK B are prohibited from replacing each other.

WARNING

- The battery is potentially dangerous, so appropriate protective measures must be taken during operation and maintenance!
- Incorrect operation may cause severe personal injury and property damage!
- Use the appropriate tools and protective equipment during battery operation.
- Battery maintenance must be performed by those who have battery expertise and received safety training.

11.7. Coolant Replacement

Object	Standard	Period	Tools
Coolant	1. There are obvious impurities in antifreeze; 2. Antifreeze is significantly darker in color.	5–6 years	Water pump, hose, hose clamp, slotted screwdriver. Note: Please contact Master Battery Customer Service to replace hardware facilities

WARNING

Normally coolant is not a health hazard, excessive exposure may cause irritation to the eyes, skin and breathing.

NOTICE

- The coolant in the refill tank must not exceed the "H" line.
- The brand of coolant to be replaced is limited to Great Wall and Acwell, and it is recommended to use the same brand of coolant. If you choose to mix Great Wall and Acwell coolants, the mixing ratio of different coolants is limited to 9:1.

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Personal Protection

Wear personal protective equipment (PPE) when changing coolant. PPE should comply with relevant national standards, including but not limited to the following protective equipment.

Protective parts	Protective equipment
Respiratory protection	Under normal conditions of use, it is generally not necessary to wear respiratory protection equipment. If the engineering control facility does not maintain the air concentration at a level sufficient to protect the health of personnel, choose respiratory protection equipment suitable for the conditions of use and in compliance with relevant legal requirements. If you need to wear a safety filter mask, please choose a suitable mask and filter combination. Choose a filter suitable for a mixture of particulate/organic gas and vapor [boiling point >65 ºC (149 ºC)].
Hands protection	Use oil-resistant, chemical-resistant protective gloves.
Eyes protection	Please use protective goggles.
Skin and body protection	Use non-permeable protective clothing and safety shoes.

Disposal considerations

Waste types	Disposal measures
Coolant	Discharges are made in accordance with local regulations and are not disposed of haphazardly.
Rubbish remnant	Separate and recycle, and if it meets the relevant regulations, it can be burned or reused.
Containers	Dispose of in accordance with all applicable local and national regulations. Use recovery/recycling where feasible, otherwise incineration is the recommended method of disposal. Empty containers may contain hazardous residues. Do not cut, puncture or weld on or near to the container. Labels should not be removed from containers until they have been cleaned. Contaminated containers must not be treated as household waste. Containers should be cleaned by appropriate methods and then re-used or disposed of by landfill or incineration as appropriate. Do not incinerate closed containers.

Accidental release measures

When a coolant leak occurs, refer to the following measures to deal with it.

- Immediately contact a professional to have uninvolved persons evacuated quickly to safety.
- Cut off the source of the spill as far as possible and prevent it from entering spaces such as

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sewers, drains and bodies of water.

- When cleaning up spilled liquids, wear protective equipment to protect your body from contact with the spilled or released material.
- Use sand, mud or other materials that can be used as barriers to set up barriers to prevent diffusion. Recover liquid directly or store in absorbent. Clean the contaminated area with detergent, water and a hard broom. Put the collected liquid in a disposable container.

First aid mesures

Contact method	Measures
Inhalation	Move to fresh air. If breathing has stopped, give artificial respiration first aid. Seek medical attention.
Skin contact	Take off contaminated clothing. Rinse the skin thoroughly with soap and water. Seek medical attention if skin inflammation or rash occurs.
Eyes contact	Flush eyes with plenty of water for at least 15 minutes. Seek medical attention.
Ingestion	If ingested, but conscious, water or milk to drink and actively seek medical help, do not induce vomiting unless instructed by healthcare patients. If you cannot get help from a doctor, please send the patient and the container and label to the nearest medical emergency center or hospital. Do not give any food to unconscious patients.

11.8. Common Troubleshooting

WARNING

In the Fault/Malfunction state, the PCS AC circuit breaker may be in the tripped (open) state. When resetting and powering on, be sure to check and re-energize the system.

Sr	Observation	Possible Reasons	Actions
1	Operation indicator light off	System not powered on or operation indicator light malfunction.	Check if the system is powered on and if the indicator light is working properly. Replace the indicator light if damaged.
2	Fault indicator light on	Faults such as undervoltage, overfrequency, overcurrent, etc., in the system will cause the fault indicator light to illuminate.	To operate the system, follow the shutdown/startup procedure to restart the product. If the fault light remains on after restarting the system, please contact our customer service
3	AC over voltage	Grid voltage too high	After confirming the AC input voltage is normal, close the AC circuit breaker again.
4	AC under voltage	Grid voltage too low	After confirming the AC input voltage is normal, close the AC circuit breaker again.

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5	AC over current	AC load current exceeds protection limit	After power off, check the condition inside and outside the cabinet. If no abnormalities are found, reset the fault and try starting the system with low power, gradually increasing the power to the rated value. If the issue persists, please contact our customer service.
6	Battery fault	Battery cell overvoltage, undervoltage, overtemperature, undertemperature, communication failure	Observe if the fault is caused by the operating environment. Once the operating conditions are met, start the equipment. If the fault is not caused by environmental factors, please contact our customer service.
7	Battery management system fault	Battery management slave or master control malfunction, program issues	Disconnect the AC power supply and restart the product. If the fault persists, please contact our customer service.
8	Cabinet paint peeling of f	-	Repaint the cabinet
9	Loose, unfastened, or damaged mounting screw	-	Re-secure or replace the mounting screws.
10	High-voltage wiring harness damag	-	Replace the high-voltage wiring harness.
11	Low-voltage wiring harness damag	-	Replace the low-voltage wiring harness.
12	High-voltage connector damage	-	Replace the high-voltage connector.
13	Low-voltage connector damage	-	Replace the low-voltage connector.

11.9. Battery Cluster Replace/Repair

1. Power down the system according to the normal power down procedure (make sure that the DC side switch and the AC side grid-connected circuit breaker are in the "OFF" position), and cut off the rest of the auxiliary power supply;
2. Remove the power supply and communication harness of the battery cluster and contact our after-sales service personnel.

NOTICE
Customers are advised not to replace or repair the battery unit unless absolutely necessary. Please contact Master Battery Support in case of needed. The battery system is high-voltage equipment and will remains charged at all times. Only qualified personnel with the proper training and equipment are allowed to perform replacements or maintenance of battery.

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12. Appendix

12.1. Abbreviations

Abbreviation	Definition
B	
BM	Battery Module (or PACK)
BC	Battery Cluster (or RACK)
BMU	Battery Management Unit
BCMU(CMU)	Battery Cluster Management Unit (CMU for short)
BSMU(SMU)	Battery System Management Unit (SMU for short)
BMS	Battery Management System
BSC	Battery System Controller
BCP	Battery Collection Panel. Battery DC inputs are combined into the BCP DC copper bar, and connected to the PCS DC side through the copper bar on the other side of the BCP.
BSP	Battery Power Supply Panel. It is used as an auxiliary power supply for the components inside the battery, such as lighting, FSS, etc.
D	
DC/DC	DC/DC Converter
L	
LC	Local Controller
P	
PCS	Power Conversion System
S	
SCADA	Supervisory Control and Data Acquisition System
S/G	Switch Gear
SOC	State Of Charge
SOH	State Of Health

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12.2. Technical Data

Product	SCS-261kWh	
Product Mode	LFP battery energy storage system	
	AC Side	
S.N.	Item	Specification
1	Rated Power	125kW
2	Rated Grid Voltage	AC 400V
3	Grid Voltage Range	AC 340V~460V
4	Distribution Power Supply	AC 220V
5	AC Access Method	Three-phase four wire system
6	Grid Frequency Range	50±2.5Hz
7	Grid Voltage Range	-15% ~ +15%
8	Total Harmonic Distortion Rate of Current	≤3% Full Load
9	Power Factor	-1 ~ +1
	DC Side	
S.N.	Item	Specification
10	Battery Cell Type	LFP 314Ah
11	System Configuration	5×1p52s
12	Installed Energy Capacity	261.248kWh
13	Voltage Range	DC 728V ~ 923V
14	Nominal Voltage	832V
15	Rated DC Current	157A
16	Maximum DC Current	179.4A
17	Operating Temperature Range	0℃~55℃ (Charge)-30℃~55℃
	System Specification	
S.N.	Item	Specification
18	Overall Dimension (W×D×H)	1100mm×1400mm×2350mm
19	Maximum Efficiency	Under Rated ≥90%
20	Operating Temperature	-30℃ ~ +55℃
21	Allowable Relative Humidity	≤95% Free of condensation
22	Noise	≤75dB
23	Cooling Method	PCS:Air-cooling / Battery:Liquid Cooling
24	Protection Grade	IP55
25	Altitude	≤2000 m.a.s.l.
26	Weight	3t
27	Communication Protocol	MODBUS TCP、IEC104、4G

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12.3. Tightening Torques

To avoid poor contact caused by the loosening of copper cable lugs due to stress, and to prevent heat or even fire due to increased contact resistance, make sure to tighten the screws on the cable lugs at the recommended torques:

Bolt	Torque (N·m)	Bolt	Torque (N·m)
M3	0.7–1	M8	18–23
M4	1.8–2.4	M10	34–40
M5	4–4.8	M12	60–70
M6	7–8	M16	119–140

*Torque values listed in the table are intended for the bolt and nut assembly, and do not apply to riveted nuts or riveted screws, etc. The torque to be adopted should depend on the actual situation.

**Secure the cable at a proper point to reduce the stress on the cable lug.

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13. After-sales Service

Master Battery Storage provides comprehensive technical support and after-sales service to customers. The Standard Warranty period will be specified in the contract. The following situations are not covered by Master Battery Standard Warranty service:

- Damage to the system or faults caused by failure to operate according to the user manual.
- Damage or faults caused by improper wiring and power supply not in accordance with relevant electrical safety standards, or damage caused by poor on-site environmental conditions.
- Damage or faults caused by irresistible natural factors such as typhoons, earthquakes, floods, fires, or severe environmental conditions (high temperature, low temperature, high humidity, high salinity, etc.).
- If the user fails to maintain the initial fault state, does not notify the manufacturer in a timely manner, and attempts to resolve the issue independently after a fault occurs, resulting in the inability to analyze or handle the fault cause effectively and appropriately.

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14. Appendix I: Quality Assurance

- Products that fail during quality assurance.
- We will repair or replace new products free of charge.

1. **Evidence**

During the warranty period, the company requires customers to produce invoices and dates for purchasing products. At the same time, the trademark on the product should be clearly visible, otherwise it has the right not to give quality assurance.

2. **Conditions**

- Unqualified products after replacement shall be handled by our company.
- Customers should reserve reasonable time for the company to repair faulty equipment.

3. **Immunity from liability**

In the following circumstances, the company has the right not to undertake quality assurance:

- The whole machine and parts have exceeded the free warranty period.
- Transportation damage.
- Improper installation, modification or use.
- Operating in very harsh environments beyond those described in this manual.
- Machine failure or damage caused by installation, repair, alteration or disassembly by non-company service personnel.
- Any installation and use beyond the scope specified in the relevant international standards.
- Machine failure or damage caused by the use of non-standard or non-approved components or software.
- Damage caused by abnormal natural environment causes product failure due to the above situation. Customers require maintenance services. After judging by the company's service agencies, it can provide paid maintenance services.

In order to continuously improve customer satisfaction, the company's products and product manuals are in the process of continuous improvement and upgrading. If there is a difference between the manuals and the products in your hand, it may be the reason for the edition, please refer to the specific products. If you still have questions, please contact us.

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