FelicityESS™

USER MANUAL

(FLS-ES232LC-G)

Outdoor Liquid-cooled Energy Storage Cabinet

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Overview

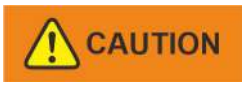
This Document is designed to elaborate the methods for the installation, electrical connection, commissioning, and troubleshooting of the outdoor liquid-cooled energy storage cabinet (the "liquid-cooled cabinet"). Please read this Manual carefully for the safety information and the functions and features of the liquid-cooled cabinet before installing and using it.

Readers

This Manual is intended for power station operators and qualified electrical technicians.

Symbols

This Document may contain the following symbols, whose indications are as follows:

Symbols	Description
	It indicates a hazard carrying a high level of risk that will result in deaths or serious injuries if not avoided.
	It indicates a hazard carrying a moderate level of risk that may result in deaths or serious injuries if not avoided.
	It indicates a hazard carrying a low level of risk that may result in minor or moderate injuries if not avoided.
	It conveys safety warnings on Device or environments. It indicates Device damage, loss of data, reduced Device performance, or other unpredictable consequences if not avoided. "NOTICE" does not involve personal injury.
 Instruction	It is used to highlight important/critical information, best practices, tips, etc. "INSTRUCTION" is not about a safety warning, and does not address personal injuries, Device damage, or environmental hazards.

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1. Safety Precautions

Disclaimer

Read and follow this Manual exactly before transporting, storing, installing, operating, using and/or maintaining the Device and observe the labeling on the Device and all safety precautions stated in this Manual. In this Manual, "Device" refers to products, software, components, spare parts, and/or services to which this Manual relates; "the Company/we/our/us" refers to the manufacturer (the producer), the seller, and/or the service provider of the Device. "You" refers to the person who transports, stores, installs, operates, uses and/or maintains the Device. "DANGER", "WARNING", "CAUTION" and "NOTICE" highlighted in this Manual do not represent all safety precautions that shall be observed. You shall also comply with relevant international, national or regional standards and industry practices.

The Company assumes no responsibility for any violation of requirements for safe operation or of safety standards for the design, manufacture and use of the Device.

This Device shall be used in an environment that complies with design specifications. Otherwise, the possible Device failure, malfunction or damage to parts of the Device shall not be covered by the warranty; and the Company shall not be liable for the compensation for the resultant personal injuries or deaths, property damage, etc.

All operations such as transportation, storage, installation, operation, use and maintenance shall comply with applicable laws, regulations, standards and specifications.

The Company shall not be liable for any of the following or the results there of:

- Damage to the Device caused by earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure;
- Not operating under the operating conditions described in this Manual;
- The installation and use in an environment that does not meet the relevant international, national or regional standards;
- The installation and use of the Device by unqualified personnel;
- Failure to follow the operating instructions on the product and safety warnings in the Document;
- Unauthorized disassembly, alteration of the product or modification of the software code;
- Damage caused by transportation by you or a third party you have commissioned;
- Damage caused by storage conditions that do not meet the requirements of the product documentation;
- Your own materials or tools do not meet the provisions of local laws and regulations and relevant standards; or damage caused by you or a third party due to negligence, intent,gross negligence, improper operation, or for reasons not attributable to the Company.

1.1 Personal safety

DANGER	Hot-line work is prohibited. Do Not install or remove cables with power on. A transient contact between the cable core and the conductor may generate electric arcs, electric sparks, fires or explosions, which may lead to fires or personal injuries.
DANGER	When the Device is powered on, improper or incorrect operations may cause fires, electric shocks or explosions, resulting in personal injuries or property damage.
DANGER	Do Not wear watches, bracelets, bangles, rings, necklaces, or other conductive objects during the operation to avoid electric shock and burns.
DANGER	Use dedicated insulated tools to avoid electric shocks or short-circuit faults. The level of insulation and dielectric strength shall meet the provisions of local laws, regulations, standards and codes.
WARNING	Always wear protective clothing, insulated shoes, goggles, safety helmets, insulating gloves and other specialized protective Device during operation.

General requirements

- Do Not deactivate Device protection devices or ignore warnings, cautions and precautions in the Manual and on the Device.
- Stop the operation immediately where a fault that may cause personal injuries or Device damage is detected during operation, report the fault to the person in charge, and take effective protective measures.
- Do Not power on the Device before it is fully installed and confirmed by a qualified person.
- Do Not directly contact, or indirectly contact the power supply Device with another conductor or a damp object. Measure the voltage at the point of contact to ensure that there is no risk of electric shock before contacting any conductor surface or terminal.
- Do Not touch the shell of the Device when it is running at a high temperature, which may cause burns.
- Do Not touch the operating fan with fingers, parts, screws, tools, or veneers to avoid injuries to hands or damage to the Device.
- Evacuate the building or Device area and press the fire alarm or call the fire alarm in case of fire. Do Not re-enter a burning building or the Device area under any circumstances.

Personnel requirements

- The personnel who operate the Device shall be professional or trained.

- Professional: a person who is familiar with the principles and configurations of the Device, who has received the training for the Device or has the experience in operating the Device, and who is aware of the sources and levels of potential hazards during installation, operation, and maintenance of the Device.

- Trained personnel: a person who has received the required technical and safety training and the necessary experience to be aware of the risks that may be posed to him/her in an operation and to take measures to minimize the risks to himself/herself or to others.

- The Device installation and maintenance personnel shall be fully trained to properly operate the Device and be aware of various safety precautions and relevant standards of the countries/regions where the Device is located.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the Device.
- Only qualified professionals are allowed to disassemble safety facilities and service the Device.
- Personnel working in special settings, such as electrical operations, work at heights, or operation of special Device, shall have special operating qualifications required by the local country/region.
- Medium voltage Device operators shall hold a high voltage electrician's operating certificate.
- Replacement of Device or parts shall be done by an authorized professional.
- Persons other than those operating the Device shall keep away from the Device.

1.2 Electrical safety

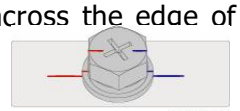
DANGER	Make sure the Device is intact before making an electrical connection to avoid electric shocks or fires.
DANGER	Improper or incorrect operations may cause accidents such as fires or electric shocks.
DANGER	Do prevent foreign objects from invading the Device during operation, as this may result in short-circuit failure or damage to it, derating or loss of power to the load, and personal injuries.
DANGER	When installing the Device that requires grounding, the protective ground wire shall be installed first; when removing it, the protective ground wire shall be removed last.
WARNING	Cables are not allowed at the air inlet or outlet of the Device.

General requirements

- Installation, operation and maintenance shall be conducted by the sequence of steps in this Manual. Do Not modify, add or change the Device, or change the installation sequence without authorization.
- It is necessary to obtain the permission from the power department of the country or region in which the power plant is located before it can be connected to the grid.
- Observe the safety regulations of the power plant, such as the work & operation ticket system.
- Install temporary fences or warning ropes and hang "No Entry" signs in the working area, where the non-staff are forbidden to enter.
- Disconnect the Device and its front and rear switches before installing or removing power cables.
- Turn off the power immediately where liquid is detected inside the Device, and stop using the Device.
- Carefully check if the tools used meet the requirements and keep a record before operating the Device; and collect the tools used by number after operation to prevent them from being left inside the Device.
- Make sure that the cable labels are correctly labeled and that the cable terminals are well insulated before installing the power cables.
- When installing the Device, use a torque tool with the appropriate range to tighten the

screws. When tightening with a spanner, make sure that the spanner is not skewed and that the tolerance of the torque value does not exceed 10% of the specified.

- Use a torque tool to fix the screws, and double-check them with red and blue markings. Apply blue markings to the screws after the installer confirms that the screws are tightened; and apply red markings (mark lines across the edge of the screw) after the inspector confirms that the screws are tightened.



- Ensure that all protective shells and insulation sleeves of the electrical components are in place after installation to avoid the risk of electric shocks.
- Disconnect all inputs and wait until the Device is completely powered off before operating the Device in case the Device has multiple inputs.
- Disconnect the corresponding output switch of the power supply Device for maintenance of the electrical Device or the distribution Device at the rear of the power supply Device.
- When performing maintenance on the Device, hang a "No Switching On" sign on the uplink and downlink switches or the circuit breakers, and post a warning sign to prevent accidental connections. The fault shall be rectified before the power is reapplied.
- In fault diagnosis and troubleshooting, the following safety precautions shall be taken if a power cut is needed: power cut > electric test > installation of a grounding wire > hanging of a sign and installation of a shield.
- Check the screws of the Device connection terminal on a regular basis to make sure they are tightened securely.
- Damaged cable shall be replaced by professionals to avoid risks.
- Do Not alter, damage, or cover the signs and nameplates on the Device, and replace any signs or nameplates that have become illegible due to long-term use.
- Do Not clean internal or external electrical components with water, alcohol, oil or other solvents.

Grounding requirements

- The grounding impedance of the Device shall meet local electrical standards.
- The Device shall be permanently connected to a protective earth. Check the electrical connection of the Device to ensure that it is reliably grounded before operating the Device.
- Do Not operate the Device without a grounding conductor.
- Do Not tamper with the grounding conductor.

Wiring requirements

- Cable selection, erection, and wiring shall follow local laws, regulations, and codes.
- Looped or twisted cables are prohibited in placing power cables. Replace the power cord in case of insufficient length. Do Not make a joint or solder joint in the power cord.
- All cables shall be securely connected, well insulated, and of appropriate specifications.
- Cable slots and holes shall be free of sharp edges, and the positions of the cable conduits or holes shall be protected to avoid damage to the cables by sharp edges or burrs.
- Immediately seal the cable port with sealing clay to avoid water vapor or small animals from invading when the wiring is completed or when you have to leave during the wiring process.

- Buried cables shall be securely fixed with cable holders and cable clips, and cables in the backfilled area shall be tightly connected to the ground to prevent deformation or damage caused by force on cables when backfilling soil.
- When the external conditions (such as the laying method or the ambient temperature) change, cable selection shall be verified with reference to IEC-60364-5-52 or local regulations and codes, for example, whether the carrying capacity meets the requirements.
- The insulation layer may age or be damaged when cables are used at high temperatures. The distance between the cable and the periphery of the heat-generating device or the heat source area shall be: 500mm for parallel position and 300mm for cross position.
- When the temperature is too low, violent shocks or vibrations may cause brittle cracking of the plastic sheath of the cable. The following requirements shall be followed to ensure construction safety:
  - All cables shall be laid and installed above 0℃. Handle cables with care, especially in low-temperature environments.
  - Move the cables to and stand them in the room temperature environment for more than 24 hours before laying the cables in case the temperature of the cable storage environment is below 0℃.
- Do Not push down the cable directly from the vehicle or perform other irregular operations to avoid cable damage that degrades cable performance in current carrying and temperature rises.

1.3 Environmental requirements

DANGER	Do Not place the Device in an environment exposed to flammable or explosive gases or fumes, and do Not perform any operations in such an environment.
DANGER	Do Not store inflammable or explosive materials in the Device area.
DANGER	Do Not place the Device near sources of heat or ignition, such as fireworks, candles, heaters or other heat generating devices, as heat may damage the Device or cause a fire.
WARNING	The Device shall be installed away from liquids, and shall not be installed under water pipes, air vents or other locations that are prone to condensation; nor shall it be installed under air conditioning vents, ventilation openings, computer room windows or other locations that are prone to leakage of water to prevent liquids from entering the interior of the Device and causing Device malfunctions or short-circuits.

WARNING

When the Device is in operation, do Not block the air vents, cooling system or cover them with other items to prevent damage or a fire presented by high temperatures to the Device.

General requirements

- The Device shall be stored in a clean, dry, well-ventilated area with a suitable temperature and humidity, and shall be protected from dust and condensation.
- Do Not install or operate the Device beyond the range specified in the technical specifications to ensure the performance and safety of the Device.
- Do Not install, use, or operate outdoor Device or cables (including but not limited to handling Device, operating Device and cables, plugging and unplugging signal interfaces connected to the outdoor area, working at heights, outdoor installation, opening doors, etc.) in severe weather conditions such as thunder and lightning, rain, snow, or strong breeze.
- Do Not install the Device in an environment exposed to dust, fumes, volatile gases, corrosive gases, infrared or other radiation, organic solvents, or high salt content.
- Do Not install the Device in an environment exposed to metallic conductive dust or magnetic dust.
- Do Not install the Device in an area that is susceptible to fungus, molds or other microorganisms.
- Do Not install the Device in an area exposed to strong vibrations, strong noise sources, or strong electromagnetic field interference.
- Site selection shall comply with local laws and regulations and relevant standards.
- The ground surface for installation of the Device shall be solid, free of unfavorable geology such as rubber soil, soft soil or sinkable soil. Do Not select low-lying areas or water-prone areas. The water level of the site shall be higher than the highest water level ever recorded in the area.
- Do Not install the Device in a location that can be flooded by water.
- Where the Device is installed in a site with thick vegetation, the ground under the Device shall be hardened, for example, paving cement or gravel in addition to routine weeding.
- Clear the water, snow, ice, or other debris at its top before opening the door to prevent debris from falling into the Device when installing, operating, or maintaining it.
- Make sure that the installation surface is sturdy enough to meet the load-bearing requirements for the Device when installing it .
- The cable holes shall be sealed. Seal the routed cable holes with sealing clay, and seal the unrouted cable holes with the cover supplied with the Device.
- Remove empty packing materials, such as cartons, foam boxes, plastics, cable ties, etc., from the Device area after installing the Device.

1.4 Mechanical safety

WARNING	Tools shall be fully prepared and inspected by professional institutes. Do Not use tools with scars, unqualified tools, or those beyond the validity period of inspection. Make sure tools are firm and not overloaded.
WARNING	Before installing the Device into the cabinet, make sure that the cabinet is fixed properly to avoid tilting and collapsing due to an unstable center of gravity, which may cause injuries to the installer and damage to the Device.
WARNING	Be careful of unstable or heavy Device installed in the cabinet when pulling the Device out of the cabinet to avoid being crushed or injured.
WARNING	Do Not drill holes in the Device. As it may damage the sealing, internal components, and cables of the Device, and metal shavings from drilling may fall into the Device and cause a short circuit of the circuit board.

General requirements

- Repair paint scratches that occur during transportation and installation of the Device in a timely manner. Long-term exposure of the scratched parts is strictly prohibited.
- Without our assessment, do Not perform arc welding, cutting or other operations on the Device.
- Without our assessment, do not install other Device on top of the Device.
- Protect from the top of the Device to prevent it from damage when working in the space above the top of the Device.
- Use right tools and know how to use them properly.

Safe handling of heavy objects

- When handling heavy objects with a forklift, keep the forklift in the middle to prevent it from tipping over. Fasten the Device to the forklift with a rope before moving it. Perform special supervision when moving the Device.
- Choose sea or better road conditions when transporting the Device. Do Not transport the Device by railway or by air. Minimize bumps and tilts in transit.

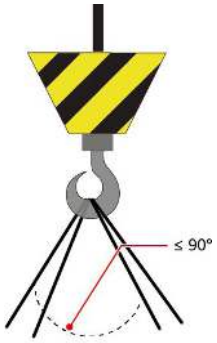
Ladder safety

- Use wooden or insulated ladders in electrical operations or work at heights.
- Priority shall be given to platform ladders with protective rails. Do Not use single straight ladders.
- Make sure that the ladder is in good condition and the ladder's load capacity meets the requirements before using it. Overweight use is prohibited.
- Place the ladder in a secure place, and the ladder shall be held by another person during operation.

- Keep steady and make sure that your center of gravity does not deviate from the edge of the ladder when climbing it to reduce risks for safety.
- Secure the pull ropes when using a step ladder.

Lifting safety

- Personnel carrying out lifting operations shall be trained and qualified before they are allowed to work.
- Temporary warning signs or fences shall be erected to isolate the lifting area.
- The foundation for the lifting operation shall meet the load-bearing requirements for the crane work.
- Make sure that the lifting tools are securely fixed to a fixture or wall that meets the load-bearing standard before lifting.
- Do Not walk underneath the crane arms or lifted objects during lifting.
- Do Not drag the steel wire ropes or the slings for lifting loads, and do Not use hard objects to impact the crane during lifting.
- Make sure that the angle between the two ropes is not greater than 90° during lifting, as shown in the figure below.



Drilling safety

- Obtain customer and contractor approval before drilling.
- Always wear PPEs such as goggles and protective gloves when drilling. Avoid pre-buried pipes or lines when drilling to avoid short circuits or other hazards.
- Protect the Device from debris when drilling, and clean up debris after drilling.

1.5 Device safety

1.5.1 Energy storage system safety

DANGER	Do Not open the cabinet door while the system is running.
DANGER	Avoid standing at the cabinet door (including within the opening range of the door) when the energy storage system is malfunctioning.
CAUTION	Evacuate the site urgently when the audible and visual alarms for fire are triggered.
NOTICE	The energy storage system shall be fenced off. Safety warning signs shall be erected for isolation to prevent unauthorized personnel from entering during operation, which may lead to personal injuries or property damage.

- The installation layout of the energy storage system shall meet the fire distance or firewall requirements stipulated by local standards, including but not limited to code requirements of the GB 51048-2014 Design Code for Electrochemical Energy Storage Power Stations and the NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.
- The energy storage system shall be inspected against fires on a regular basis, specifically, not less than once per month.
- When inspecting the system with power on, pay attention to the hazard warning signs on the Device and avoid standing at the cabinet door.
- After the power components of the energy storage system are replaced or the cable connections are changed, manually start a cable inspection and topology identification to avoid system exceptions.
- Users are recommended to provide their own camera devices to record the detailed process of installation, operation and maintenance of the Device.

1.5.2 Battery safety

DANGER	Do Not expose the battery to high temperatures or heat-generating Device such as hot sunlight, fires, transformers, heaters, etc. Overheating of the battery may cause leakage, smoke, release of flammable gases, thermal runaway, fires or explosion.
DANGER	The battery shall not be subjected to mechanical shocks, drops, collisions, punctures with hard objects or pressure shocks, as this may cause damage to the battery or fires.
DANGER	Do Not disassemble, modify or damage the battery (e.g. inserting foreign objects, crushing, immersing in water or other liquids), so as to avoid leakage, smoke, release of flammable gases, thermal runaway, fires or explosion.
DANGER	Do Not allow the battery terminals to be exposed to other metal objects, as this may cause heat or electrolyte leakage.
DANGER	Using or replacing batteries of incorrect type poses a risk of fires or explosion. Use batteries of the type recommended by the manufacturer.
DANGER	Battery electrolyte is toxic and volatile. Avoid contact with the leaking liquid or gas when there are electrolyte leaks or abnormal odor. Keep the battery away from non-professionals and contact a professional immediately. Professionals shall wear goggles, rubber gloves, gas masks, protective clothing, etc. Power off the Device in a timely manner, take out the leaking batteries, and at the same time, contact a technical engineer to deal with the problem.
DANGER	The battery is a closed system that does not release any gases under normal operation. In the event of extreme abuse, such as fire, puncture, crushing, lightning strikes, overcharging, or other severe conditions that may result in thermal runaway of the battery, which may result in battery breakage or abnormal chemical reactions within the battery, leading to electrolyte leakage or generation of gases such as CO, H2, etc., it is important to ensure that measures for venting of flammable gases are in place at the site to avoid combustion or corrosion of the Device.
DANGER	Battery combustion produces gases that irritate eyes, skin and throat. Please be careful.
WARNING	The battery shall be installed from liquids, and shall not be installed underneath air conditioning vents, ventilation openings, computer room windows, water pipes or other locations that are prone to leakage of water to prevent liquids from invading the interior of the Device and causing Device malfunctions or short-circuits.

WARNING	During battery installation and commissioning, fire fighting facilities, such as fire sand and carbon dioxide extinguishers, shall be equipped according to the construction standards and regulations. Make sure that the firefighting facilities meet the requirements of local laws, regulations and codes before putting into operation.
WARNING	Before unpacking the battery, make sure the outer packing box is intact and correctly placed according to the labels on the packing box when storing and transferring the battery. Do Not place the battery upside down, sideways, upright or tilted, and stack in accordance with the stacking requirements on the outer packing to avoid any battery damage or scrap caused by any collision or drop.
WARNING	After unpacking the battery, place it in the required direction. Do Not leave them upside down, sideways, upright, tilted or stacked to avoid any battery damage or scrap caused by any collision or drop.
WARNING	Tighten the fastening screws on the copper bars or cables according to the torque specified in this Manual. Regularly check whether the fastening screws are tightened, and whether there is any rust, corrosion or other foreign matters, and dispose of them if any; and loose screws will, otherwise, lead to excessive voltage drop, and even burn the battery by generating a large amount of heat when the current is high.
WARNING	After the battery is discharged, charge the battery in time; otherwise, the battery may be damaged due to over-discharge.

Disclaimer

The Company shall not be liable for damage to the batteries supplied by the Company and other results caused by the following reasons:

- Damage to the battery caused by earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure;
- Direct damage to the battery caused by the operating environment of the Device at the site or external power parameters that do Not meet the environmental requirements for normal operation, including but not limited to too high or too low actual operating temperature of the battery, and frequent power outages due to unstable power grid, etc.;
- Battery damage, drop, liquid leakage, rupture, etc. caused by improper operation or failure to connect the battery as required;
- Damage caused by over-discharge of the battery due to failure to power up the battery in time after the battery is installed and connected to the system on site;
- Battery damage caused by not timely acceptance due to your reasons;
- Your failure to correctly set the battery operation and management parameter;
- Your mixed use of the batteries provided by us with other batteries, resulting in accelerated capacity degradation, including but not limited to: mixing with other brands of batteries, mixing with batteries of different rated capacities, etc;
- Your improper maintenance causes frequent over-discharge of the battery, and your on-site expansion or failure to fully charge the battery for a long time;
- Your failure to properly maintain the battery according to the operation manual of the supporting Device, including but not limited to: not regularly checking whether the battery terminal screws are tightened, etc.;
- Battery damage caused by your failure to follow the storage requirements (e.g., stored in a humid, rain-prone environment);
- Overdue storage, and consequent loss of capacity or irreversible damage to the battery due to your failure to charge in a timely manner;
- Damage to the battery caused by you or a third party, including but not limited to: relocating or installing the battery without following the requirements of the Company;
- Your change of the usage scenario of the battery without consulting us;
- Your voluntary connection of additional loads to the battery;
- The battery has exceeded its maximum storage period;
- The battery has exceeded its warranty period. Batteries that have exceeded the warranty period carry certain safety risks and are not recommended for continued use.

General requirements

NOTICE

Please use the battery configured by the Company to ensure the safety of the battery and the accuracy of the battery management function. The Company shall not be liable for any battery related failures caused by the use of batteries other than those configured by the Company.

- Please read the instructions provided by the battery manufacturer and follow the requirements of the battery manufacturer before installing, operating, or maintaining the battery. The safety precautions in this Manual are intended as a reminder only. For further safety precautions, please refer to the instructions provided by the battery manufacturer.
- Use the battery within the specified temperature range. Do Not charge the battery when the ambient temperature is lower than the lower limit of the operating temperature to avoid internal short circuits of the battery due to low temperature charging.
- Do Not use damaged batteries (drops, bumps, swelling or dents in the case, etc.), which may cause leakage of liquids or release of flammable gases. Immediately contact your installer or a professional service technician for removal and replacement if the battery is damaged, such as leakage and structural deformation. Do Not store damaged batteries near other Device or flammable materials, and keep non-professionals away from damaged batteries.
- Make sure that there is no irritating or burning odor around the battery before operating it.
- Do Not place installation tools, metal parts, or debris on the battery during installation. Clean up the items on and around the battery in a timely manner after the installation is completed.
- Discontinue the installation if the battery is accidentally drenched with water, and transport the battery to a safe isolation point and dispose of it in time.
- Check whether the battery pack is abnormal before installing. An abnormal battery pack indicates one of the following phenomena:
  – The battery pack case is deformed or broken.
  – The total positive to total negative voltage of the battery pack is far below the specification range.
- Determine whether the positive and negative terminals of the battery are accidentally grounded. Disconnect the battery terminals from the ground if they are accidentally grounded.
- Do Not weld, grind, or conduct similar operations around the battery to avoid electric sparks, arcs, etc.
- Store and recharge the battery as per requirements where the battery is idle for a long time.
- Do Not charge or discharge with Device that does not comply with local laws, regulations or specifications.
- Keep the battery circuit disconnected during installation and maintenance.
- Monitor the damaged batteries during storage to make sure there are no signs of smoke, flame, electrolyte leakage, or heat generation.
- The surface temperature of a faulty battery may be too high. Avoid touching the battery against burns.
- Do Not stand, lean against or sit on the Device.
- Do Not use the battery for the following purposes in a reserve power supply scenario.
  – for medical Device directly related to human life.
  – for control Device such as trains and lifts, which may cause personal injuries.
  – for computer systems of social and public importance.
  – for locations near medical Device.
  – for Device of the same type as described above.

Short-circuit protection

- Wrap the exposed cable terminals on the battery with insulating tapes during battery installation and maintenance.
- Avoid foreign objects (e.g. conductive objects, screws, liquids, etc.) from invading the battery, causing a short circuit.

Disposal of liquid leakage

NOTICE

Electrolyte overflow may cause potential damage to the Device. Overflowed electrolyte corrodes metal objects and veneer boards, resulting in damage to the veneers.

Electrolyte is corrosive and the exposure to it may cause skin irritation and chemical burns. Take the following measures to deal with contact with battery electrolyte.

- Inhalation: Evacuate the contaminated area, get fresh air immediately, and seek immediate medical help.
- Eye contact: Immediately flush eyes with plenty of water for at least 15 minutes, do Not rub the eyes, and seek immediate medical help.
- Skin contact: Immediately wash the contact area with plenty of water and soap, and seek immediate medical help.
- Ingestion: Seek immediate medical help.

Recycling

- Dispose of used batteries in accordance with local laws and regulations. Do Not dispose of them as household waste.
- Improper disposal of batteries may lead to pollutions or explosions.
- Contact technical support or a battery recycling company to dispose of the batteries in case of leakage or damage.
- Contact a battery recycling company to dispose of the batteries in case they are out of service lives.
- Avoid exposing used batteries to high temperatures or direct sunlight.
- Avoid exposing used batteries to high humidity or corrosive environments.

2. About the Product

Introduction

This product is an all-in-one outdoor energy storage machine featuring a large capacity for industrial and commercial purposes. It is integrated with a complete energy storage system, which encompasses a battery module, intelligent BMS, bidirectional energy storage AC/DC converter (PCS)、energy management system (EMS), active fire-fighting device, intelligent chiller, etc.

This product is designed to be connected to the grid for charging. The load is powered by the grid under normal circumstances. Moreover, this product is designed for charging or discharging and the interaction with the power grid normally.

2.1 Models

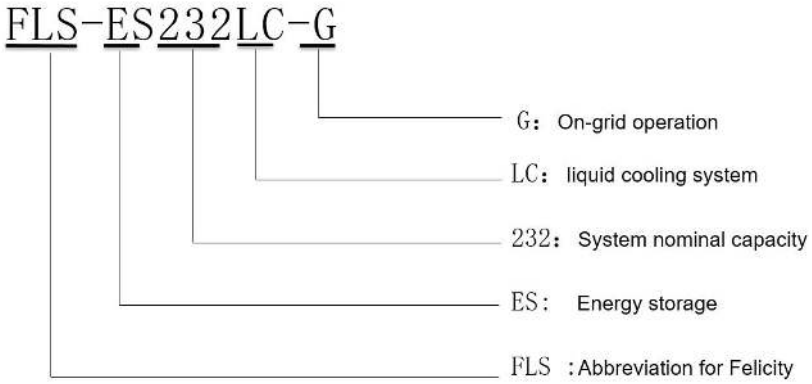


Figure 2-1 Models

Model identification:

Identification	Indications	Value
G	On-grid type	On-grid operation
LC	Cooling type	Battery PACK adopts substrate-type liquid cooling method
232	Energy rating	Battery nominal energy of 232kWh
ES	System type	Energy storage system
FLS	Enterprise code	Abbreviation for Felicity

2.2 Product features

- Highly integrated: All-in-one design
- Easy to manage: ready-to-use, on-grid operation
- Easy maintenance: self-diagnosis, fault location
- High safety: no parallel connection, no loop current, dual fire protection
- High efficiency: 94% for battery, and 87% for system
- Long life: battery cycle times ≥ 6,000 times

2.3 Product specification parameters specification parameters

The following table sets forth system parameters for the DC side, the AC on-grid side, the AC off-grid side, and the entire product:

DC side parameter					
Battery type	Lithium iron phosphate battery 280Ah	Voltage scope	650~949 V	PACK capacity and configuration	46.59kWh/1P52S
Protective measures	Circuit breaker + fuse	PACK protection grade	IP67	System capacity and configuration	232.96kWh/1P260S
Rated current	140A	Charge/discharge ratio	0.5Cp	DC side efficiency	94%
DC side parameters (on-grid)					
Rated power	100kW	Grid voltage range	AC340V~460V	Power factor adjustable range	-0.99~0.99
Rated current	145A	Grid frequency range	50Hz/60 Hz	Connection method	3P+N+PE (non-isolated)
System parameters					
Comprehensive system efficiency	87%&0.5P under standard condition	Communication mode	LAN, Modbus TCP	Fire fighting system	Aerosol + water fire protection
Depth of discharge	5~95%	Charge/discharge ratio	0.5Cp	Maximum refrigerating capacity	2.2kW
Cooling method	Liquid cooling (50% glycol aqueous solution)	Rated refrigerating capacity	5.0kW@W18/L35	Operating temperature	-20℃~55℃ (derating if the temperature > 45℃)
Cabinet ingress protection grade	Electrical compartment IP54 Battery compartment IP55	Relative humidity	5~95%RH, no condensation	Noise	<75dB
Weight	Not more than 3,000kg	Altitude	≤2,000m	External dimension (mm)	1400L×1400D×2200H

Table 2-1 Product Technical Parameters

2.4 Product appearance parameters

The following figure shows the overall appearance and length, width and height parameters of the product:

Figure 2-4 Product Appearance

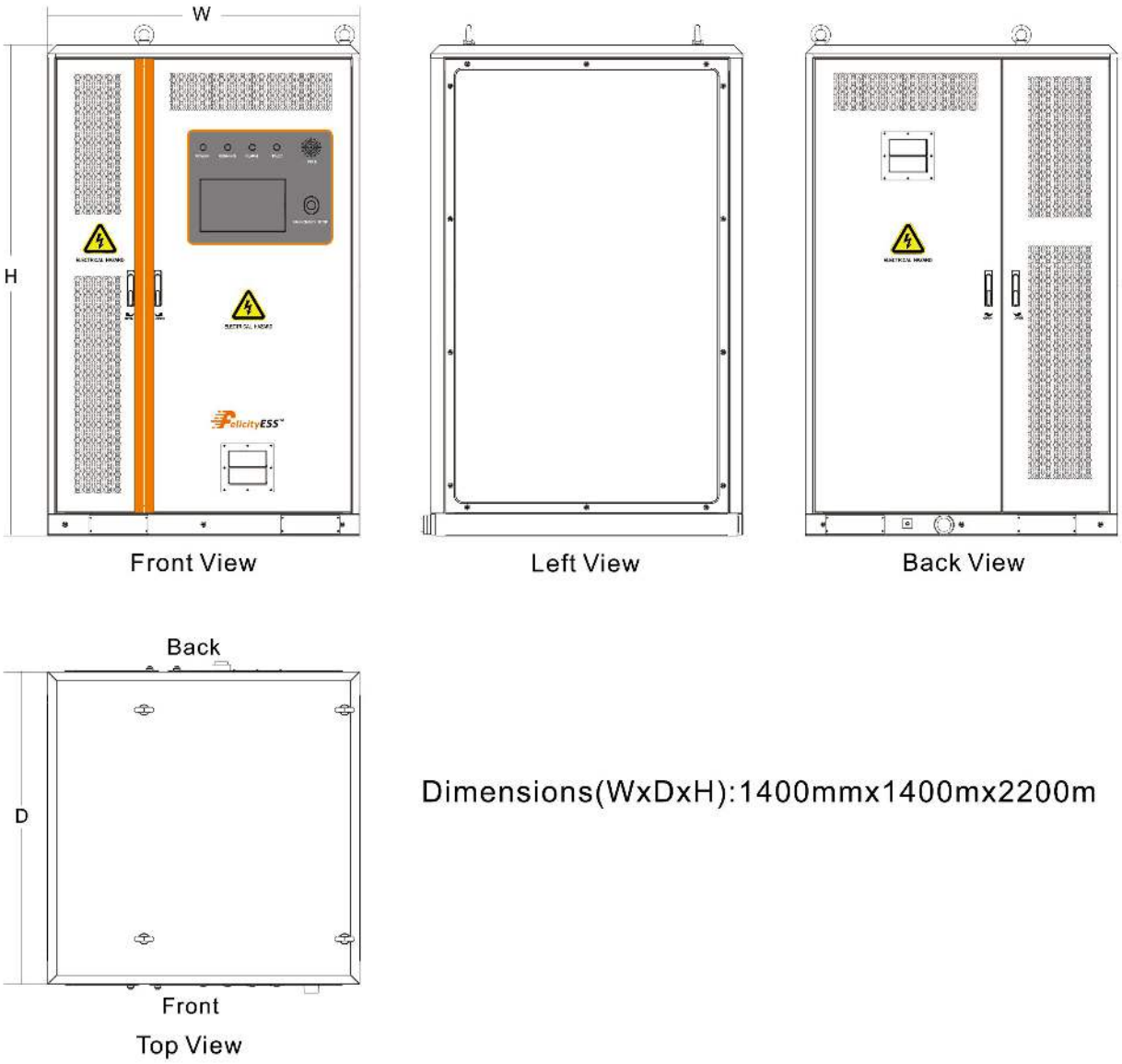


Figure 2-5 Product Dimensions

2.5 Introduction of key components

1) Cabinet periphery: The following illustration is an introduction to the peripheral components of the product with its door closed:

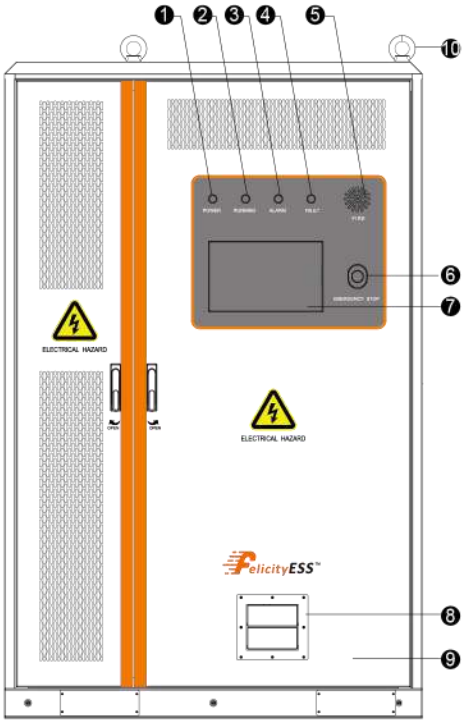


Figure 2-6 Configuration of exterior components

No.	Module description	Maximum number of configurations of a single energy storage system	Description
1	Green indicator	1	Incoming power indicator
2	Blue indicator	1	Running indicator
3	Orange indicator	1	Alarm indicator
4	Red buzzer	1	Energy storage system fault indicator
5	Audible and visual alarm	1	Fire failure alarm
6	Scram button	1	For emergency stop of the Device.
7	Touch screen	1	Touch screen
8	Inlet of the explosion-proof fan	1	Inlet of the explosion-proof fan
9	Cabinet	1	
10	Stationary rings	4	

Table 2-2 Description of Exterior Component Configuration

2) Cabinet interior: The following figure shows the components behind the front door of the product:

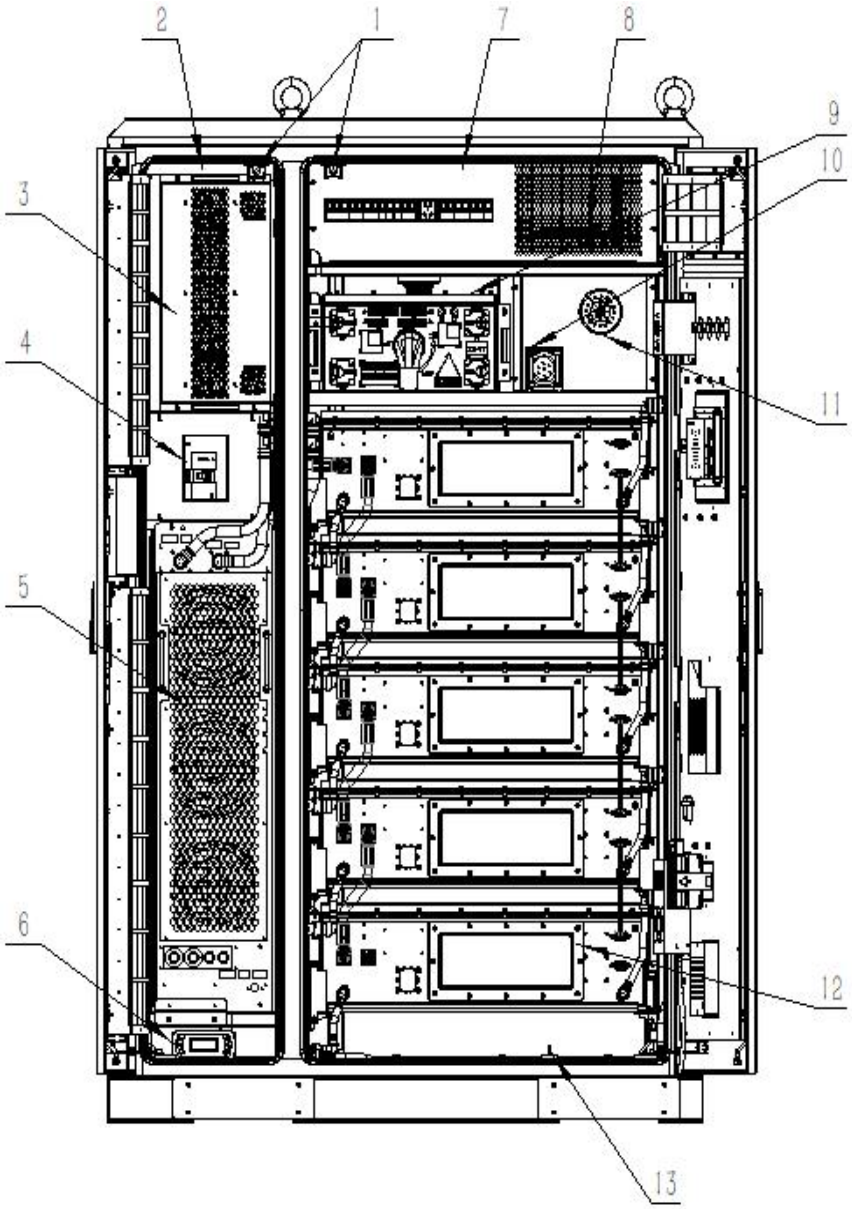


Figure 2-7 Description of Interior Component Configuration

No.	Symbols	Module description	Quantity	Description
1	SQ1-SQ2	Access control	1	Limit switch on the cabinet door
2	PMP	Lighting	1	Cabinet lighting
3	PCS	Power Conversion System	1	Controls the charging and discharging of the battery pack and converts AC and DC currents
4	QF1	Grid power circuit breaker	1	Controls the connection and disconnection of the energy storage system
5	LCS	Liquid Cooling System	1	Used for battery cooling.
6	LCS-HMI	Liquid-cooled cabinet display screen	1	Used to display parameters and settings of the liquid cooling system

7	Mountin g plate 1		1	Auxiliary power supply electrical components
8	EMS	Energy Management System	1	Communicates with PCS and BMS via LAN port and RS485 interface to realize energy scheduling of the energy storage system
9	BMS	High Voltage Box and BMS system	1	Manages and maintains individual battery cells against overcharging and over-discharging and monitors battery status.
10	FFS	Fire Fighting System	1	When the thermal runaway of the pack is detected, the fire fighting system will be activated to extinguish the fire
11	HD	Heat Detector	1	Used to detect the temperature of the battery compartment
12	PACK1-5	Battery PACK	5	A battery pack is a battery assembly in which battery cells are connected in series with a pair of positive and negative terminals for external output. It contains a battery management module. The battery management module consists of a BMU (battery management unit) and a battery optimization module.
13	LD	Water sensor	1	Used for water detection

Table 2-3 Description of Interior Component Configuration

2.6 Product electrical primary diagram

The following figure shows the electrical primary diagrams for the DC side, the AC on-grid side, the AC off-grid side, and the entire product:

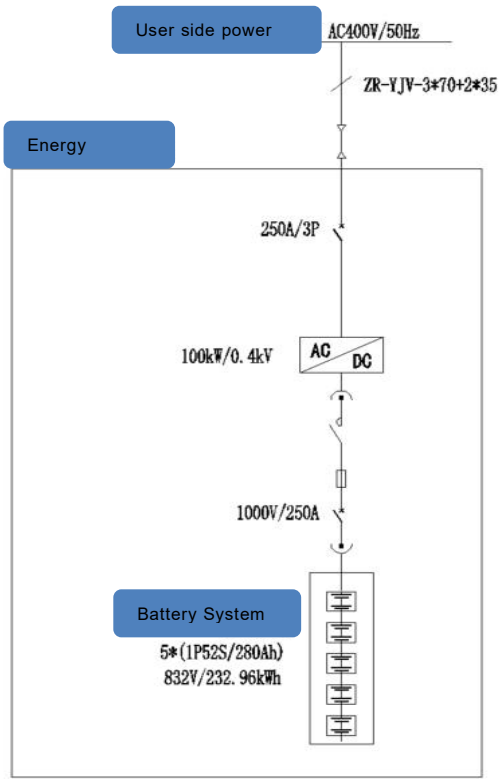


Figure 2-8 Product Electrical Primary Diagram

2.7 Product communication topological diagram

The following figure shows the communication topology of the in-product Device:

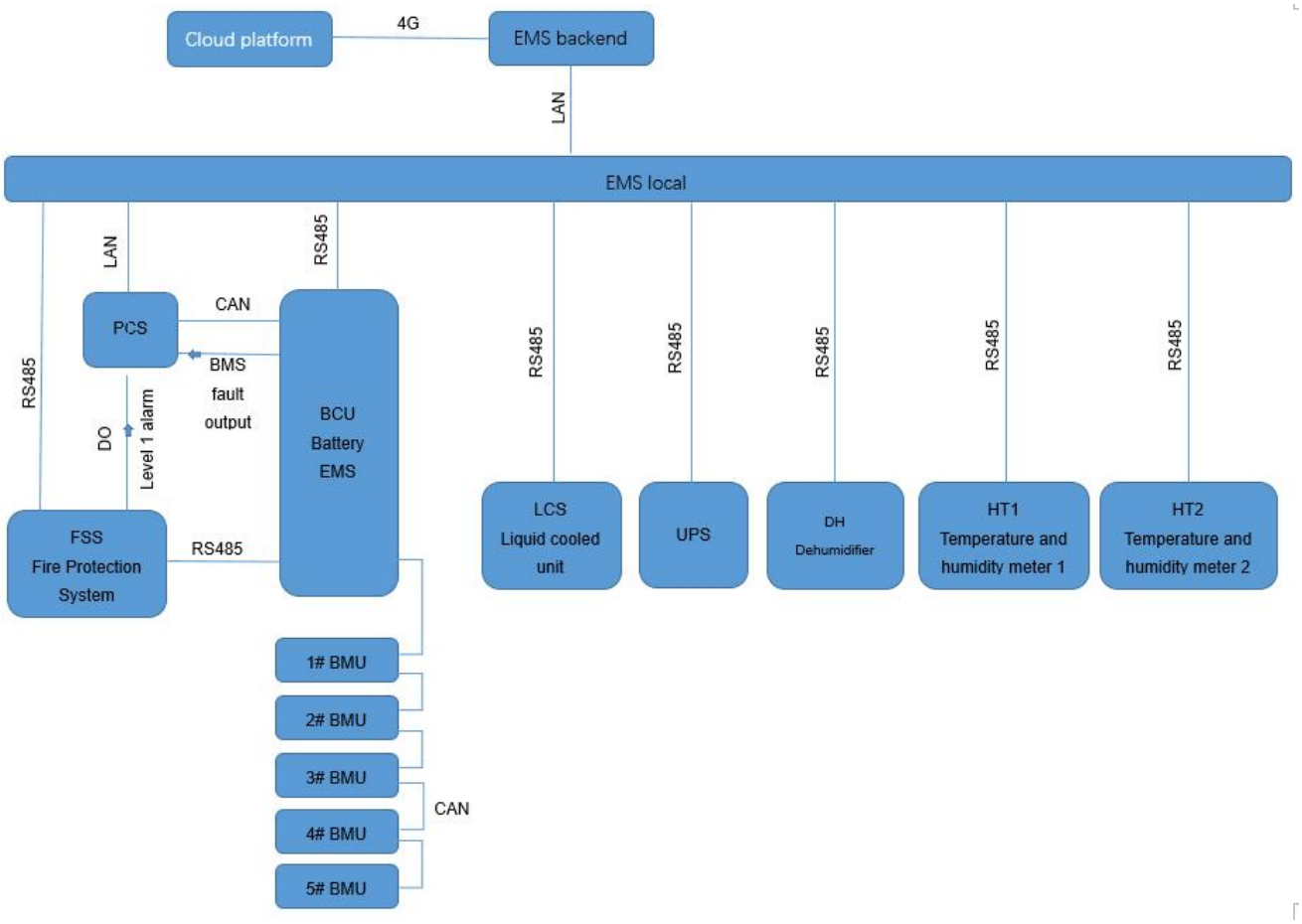


Figure 2-9 Product Communication Topological Diagram

2.8 Product application system diagram

The following is an application system diagram of the product connecting to the power grid:

The following is an application system diagram of the product connecting to the power grid:

Figure 2-10 Product Application System Diagram

3. Requirements for Transportation

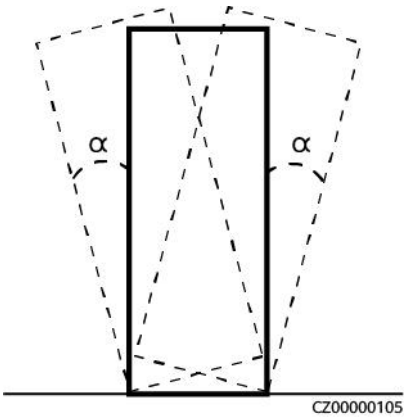
Packaging Information

No.	Name	Unit	Quantity	Description
1	Outdoor liquid-cooled energy storage cabinet	set	1	Complete with the cabinet key
2	User's Manual	copy	1	
3	Certificate of conformity	copy	1	
4	Ex-factory test report	copy	1	

Table 3-1 Product Packaging Information

3.1 Packaging requirements

- When handling the Device manually, always wear protective gloves, safety shoes and other PPEs to avoid injuries.
- Remove the bottom baffle plate from the front and rear of the cabinet for easy Device handling before transportation.
- When handling the Device manually, get close to the Device, squat down, and lift it slowly and smoothly with the strength of straightening your legs, not with the strength of your back. Do Not suddenly lift the Device or twist your body.
- When moving or lifting the Device, hold the handles of the Device or the bottom edge of the Device, not the handles of the modules installed inside the Device.
- Handle heavy objects with a balanced and smooth force to move them at an even and low speed; and move them smoothly and slowly into positions to avoid any bump or fall, which may scratch the surface of the Device or damage Device components and cables.
- When handling heavy objects, be especially careful of workstations, slopes, stairs, and slippery areas. When handling heavy objects over door thresholds, make sure that the door is wide enough to allow the Device to pass through to prevent bumping or bruising of fingers.
- When handling heavy objects with a forklift, keep the forklift in the middle to prevent it from tipping over. Fasten the Device to the forklift with a rope before moving it. Perform special supervision when moving the Device.



- The tilt angle of the cabinet shall conform to the requirements as shown in the below drawings, namely, the tilt angle α≤15° with packaging, and the tilt angle α≤10° without packaging.

3.2 Requirements for transportation

DANGER	Rough handling is prohibited, as it may result in a short circuit, damage (leakage, rupture, etc.), fire or explosion of the battery.
WARNING	Do Not handle the battery by holding its terminals, bolts or cables to avoid damage to the battery. Handle batteries in the direction as per the requirement. Do Not make batteries inverted, tilted, dropped, struck by machinery, exposed to rain or snow, or dropped into water. Batteries shall be transported separately. Do Not transport a cabinet with batteries installed; and remove the batteries installed in the cabinet before transporting or moving the cabinet.

- The batteries are certified with UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and SN/T 0370.2-2009 Procedures for Inspection of Packaging of Dangerous Goods for Export - Part 2: Performance Inspection, and this product falls under Class IX dangerous goods.
- Batteries can be delivered directly to the site to meet the requirements for transport by cars or by ships.
- Choose sea or better road conditions when transporting the Device. Do Not transport the Device by railway or by air. Minimize bumps and tilts in transit.
- Sea transportation shall comply with the transport requirements under the International Maritime Dangerous Goods Code (IMDG Code).
- Land transportation shall comply with the transport requirements under ADR or JT/T 617.
- Check the battery packaging before transportation. Do Not transport the battery where it is intact or it comes with an odor, liquid leakage, smoke or fire.

- The packing box shall be secure. Be careful in handling and transporting, and take precautions against moisture.
- Handle batteries with care. Do Not bump against the batteries, and ensure personal safety.
- Unless otherwise specified, dangerous goods shall not be mixed in the same vehicle or container with goods containing food, drugs, animal feed and their additives.
- Unless otherwise specified, packages of dangerous cargo shall be segregated in one of the following ways when loaded in the same vehicle or container as general cargo:
- - Use a barrier of equal height to the package
- - ≥800mm from the left and the right side of the obstacle and≥1,000mm from the rear of the obstacle.

4. Requirements for Storage

General requirements

Description

- During storage, keep relevant proof of compliance with product storage requirements, such as temperature and humidity log data, photos of the storage environment, and inspection reports.
- Store the product in a clean and dry place and protect it from dust and moisture. Keep the product from rain or excess surface water to avoid erosion.
- Long-term storage of the battery pack is not recommended. Long-term storage of lithium batteries will result in capacity loss, and the general irreversible capacity loss of lithium batteries is 3%~10% after 12 months of storage at the recommended storage temperature.
- Ambient air shall not contain corrosive or flammable gases.
- Do Not store the product in an inclined or inverted position.
- When Device other than battery packs is stored for two or more years, it shall be checked and tested by a professional before use.

4.1 Storage of energy storage products

- Do Not remove the package for long-term storage.
- No stacking.
- Store (permanent or temporary) the product on a level surface.
- Close the cabinet door.
- Temperature of the storage environment: 25±5℃, humidity: 5%~95% RH.
- A refill label shall be attached to the outer packing box of the battery. The label shall indicate the last charging time and the next charging time required.

4.2 Storage requirements for energy storage products

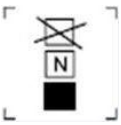
WARNING

- Store the battery indoors. Avoid direct sunlight or rain. Keep the environment dry, clean and well ventilated. Make sure there are no large amounts of infrared radiation or other radiation, no organic solvents or corrosive gases, no metallic conductive dust, etc. Keep the battery away from heat and fire sources.
- Batteries shall be discarded if they are expanded, deformed, damaged or leaking, regardless of their storage time.
- When storing batteries, place them correctly according to the labels on the packing box. Do Not place batteries upside down, sideways, or tilted, and stack batteries in accordance with the stacking requirements on the outer packing.
- When storing batteries, store them separately to avoid mixing them with other Device, and avoid stacking them too high. There shall be fire-fighting facilities on site that meet the requirements, such as fire sand and fire extinguishers.

CAUTION

It is recommended to use batteries in a timely manner. For batteries that have been stored for a long time, please recharge them regularly, otherwise the batteries may be damaged.

Table 4-1 Packing Illustration and Description

Illustration	Description
	Upwards, which indicates that the package shall be kept upright during transport and storage.
	Fragile, which indicates that the package contains fragile items and shall be handled with care.
	Rainproof, which indicates that the package shall be kept dry.
	Stacking limit by number, in which N indicates the maximum number of layers that can be stacked for the same package, subject to the actual illustration.

- Environmental requirements for storage:
  - Ambient temperature: 25±5℃ (20℃～30℃ recommended).
  - Relative humidity: 5%~95% RH (around 45% RH recommended).
  - Dry, ventilated and clean.
  - Avoid exposure to corrosive organic solvents, gases and other substances.
  - Avoid direct sunlight.

- The distance from the heat source shall not be less than two meters.

- Disconnect batteries from external devices before storing. The indicator light (if any) on the battery panel shall be off.
- The storage time shall be calculated from the last charging time marked on the refill label on the battery's outer packing. After the battery has been recharged, refresh the last charging time on the refill label (it is recommended to record the time at xx:xx (hour:minute) on xx/xx/xx (year/month/day) and the next charging time (the next charging time = the last charging time + recharging cycle).
- Do Not remove the battery's outer packing. The battery shall be recharged (if necessary) by a professional as per requirements, and shall be put back into the package after recharging.
- The warehouse keeper shall keep monthly statistics on the battery storage, regularly report battery inventory, and arrange for timely recharging for batteries stored for a long time.

CAUTION

- Recharging shall be carried out by trained professionals wearing insulated gloves and using dedicated insulated tools.
- A person shall be present to observe the recharging process so that abnormalities can be handled in a timely manner.
- Stop charging immediately and scrap the battery that is abnormal (e.g. expanded or smoky).

- Batteries stored beyond the expiration date shall be reported in time.
- Batteries shall be shipped on a first-in-first-out basis.
- Batteries shall be handled with care. Do Not damage the batteries.

Judgment for Overdue Storage of Battery Packs

- Long-term storage of batteries is not recommended in principle, and they shall be used in a timely manner.
- Batteries stored beyond the expiration date shall be reported in time.
- Batteries shall be discarded immediately if they are deformed, damaged or leaking, regardless of their storage time.
- The storage time shall be calculated from the last charging time marked on the refill label on the battery's outer packing. After the battery has been recharged, refresh the last charging time on the refill label (it is recommended to record the time at xx:xx (hour:minute) on xx/xx/xx (year/month/day) and the next charging time (the next charging time = the last charging time + recharging cycle).
- Recharging of stored batteries is allowed once every 8 months, a maximum of 3 times is allowed. Scrap the battery if the recharging limit is exceeded.

5. Requirements for Sites

5.1 Siting requirements

NOTICE

Refer to the GB 51048 Design Code for Electrochemical Energy Storage Power Stations , the NFPA 855 Standard for the Installation of Stationary Energy Storage Systems and local regulatory requirements as for siting.

The energy storage system is only applicable to outdoor scenarios and requires outdoor arrangement. Indoor layout is not supported. The general requirements for siting are as follows:

- Do Not install in a low-lying area, and the installation level shall be above the highest recorded water level in the area.
- There shall be no vegetation or flammable plants within 3m of the installation site or the perimeter of the energy storage system or the energy storage power station to prevent wildfires caused by high temperatures in summer from causing fires in the energy storage system.
- The distance from the top of the energy storage system to the combustibles shall be ≥2m.
- For safety considerations, the distance between the energy storage system and residential buildings shall be ≥ 12m, and that between the energy storage system and crowded buildings such as schools and hospitals shall be > 30.5m. If such safety distance cannot be met, a firewall shall be built between the energy storage system and the buildings.
- The safety distance between the energy storage system and the production buildings shall comply with local fire codes or standards.

China Region:

The safety distance between the energy storage system and the production building of category A shall be ≥12m, the production building of category B shall be ≥10m, and the production buildings of categories C, D and E with fire resistance ratings I and II shall be ≥10m, and the safety distance from the production buildings with a fire resistance rating III shall be ≥12m.If the external walls of the adjacent buildings are non-combustibles and there are no doors, windows or exposed burning eaves, the fire separation can be reduced by 25% on the basis of 3m.

If the above safety distance cannot be met, a firewall shall be installed between the battery Device room, the energy storage room or the energy storage installation areas and buildings of categories C, D and E. A firewall with a fire resistance time of not less than 3h shall be installed for safety protection, and the length and height of the firewall shall exceed the outer contour of the energy storage system by 1m each. At the same time, the space requirements for Device transport, installation and maintenance shall be considered.

Non-China Region:

- Energy storage systems located outdoors shall be separated from boundaries, public roads, buildings, inflammable materials, hazardous materials, high stockpiles, and other hazards not related to the grid infrastructure by a minimum of 10 feet (3.048m).
- The distance between the energy storage system and the production building may be reduced to 0.914m when one of the following conditions is met, taking into account space requirements for Device transportation, installation, and maintenance.
- The energy storage system has a separate firewall with a fire resistance time of 1h, and the length and height of the firewall shall exceed the outer contour of the energy storage system by 1.5m each.
- The walls adjacent to the energy storage system are provided with a non-combustible exterior wall, with no openings or combustible exterior finishes, and the fire resistance rating of the exterior wall meets the 2h fire resistance rating of ASTME119 or UL263.

- The installation of the energy storage system or the siting of the energy storage power plant shall be in an environment free of risk of ignition or explosion.
- Have easy access to transport and reliable fire suppression system Device.

Description

- The installation, commissioning and operation of the energy storage system shall meet the principle of fire protection first: the number of gas extinguishers near each unit shall be ≥ 2.
- The distance between the exhaust gear of the energy storage system and the heating, ventilation, air-conditioning air intake, windows, doors, loading platforms and sources of ignition of other buildings or facilities shall be > 4.6m.
- Reserve connections for the water extinguishing system at the energy storage system sites.
- Meet the required site area in the near future, and leave room for further expansion to meet the needs of the whole life cycle.
- The energy storage system shall be installed at a location of more than 30m from third-party wireless communication facilities.
- Select a well-ventilated location.
- Do Not install the energy storage system in a salt-affected or polluted area as it may cause corrosion of the system and thus result in a fire. The energy storage system can be used in the following or better environments:

- Outdoor environments where the distance from the coast is more than 2,000m. The use of the energy storage system is not recommended at a distance of 500m to 2km from the coast (if required, please confirm with the dealers or our engineers). The energy storage system can not be used at a distance of less than 500m from the coast.
- The distance from heavy pollution sources such as smelters, coal mines, thermal power plants is greater than 1,500m~3,000m
- The distance from medium pollution sources such as chemicals, rubber, and electroplating is greater than 1,000m~2,000m
- The distance from light pollution sources such as food, leather, heating boilers, slaughterhouses, centralized dumping sites, and sewage treatment stations is greater than

500m~1,000m

Description

Re-siting is recommended when the site cannot be safely spaced to meet the relevant national standards.

Siting shall avoid scenarios that are not recommended by industry standards and regulations, including but not limited to the following locations, areas and sites:

- Areas exposed to strong vibrations, strong noise sources and strong electromagnetic field interference.
- Areas where dust, fumes, harmful gases, corrosive gases, etc. are generated or present.
- Places where corrosive, flammable, or explosive substances are produced or stored.
- Places with existing underground facilities.
- Ground with unfavorable geology such as rubber soil, soft soil, or water-prone or sinkable areas.
- Below cisterns, water features, and water rooms.

Description

- If it is unavoidable to set up in a place where water may accumulate, water-retaining and drainage facilities shall be installed, and measures to raise the ground level shall be taken.
- Cable trenches shall not be used as drainage paths, and openings of cable wiring (e.g., holes where cables run through partitions or floor slabs) shall be blocked with fire retardant.
- Earthquake faults and earthquake regions with a design intensity higher than 9.
- The section subject to mudslides, landslides, quicksands, caves and other direct hazards.
- Within the boundary of mining subsidence (tangential dislocation) zones.
- Within the blasting hazard areas.
- Areas that may be inundated after a dam or levee bursts.
- Important sanitary protection areas for water-supply sources.
- Protected areas of historical cultural relics and monuments.
- Densely populated places, high-rise buildings, and underground buildings.
- Intersections of urban arterial roads and roads with heavy traffic.
- Requirements for site protection against flooding and water-logging:
- The design elevation of the station area for large-scale electrochemical energy storage systems (power ≥100MW) shall be higher than the flood level with a frequency of 1% or the highest recorded water-logging level.
- The design elevation of the station area for medium- and small-scale electrochemical energy storage systems (power ＜100MW) shall be higher than the flood level with a frequency of 2% or the highest recorded water-logging level.
- Where the design elevation of the station area cannot meet the above requirements, another site shall be selected, or different flood prevention and water-logging prevention measures shall be taken for different situations.
- For energy storage power stations along rivers, streams, lakes and seas that are affected by

wind and waves, the elevation of the flood prevention facilities shall take into account the height of wind and waves with a frequency of 2% and a safety elevation of 0.5m.

Anti-trespassing fence: The area of energy storage Device is recommended to be isolated and protected by solid walls or fences with door locks. The height of the fence shall be ＞2.2 meters, and the firewall can replace part or all of the fence, which can be considered by the designer in a comprehensive manner.

5.2 Installation requirements

5.2.1 Foundation installation requirements

- The energy storage system shall be installed on concrete or other non-combustible surfaces. Make sure that the installation surface is level, solid, and smooth with enough bearing capacity. Indentation or tilting is prohibited.
- The Device foundation shall be configured according to the gross Device weight of 3t. Re-check if the load-bearing capacity of the foundation is not satisfied.
- The bottom of the foundation pit of the Device shall be tamped and filled.
- Do Not soak or disturb the Device foundation after excavation. In case the Device foundation is soaked and disturbed, the excavation shall be continued and refilled.
- The error in the elevation of the top surface of the Device foundation (column) shall not be more than 3mm; it is recommended that the foundation be about 300mm above the level of the installation site.
- Make sure that the bottom of the Device is above the highest water level on records in the area to prevent rainwater from eroding the base and interior of the energy storage cabinet.
- A drainage system shall be constructed at the installation site to prevent the base of the energy storage system or the internal Device from being flooded during rainy seasons or heavy precipitation.
- When constructing the Device foundation, it's necessary to consider the cable outlet of the energy storage system by reserving trenches or holes for the cable.
- The holes reserved for the Device foundation and the inlet holes at the bottom of the Device shall be blocked off.
- Foundation drawings are not to be taken as final construction drawings and are for reference only. Users shall review the basic design parameters of the energy storage system according to the installation environment, geology and seismic requirements of the project site.

5.2.2 Ventilation requirements and space requirements

- Liquid-cooled energy storage cabinets may generate a large amount of heat. When the ambient temperature is too high, the electrical performance of the Device will be affected, and even the Device will be damaged. Therefore, the release of heat needs to be fully considered when designing the control room to ensure the normal and efficient operation of the Device.
- The ambient temperature for the operation of the Device shall be within the range of -20℃ ~ 55℃ (derating at 45℃) to ensure the safe, reliable and efficient operation of the Device.
- The liquid-cooled energy storage cabinet shall be installed to ensure that its left and right sides, front and rear and upper are 800mm, 1,000mm and 600mm away from obstacles, so as to meet the requirements of the minimum access for maintenance and ventilation.

5.3 Forklift requirements

- Do Not move the energy storage system after installing the battery pack.
- Before using the forklift, make sure that the forklift meets the requirements for load bearing: the load-bearing capacity shall be ≥3t.
- The recommended forklift blade length shall be ≥1.2m, the width 80cm~160cm, and the thickness 25cm~70cm.
- The center distance between two forklift blades is 860mm.

5.4 Lifting requirements

- Before lifting, make sure the crane and ropes meet the requirements for load bearing.
- When installing and removing the lifting Device, do not drag the case against possible scratches.
- Do Not lift or move the energy storage system after installing the battery pack.

Lifting Process	Precautions
Before lifting	The lifting capacity of the crane shall be ＞3t. If the working conditions on site do not meet the requirements, a professional assessment is required.
	Personnel conducting lifting operations shall be qualified after trained before they are allowed to work.
	Before using lifting tools, check they are complete.
	Make sure that the lifting tools are securely fixed to a load-bearing fixture or wall.
	For outdoor use, it is recommended to lift the Device in clear weather with no wind.
	Confirm that the crane and cables meet the requirements before lifting.
	The door of the Device shall be closed and well locked.
	Make sure that the steel cable is securely and reliably connected.

	It is recommended to use a left-to-right or right-to-left lifting sequence to ensure smooth lifting.
During lifting	Prohibit unrelated persons from entering the lifting area, and prohibit people from standing under the crane arms.
	Ensure that the crane is in the right position. Do Not lift for long distances.
	Keep it steady, and the diagonal inclination of the box shall be ≤5°.
	Ensure that the angle between two cables is ≤90°.
	Lift the Device with care. The cabinet shall fall slowly and smoothly to avoid impacting the internal Device.
	When the cabinet comes into contact with the base, do Not remove the lifting steel cables until the base is evenly stressed.
	Do Not drag the steel wire ropes or the slings against Device collisions.
	Follow-up cabinet lifting can be performed only after the first lifted cabinet is secured.

6. Unpacking and Acceptance

NOTICE

- Secure the box containing the Device to the forklift with a rope before moving to prevent the Device from tipping over. Be careful when moving the Device, as it may be damaged if it is knocked or dropped.
- Once the Device has been set down, remove the packaging carefully to avoid scratching the Device. Keep the Device stable during unpacking.
- After unpacking, check that the fastening components and removable parts are not loose, and notify the carrier and the manufacturer immediately in case they are loose.
- Before unpacking the batteries, check their packages are intact. Batteries with damaged packages shall not be used. Please notify the carrier and the manufacturer immediately in case they are damaged.
- In case of an undesired installation environment, prevent dust and condensation after unpacking (e.g., using a dust cover, plastic film or spinning cloth to cover the Device), to avoid corrosion and failure caused by condensation or dust accumulation inside the battery.

7. Installation of Device

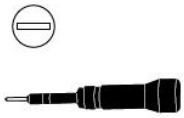
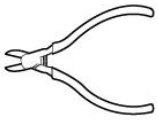
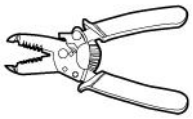
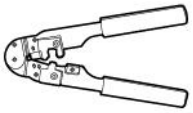
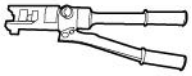
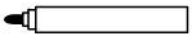
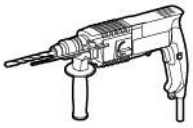
7.1 Pre-installation

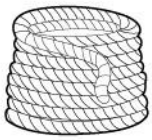
7.1.1 Preparing the tools

Description

- The tools shown in the illustration are for reference only, subject to the physical object.
- Because of the different conditions on site, this tool list may miss a few tools that may be used, which requires on-site installation personnel and users to prepare the tools based on site requirements.

Installation Tools

 Phillips insulated torque screwdriver	 Insulation torque socket spanner(complete with an extension bar) ●Sleeve specifications:6mm~19 mm ●Sleeve depth: ⩾32mm ●Socket interface matches to torque spanner ●Torque range: 1.2N • m~45N • m	 Word insulated torque screwdriver	 Diagonal pliers
 Wire stripper	 Wire cutter	 Rubber hammer	 Art knife
 Wire crimper with crystal head	 Hydraulic plier	 DC voltage range of a multimeter ≥1,500V DC	 Marker pen
 Steel tape measure	 Spirit level	 Vacuum cleaner	 Cable drilling tool

 Chopping bit Φ16mm	 Heat shrink tubing	 Heat gun	 Cable tie
 Insulation ladder	 Crane	 Rope length ≥ 1,845mm×4	 Electric forklift
 Manual forklift	-	-	-

Personal Protection Device (PPE)

 Insulated gloves	 Protective gloves	 Goggles	 Dust mask
 Insulated shoes	 Reflective vest	 Helmet	 Safety belt

7.1.2 Pre-installation checks

Checking the outer packaging

Before unpacking the Device, check the outer packaging for visible damage such as holes, cracks or other signs of possible internal damage and check the Device model. If there are any abnormalities in the packaging or if the Device model does not match, do not open it and contact your dealer as soon as possible.

Description

It is recommended to unpack the Device within 24 hours before preparing for installation.

WARNING

If the height of the cabinet exceeds 2m, take precautions against overhead operation when unpacking the cabinet.

Checking the deliverables

After unpacking the Device, check the deliverables are complete and there is no visible external damage. If any items are missing or damaged, please contact your dealer.

7.2 Mechanical installation

7.2.1 Battery pack installation

1) The battery box/high voltage control box is installed into the battery rack from the front side, please ensure that there is enough space for operation on the front side (recommended ≥1.5m, if using an electric forklift for the installation, it is necessary to consider the forklift's movement and turning space);

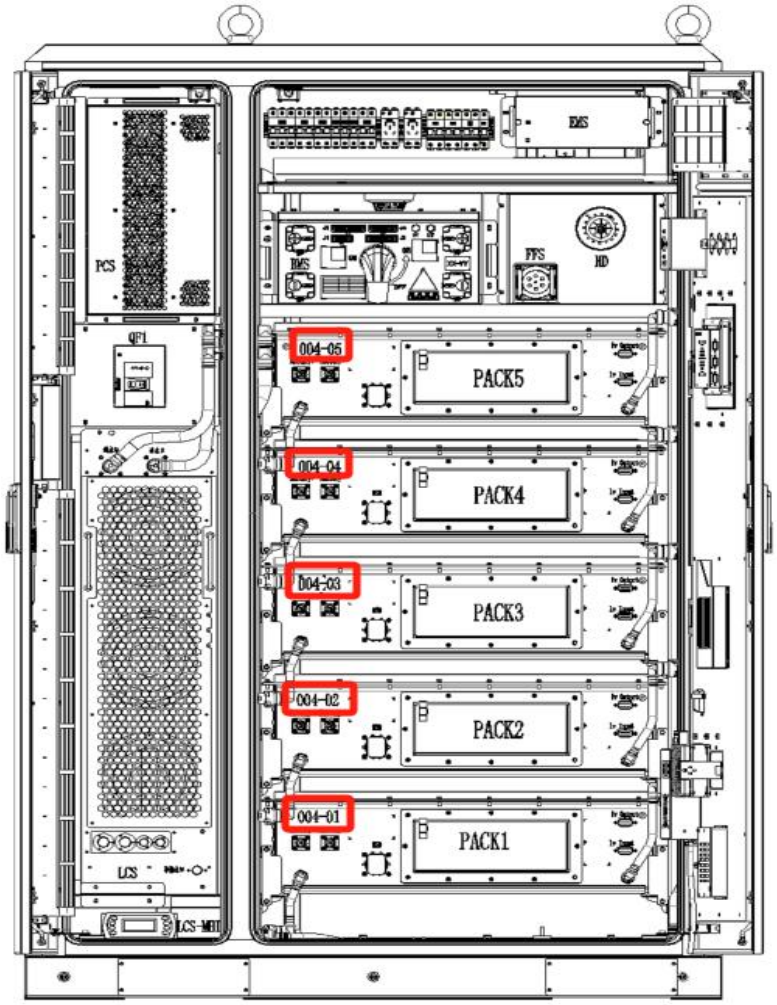


Figure 7-1 Y52 Number-Position Correspondence

2) Ensure the right numbering sequence of the battery boxes during installation. For standard battery racks, the number-position correspondence is shown in Figure 7-1:

Note:
The serial number of the battery can be identified according to the label content on the front panel of the battery module, such as XX-YY: XX represents the system number， and YY represents the rack number.

3) After the battery module is unpacked, check that the shell is not damaged and the bolts are fastened, and the protective covers of the positive and negative output terminals are in place. After the installation state is checked OK, it can be transported to the climbing forklift by crane or manual handling:

4) After the battery module is lifted to the designated position by the climbing forklift, slowly push the battery box into the corresponding position of the battery rack, as shown in Figure 7-2:

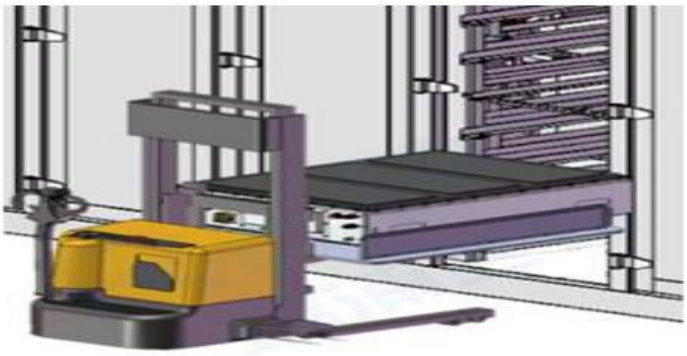


Figure 7-2 Schematic Diagram of Battery Module Installation

Note:

The recommended installation sequence is from top to bottom (PACK5-PACK4- PACK3- PACK2-PACK1) to ensure that the forklift gears will not interfere with the lower battery box;

Transport the battery module to the position where the bottom of the battery module is in contact with the L-shaped guide rail of the bracket, and then push the battery module in. Do Not leave a gap between the slotting teeth and the L-shaped guide rail to ensure that the bottom of the battery is solidly supported during the push-in process to prevent falling;

5) After pushing it in place, each battery box needs to be locked to the battery frame with 4 hexagonal flange bolts M8×30, and the recommended torque is 25±2NM, as shown in Figure 7-3:

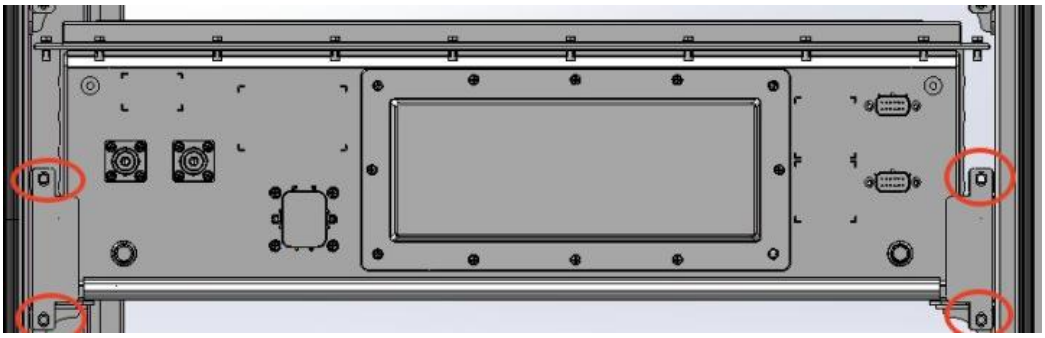


Figure 7-3 Schematic Diagram of Fixing the Battery Module

6) After all the battery boxes are installed in place, check again that the number is consistent with the input file.

Note:

Please install in strict accordance with the above process. The installer must be equipped with necessary installation tools, including climbing forklifts, anti-smashing shoes, etc.

7.2.2 Definition of battery pack interface

Definition of battery module interface

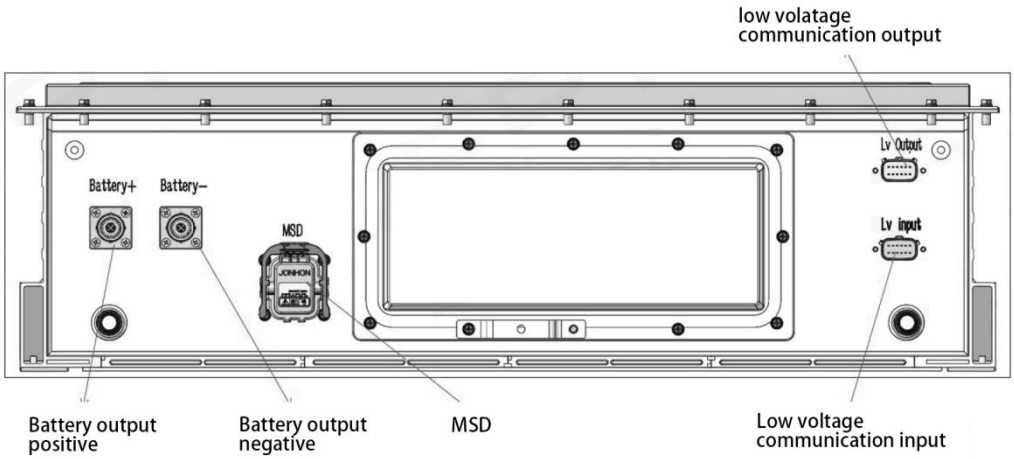


Figure7-4 Definition of Battery Module Interface

7.2.3 Definition of liquid cooling interface

1. Piping: Figure 7-5 Outlet Piping, Figure 7-6 Inlet Piping;

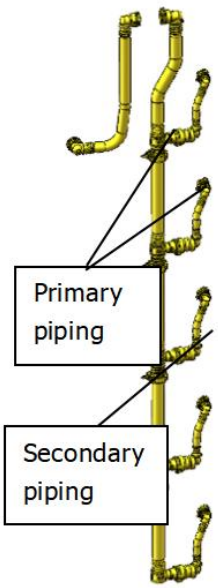


Figure 7-5

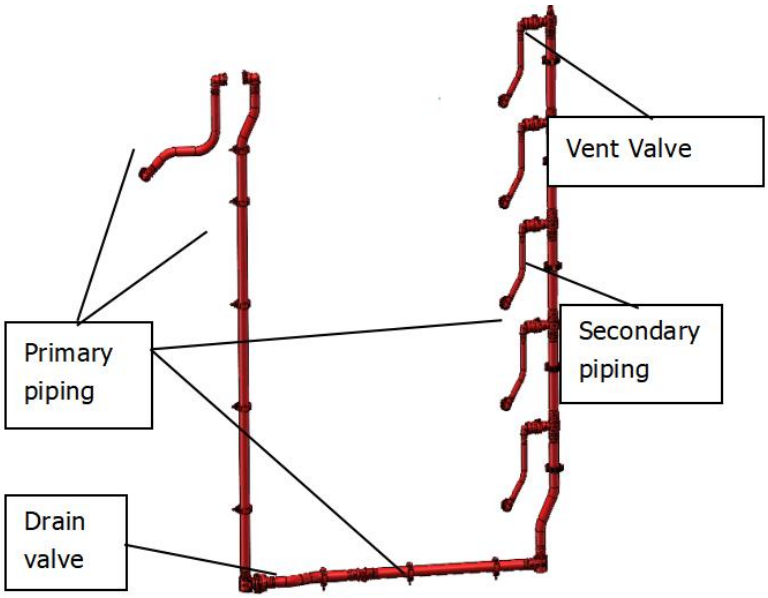
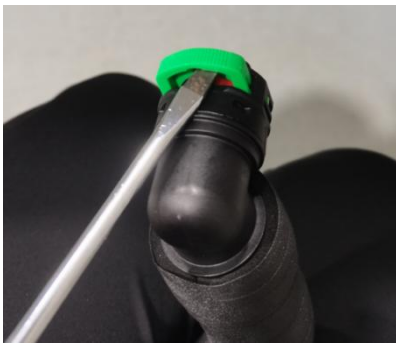


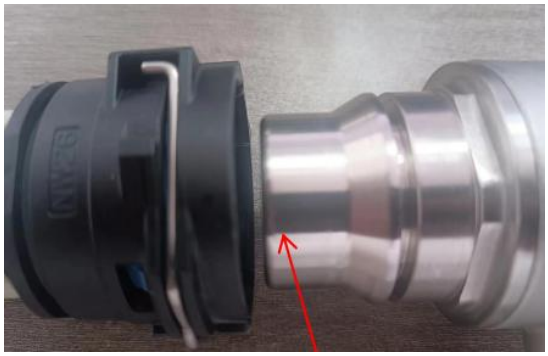
Figure 7-6

2. Primary piping installation:



Installation sequence	Installation steps
1	Check to ensure the sealing rings have no cracks, scratches, dust, dirt or other defects before installation
2	Use a small straight screwdriver to pivot the green buckle;
3	Switch the quick plug to the corresponding water outlet, and press the green buckle after the quick plug of the joint is in place;
4	Use fixed parts to fasten the primary piping tightly;
5	Check to ensure the installation direction is correct and the installation is firm;

3. Secondary piping installation:




Installation sequence	Installation steps
1	Check to ensure the sealing rings have no cracks, scratches, dust, dirt or other defects before installation
2	Seal the quick plug and the battery pack
3	After the connector is connected with the quick plug, the circlip shall be fastened in place;
4	Check to ensure the installation direction is correct and the installation is firm;

4. Liquid-cooled tube assembly: Complete the installation of the outlet pipes as shown in Figure 7-7. Complete the installation of the inlet pipes as shown in Figure 7-8.

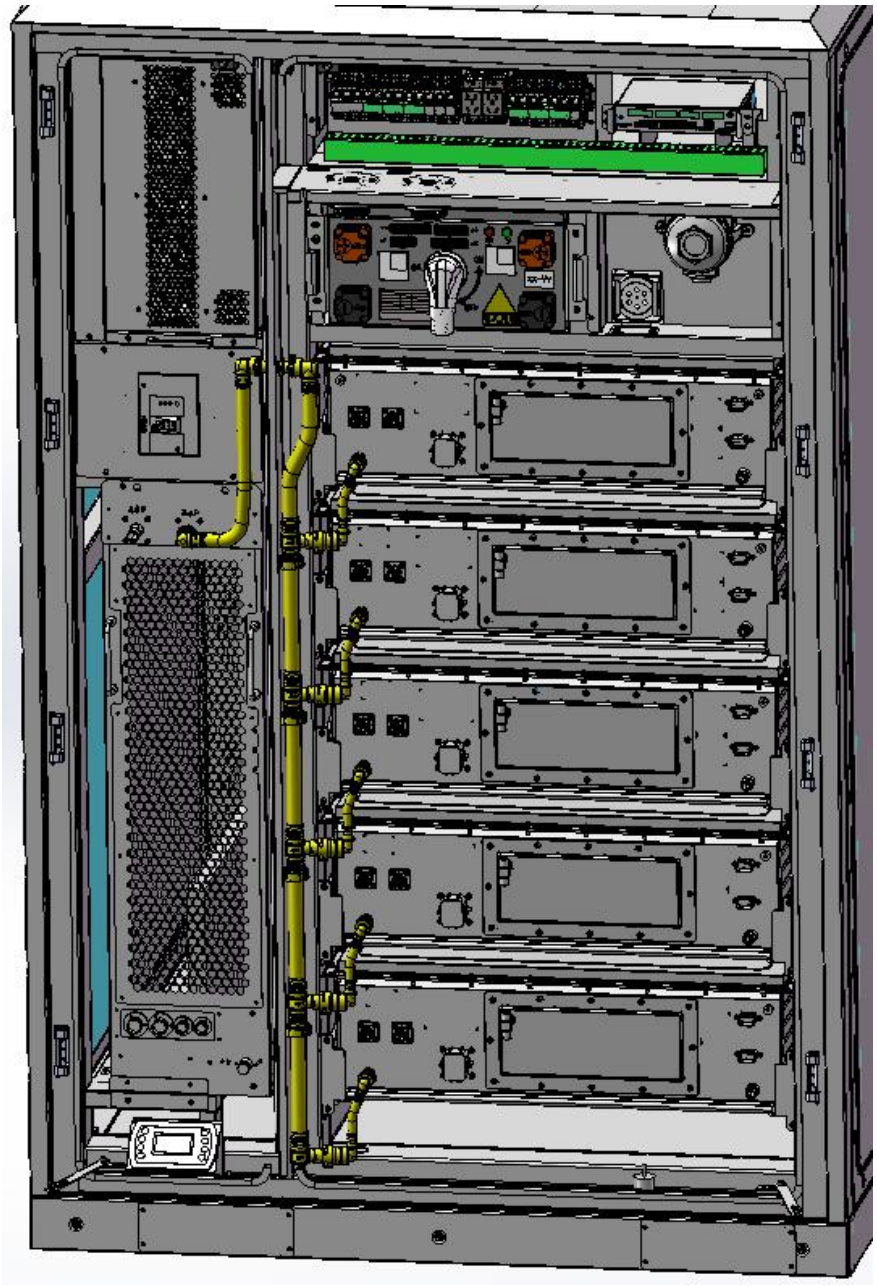


Figure 7-7

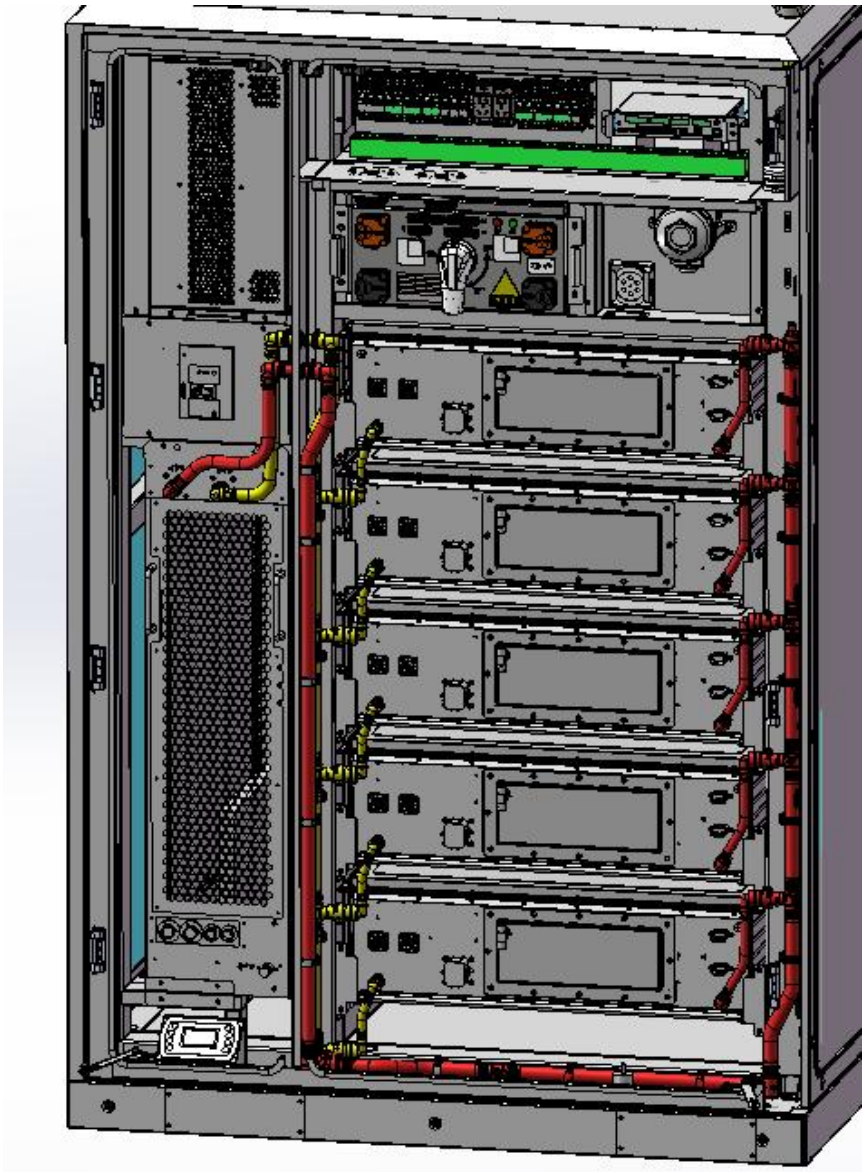


Figure 7-8

7.2.4 Installation and Fixing of energy storage cabinet

1. Schematic diagram for installation and fixing of outdoor energy storage cabinet with ground bolts (Figure 7-9)

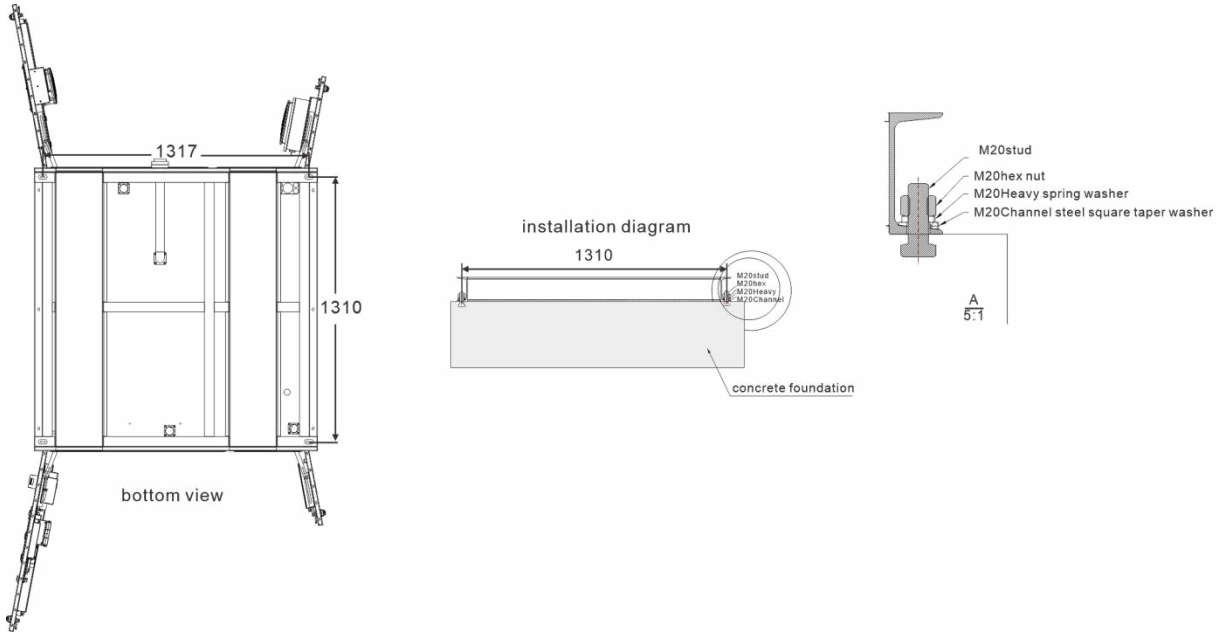


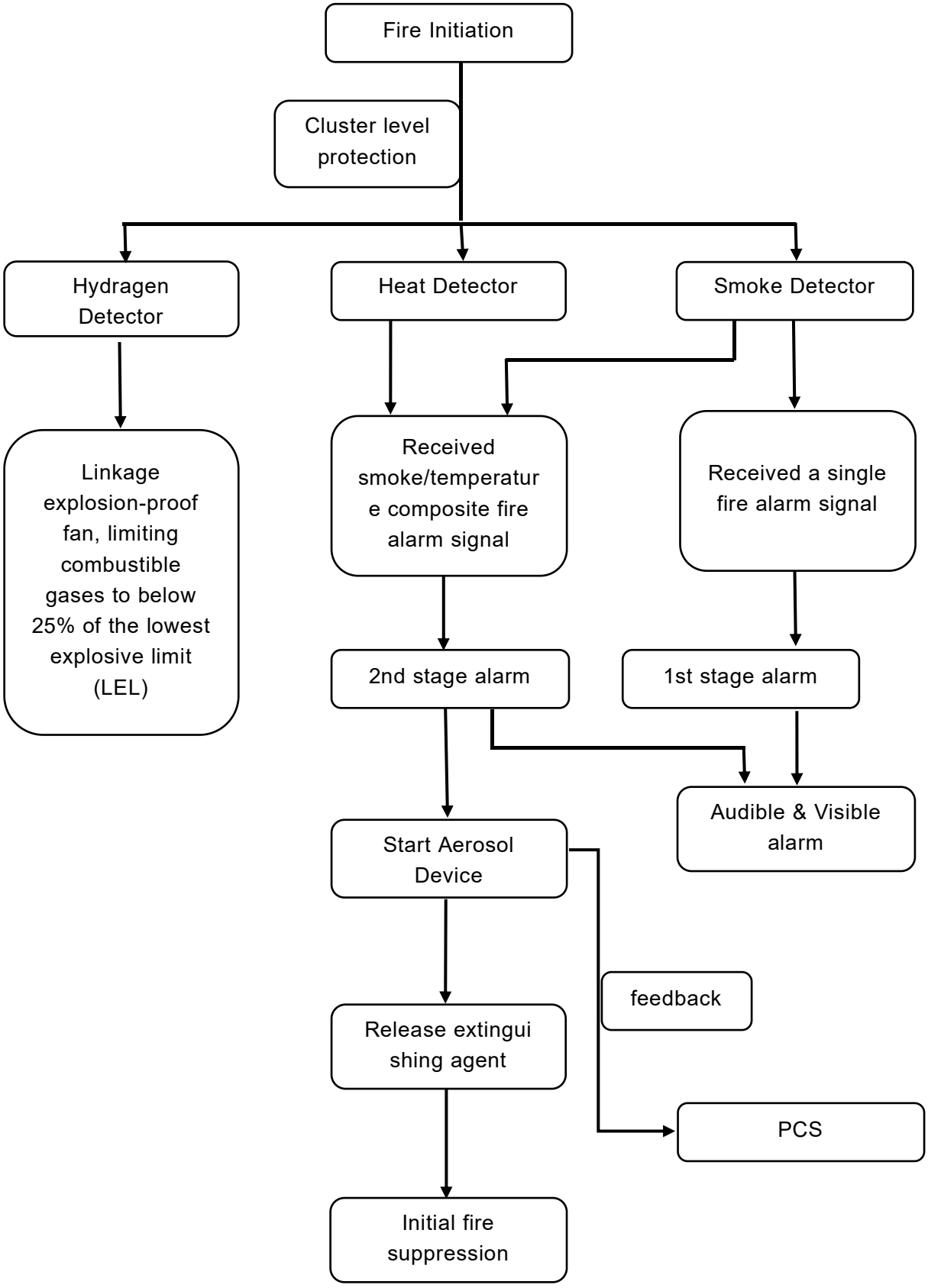
Figure 7-9 Schematic Diagram for Installation and Fixing of Outdoor Energy Storage Cabinet with Ground Bolts

7.2.5 Fire protection instructions

When the smoke detector in the protected area detects a fire, the sound and light alarm outside the protected area will immediately activate to remind personnel to respond; When smoke and te mperature detectors detect a fire at the same time, they output electrical signals, activate the so und and light alarm, activate the fire extinguishing device, implement fire extinguishing, synchro nously output feedback signals, and notify personnel to handle it in a timely manner。

7.2.5.1 Fire extinguishing system

When the smoke detector in the protected area detects a fire, the sound and light alarm outside the protected area will immediately activate To remind personnel to respond; When smoke and t emperature detectors detect a fire at the same time, they output electrical signals and connect D ynamic sound and light alarm, fire extinguishing device activated, fire extinguishing implemented, synchronous output feedback signal, notifying personnel to handle in a timely manner Reason.


Fire Initiation
Cluster level protection
Hydragen Detector
Heat Detector
Smoke Detector
Linkage explosion-proof fan, limiting combustible gases to below 25% of the lowest explosive limit (LEL)
Received smoke/temperature composite fire alarm signal
Received a single fire alarm signal
2nd stage alarm
1st stage alarm
Audible & Visible alarm
Start Aerosol Device
feedback
Release extinguishing agent
PCS
Initial fire suppression

7.2.5.2 Explosion proof exhaust system

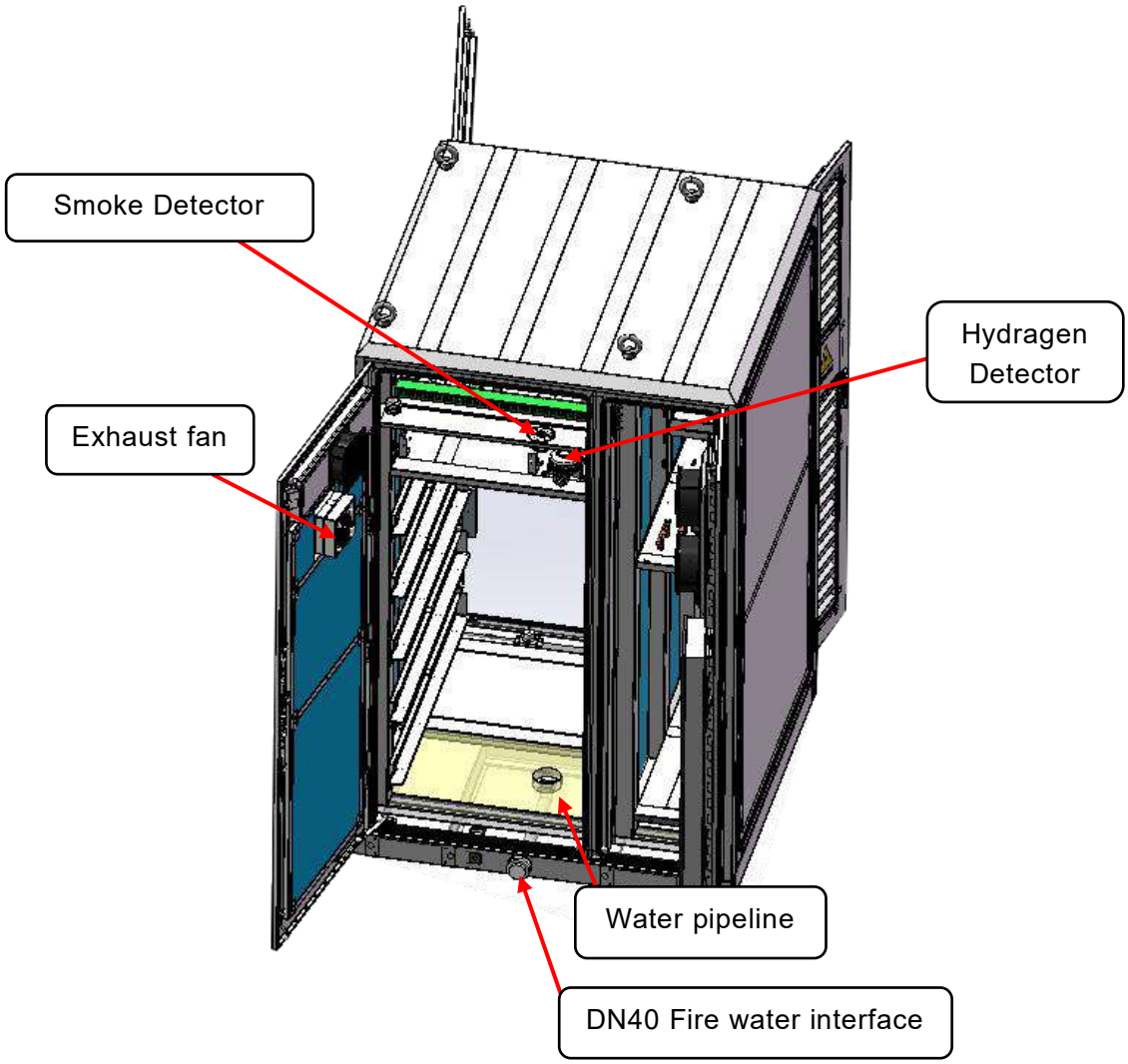
The explosion-proof exhaust system consists of a gas detector, an intake system, and an exhaust system. When the gas detector reaches the first level alarm threshold (H2 is 10% LEL, CO is 100ppm), an alarm signal is output. When the gas detector reaches the second level alarm threshold (H2 is 22% LEL, CO is 300ppm), the fan is activated for ventilation and air exchange to prevent combustible gas accumulation and explosion.

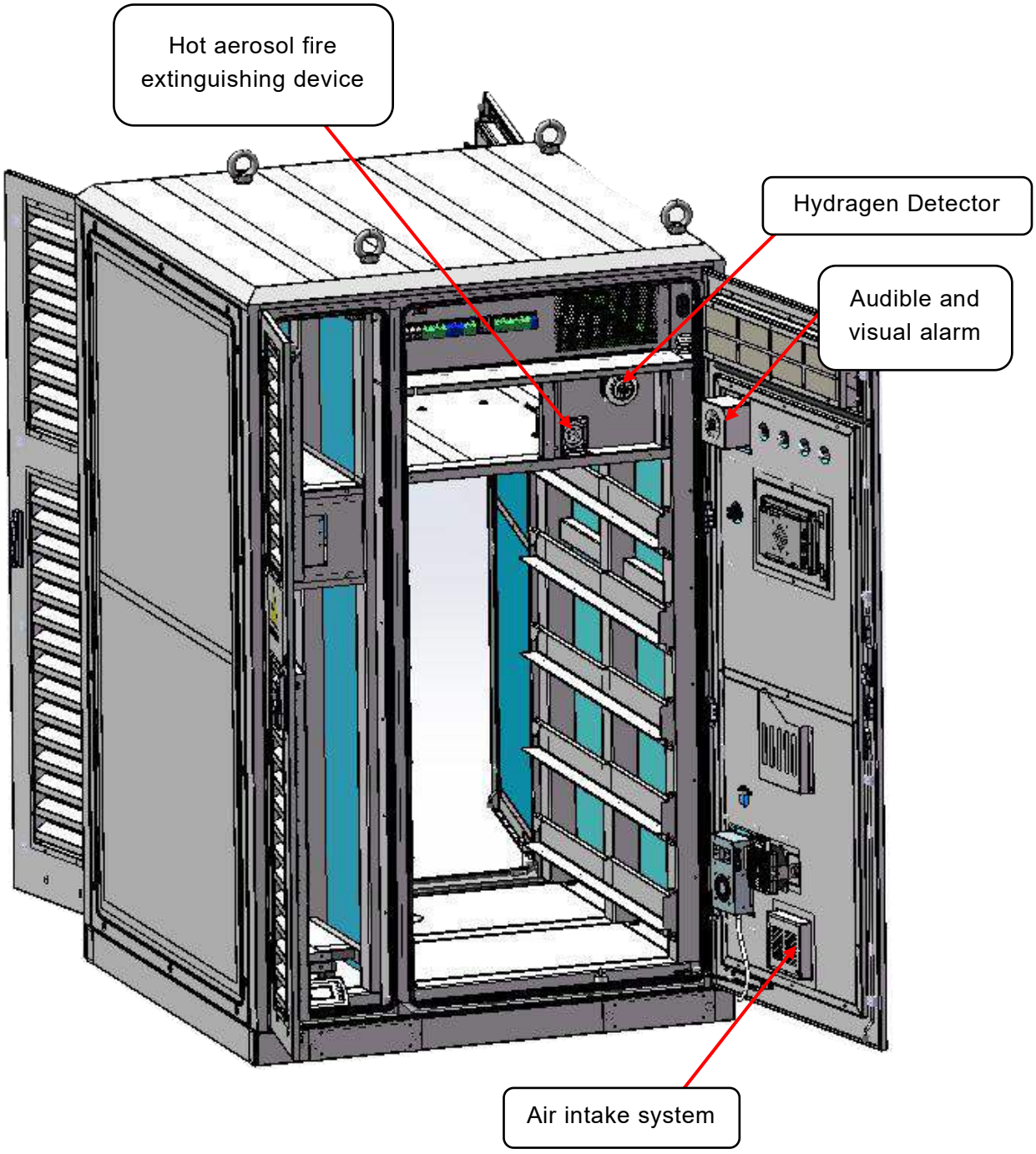
The layout of the explosion-proof exhaust system adopts a one in one out and bottom in top out scheme.

The intake system is installed at the lower part of the integrated cabinet, and the exhaust system is installed at the upper part of the integrated cabinet.

The air intake system inputs external air into the integrated cabinet from the bottom, stirs and transports the internal gas to the upper layer of the integrated cabinet, and the exhaust system directly extracts and exhausts the gas sent from the bottom and the upper layer outside the integrated cabinet.

7.2.5.3 Fire extinguishing equipment





8. Wiring

DANGER

Pay attention to the positive and negative electrodes during battery installation. Do Not short-circuit the positive and negative electrodes of individual batteries or battery strings, as this may cause a short circuit of the battery.

DANGER	➢ Do Not smoke or use open flame in the vicinity of the battery. ➢ There shall be fire-fighting facilities on site that meet the requirements, such as fire sand and carbon dioxide fire extinguishers. ➢ Use dedicated protective Device and insulating tools to eliminate electric shocks or short-circuit faults.
WARNING	Tighten the fastening screws on the copper bars or cables according to the torque specified in this Manual. Regularly check whether the fastening screws are tightened, and whether there is any rust, corrosion or other foreign matters, and dispose of them if any; and loose screws will, otherwise, lead to excessive voltage drop, and even burn the battery by generating a large amount of heat when the current is high.
CAUTION	➢ Do Not connect two or more cables in parallel at the positive and negative electrodes of the battery. ➢ When making cables, keep them away from the Device to prevent cable debris from accidentally invading the Device and causing ignition, which may cause personal injuries and damage to the Device.

Description

The colors of the cables in the electrical connection diagrams in this section are for reference only, and the cables shall be selected in accordance with local cable standards (the yellow-and-green wires can only be used for protective grounding).

8.1 Electrical installation

8.1.1 Input and output requirements

 ELECTRICAL HAZARD	There is a danger of high-voltage electric shock when the industrial and commercial energy storage cabinet is working, only electricians with professional skills are allowed to operate the optical storage unit. All connections to the Device shall be carried out in a voltage-free state. The industrial and commercial energy storage cabinet will be damaged if the input and output terminals are wrongly connected. Failure to follow this warning could result in serious personal injuries or huge property damage, or even deaths.

8.1.2 Battery clusters

The operating voltage of battery is 650V-949V. The minimum voltage of the battery shall not be lower than 650V and the maximum voltage shall not exceed 949V.

8.1.3 Cable requirements

1. Select an appropriate voltage-resistant cable based on the voltage level.
2. Calculate the corresponding cable diameter according to the actual voltage range as different voltage values will cause a change to current. The following table only provides the requirements for cables under the lowest working voltage and rated power, which shall be calculated according to the actual voltage in actual use. Please ask the Company's after-sales personnel for more information.

Table 8-1

Cable	Wire diameter requirements (mm²) MAX total wire diameter	Mounting hole diameter
Model	FLS-ES232LC-G	
Battery	70mm²	/
Grid	70mm²	Φ10
N wire	70mm²	Φ10
Ground wire	A yellow-green wire not less than 35mm²	Φ10
Communication cable	0.75mm², please use dedicated shielded communication cables	/

8.1.4 Cabling specifications

The cables used in the system can generally fall under two types that are for power and communication. When laying communication cables, keep them away from power cables, and keep cables at right angles at the intersection. Keep the cable as short as possible and keep apart from the power cable. It is recommended that the insulation impedance of the positive and negative electrodes of the DC end to the ground be more than 1MΩ. Power cables and communication cables shall be placed in separate cable channels to avoid long distance parallel lines of power cables and communication cables to reduce the output voltage transient electromagnetic interference. The distance between the power cables and the communication cables shall be greater than 0.3m. When the wires are cross-distributed, the cross angle shall be 90 degrees, and the distance can be appropriately reduced.

8.2 Battery cluster wiring

8.2.1 Battery pack DC high-voltage side wiring

	Always wear insulated gloves when connecting high-voltage wirings. The positive and negative output electrodes of the battery assembly shall not be reversed, and shall be measured with a multimeter to determine the polarity before connecting to the positive and negative input electrodes of the energy storage cabinet.

The method for DC high-voltage side wiring is as follows:

Step 1: Disconnect the DC switch QS of the high-voltage box (BMS), screw the handle to the "OFF" position and pull out the manual service disjunctor (MSD) of the 5 PACKs.
Step 2: Measure the open-circuit voltage of the battery assembly with a multimeter to ensure that it is within the permissible range;
Step 3:

1) One cluster contains 5 battery modules and 1 high-voltage box, with a total of 6 layers: the high-voltage box in the top layer, and the battery modules in the underneath 5 layers. After the positive and negative electrodes of the 5 battery modules are connected in series, the total positive and total negative electrodes are connected to the B+\B- of the high-voltage box. The wiring sequence is shown in Figure 8-1;
2) There are three types of high-voltage power lines:

①②③④	Series wiring harness among the PACKs
⑤	Positive input from module to high-voltage box
⑥	Negative input from module to high-voltage box

3) Pay attention to the color and direction of the plug, and use a multimeter to measure whether there are any abnormal voltages between the two wiring points before connecting each wire;
4) High-voltage wiring operation: make sure that the wiring color corresponds to the socket color (orange to orange, black to black); the wiring operation is shown in Figure 8-1; keep the wiring harness tidy. After the connection is locked, the wiring will not be able to rotate; pull back after locking, and make sure that it is locked (when pulling back, pull the plug to avoid pulling the wiring harness).

①Make sure the plug color matches;

②Insert the cable plug partially into the socket; at this time it is not locked and can be rotated to adjust the cable orientation;

③After confirming the direction, press the plug properly and fully insert it into the socket; when you hear a click, the plug is locked and cannot be rotated.

8.2.2 Low-voltage communication cable connection of the battery pack

Identification	Start	End	Illustration
⑫	Switch gear J4	PACK1-Lv input	
⑪	PACK1-Lv output	PACK2-Lv input	Communication wiring harness among the PACKs
⑩	PACK2-Lv output	PACK3-Lv input	Communication wiring harness among the PACKs
⑨	PACK3-Lv output	PACK4-Lv input	Communication wiring harness among the PACKs
⑧	PACK4-Lv output	PACK5-Lv input	Communication wiring harness among the PACKs
⑦	PACK5-Lv output		Terminal (harness) in racks

Figure 8-1 DC Side Wiring

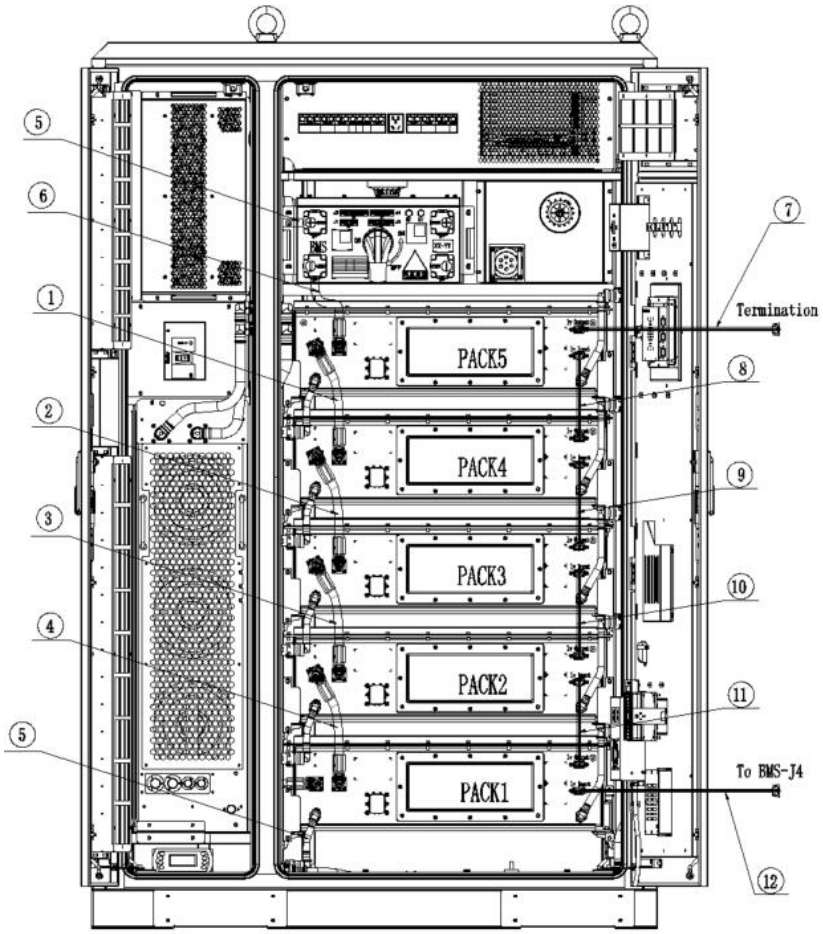


Figure 8-2 Position of Grid Inlet Copper Rows

8.3 AC side wiring

ELECTRICAL HAZARD	When connecting to the AC grid, the AC circuit breaker QF1 shall be disconnected first to ensure that the AC wires connected to the terminals are not charged.

Table 8-1 Mapping between Grid and Connection

Mapping of grid and energy storage cabinet connection	
GRID-A	Connected to grid phase A
GRID-B	Connected to grid phase B
GRID-C	Connected to grid phase C
GRID-N	Connected to grid phase N
GRID-PE	Ground cable for the ground network

The AC output voltage of the liquid-cooled energy storage cabinet is 400V. The wiring methods for the grid side, the load side and the PCS AC side are as follows.

Step 1: Disconnect the grid-side circuit breaker and the power inlet circuit breaker QF1 of the

storage cabinet;

Step 2: Measure with a multimeter to confirm that the terminal blocks are disconnected;

Step 3: Confirm the phase sequence of the cable and make line marking. AC input three-phase five-wire cables A, B, C, N, and PE shall be equipped with yellow, green, red, blue, and yellow-green insulation sleeves respectively to distinguish the phase sequence.

Step 4: Correctly connect the three-phase five-wire cables A, B, C, N, and PE to the power input copper row as refer to Figure 8-1; and the position of the grid power inlet is shown in Figure 8-2and Figure 8-3.

Step 5: Connect cables "A", "B", "C", "N", and "PE" to phases A, B, C, and N of the AC circuit breaker inside the Power Conversion System to ensure the accuracy of the phase sequence. Connect cable "PE" to the shell grounding terminal PE on the Power Conversion System.

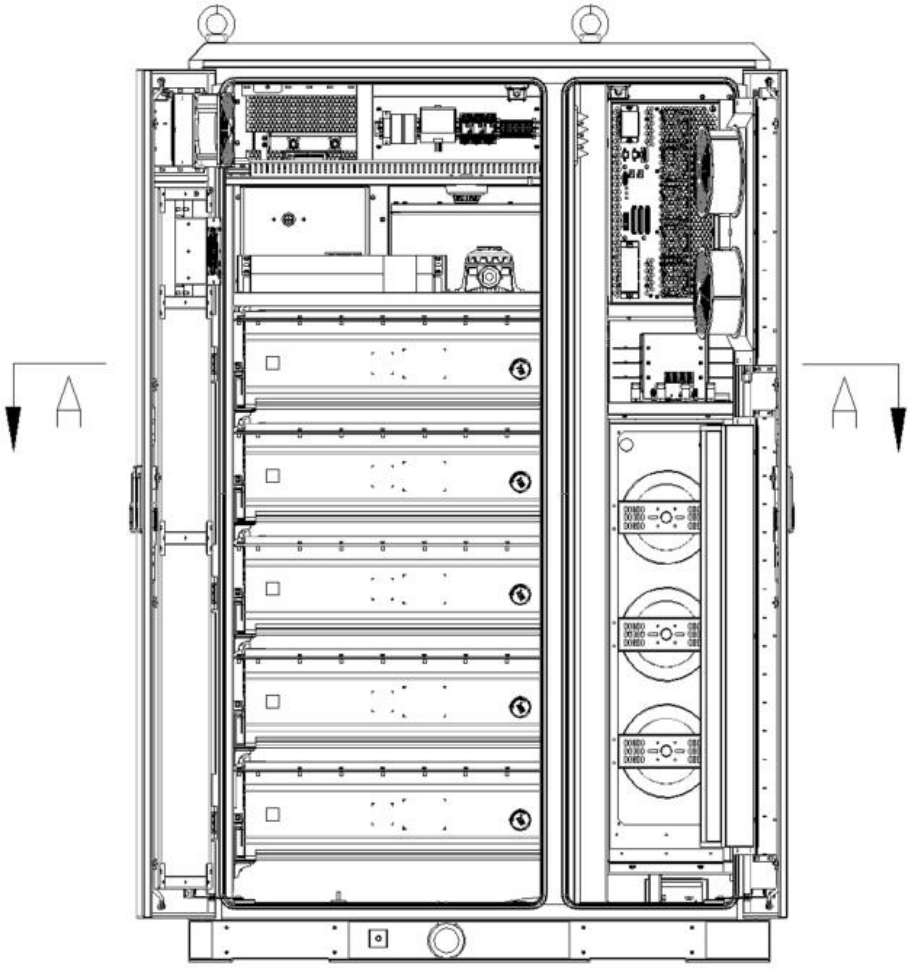
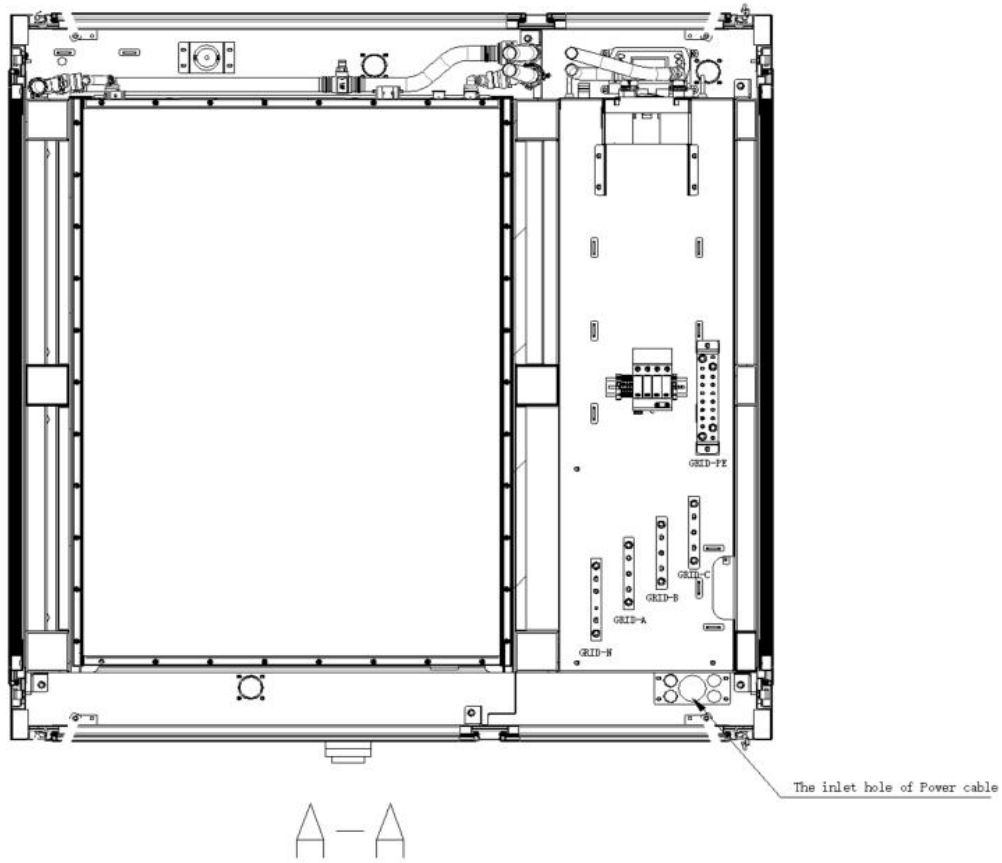


Figure 8-3 Layout of Power Cable Inlet Holes and Inlet Copper Rows



8.4 Ground wire connection

 ELECTRICAL HAZARD	There are several connecting wires connected to the PE copper row, and those wires are shell grounding of the internal Device of the liquid-cooled energy storage cabinet. Do NOT change it without authorization to avoid the danger of electric shocks!

For the sake of safety, all Device shells need to be grounded through PE conductors. The PE copper row inside the liquid-cooled energy storage cabinet has already been reliably connected to the shell of the liquid-cooled energy storage cabinet. When the PE connection is performed, the PE grounding copper row shall be reliably connected to the equipotential connection device in the installation site or the electrical control room. The diameter of the grounding cable is not less than half of the diameter of the grid inlet phase wire, and the grounding resistance of the grounding cable is less than 4Ω.

8.5 Communication

8.5.1 RS485 communication

Both ends of RS485 communication cable adopt terminal blocks, and both ends of the terminal blocks are wired in parallel to make the RS485 communication cables, the length of which shall not exceed 100 meters. Use shielded twisted pair communication cables to ensure the transmission quality. The 485 interface of the liquid-cooled energy storage cabinet is located on the EMS inside the Device. Please distinguish "A" from "B".

8.5.2 LAN communication

The liquid-cooled energy storage cabinet PCS communicates with the EMS via LAN. Both ends of the LAN communication cable adopt cat5e network shielded crystal head, and cat5e shielded network cable shall be used for LAN communication cables.

8.6 Post-installation check

A post-installation check is required after the liquid-cooled energy storage cabinet is installed:

Item	Results
1. The Device is placed and installed in a reasonable position to meet the requirements for load bearing and environmental protection;	(√/×)
2. The power cables are correctly connected, the ground wire is well connected to the ground network, and the construction unit is required to test the grounding resistance value;	(√/×)
3. Check whether the main line is connected incorrectly/the wire sequence is reversed, and judge whether it affects the safe operation of the energy storage system;	(√/×)
4. Confirm that the communication cables have all been correctly connected, and that there is no open circuit or short circuit in the connections.	(√/×)

 	The electrical wiring inspection needs to be completed by qualified personnel; After turning off the switch, the Device is already charged with high voltage. Do NOT touch any parts of the liquid-cooled energy storage cabinet unprotected.

9. System Power-up

9.1 Pre-power-up check

Before the liquid-cooled energy storage cabinet is put into operation, its installation shall be checked and at least two staff members shall perform inspections of the items listed in the following table to ensure the correctness of each installation.

Cabinet check

No.	Items	Acceptance criteria	Results
1	Installation	Installation is consistent with the design drawings. The box is horizontal and the doors can be opened normally.	(√/×)
2	Appearance	There are no cracks, dents or scratches on the surface of the box. Repair if the paint is off.	(√/×)
3	Box grounding	Each container has at least two ground points that are grounded securely with a bond resistance of ≤0.1Ω.	(√/×)
4	Accessories	The number and positions of external accessories to be installed meet design requirements.	(√/×)
5	Identification	Labels are correct, clear, and complete.	(√/×)

Interior check

No.	Items	Acceptance criteria	Results
1	Voltage	The power grid voltage matches the rated output voltage of the energy storage system;	(√/×)
2	Cable appearance	The protective coating of the cable is well wrapped without visible damage; The cable hose is intact;	(√/×)
3	Cable connection	The cable connection position is the same as the design; Terminal production is in line with the specifications, and the connection is firm and reliable; The labels on both ends of each cable are clear and distinct, and the labels are oriented in the same direction;	(√/×)
4	Cabling	The wiring meets the principle of separation of strong and weak electricity; The cable is neat and tidy; Leave a margin at the turnings as required, and do NOT pull tighten; The cable number is correctly and clearly marked, the mounting bolts are tightened, and the cables are not loosened by pulling;	(√/×)
5	Circuit breaker	Both AC and DC circuit breakers are disconnected.	(√/×)
6	Copper row	There is no obvious deformation of the copper row and no debris on the copper row.	(√/×)
7	Blocking off of cable holes	Cable hole blocking off has been completed.	(√/×)
8	Battery	There is no damage or leakage on the exterior of each battery pack.	(√/×)

	pack		
9	Foreign objects	Remove all foreign objects from the cabinet, such as tools, installation residual materials.	(√/×)
10	Lightning arrester	The lightning arrester status indicator is green.	(√/×)
11	Subcomponents	There is no damage to the exterior of each subcomponent.	(√/×)
12	Box grounding	The grounding conductor is reliably connected to the box grounding terminal blocks or the copper row.	(√/×)

PCS Installation Checks

Items	Description	Results
Installation check items	Check whether the PCS case is deformed/damaged.	(√/×)
	Check whether the bottom of the cabinet is fixed firmly and reliably.	(√/×)
	Verify whether the device has been reliably installed.	(√/×)
	Confirm whether the space around the PCS is compliant.	(√/×)
Electrical connection check items	Check whether the preceding AC switch is "OFF".	(√/×)
	PCS grounding is complete and secure	(√/×)
	The grid voltage matches the rated output voltage of the PCS;	(√/×)
	Whether the DC terminal voltage matches the PCS requirements;	
	The phase sequence of the grid connection is correct and the tightening torque meets the requirements	(√/×)
	Whether the polarity of the DC terminal connection is correct, and whether the connection is firm and reliable. Make sure there is no open circuit or short circuit.	(√/×)
	Check whether the communication cables are correctly and securely connected.	(√/×)
	Check whether all cable numbers are correctly and clearly marked, and whether the cables are damaged or cracked. Make sure that all connecting cables are intact.	(√/×)
Other checks	No tools, parts, conductive dust from drilling or other foreign objects left inside	(√/×)
	All useless conductive parts are tightened with insulating ties	(√/×)
	No condensation of moisture or icing inside	(√/×)

9.2 Power-up process

DANGER

Always wear insulated gloves and use insulated tools to avoid electric shocks or short-circuit faults.

CAUTION

- Observe the battery while powering up, and immediately power off the battery when abnormal phenomena are found. Figure out the reasons and solve the problems before powering up again.
- After the battery is powered off or discharged, recharge the battery in time. Otherwise, the battery may be damaged due to over-discharge.
- Storage of the low-power battery may cause damage to the battery due to over-discharge. Recharge the battery in time.

9.3 Energy storage system power-up

Prerequisites

1. Insulation resistance check:

Insulation resistance between the busbars (+, -) and the shell of the liquid-cooled energy storage cabinet, and between the AC cables and the shell. The insulation resistance R ≥100MΩ;

2. Voltage resistance check:

1) The withstand voltage between the busbars/bars (+, -) and the shell of the all-in-one machine: DC1,000V; test voltage: DC3,100V; no flashover or breakdown phenomenon; leakage current I＜ 20mA;

2) Voltage withstand voltage between the AC cables and the shell of the all-in-one machine: AC380V; test voltage: AC2,200V; no flashover or breakdown phenomenon; leakage current I＜ 20mA;

3. Grounding resistance check:

The grounding resistance between the cabinet, individual electrical Device and the earth: R＜4Ω.

4. Check the grid voltage:

1) Check whether the three-phase wiring marking of PCS corresponds to the three-phase marking of the power grid one by one;

2) Check whether the grid voltage is all within the predetermined range, and record the voltage values;

3) Check whether the grid frequencies are all within the predetermined range, and record the frequency values;

4) Measure the THD (Total Harmonic Distortion) of the grid voltage. The PCS may not operate where the distortion is severe.

5. Check the DC side voltage

The DC side shall be connected from the high-voltage box to the PCS.

1) Make sure the DC input electrode is correct;

2) Measure and record the DC (open circuit) voltage, which shall not exceed the maximum allowed.

9.3.1 Power-on procedure

The steps for powering on the energy storage cabinet are as follows:

Step 1: Plug the covers of the manual service disjunctors (MSD) of PACK1~PACK5 into the PCAK in turn after confirming that all the above checks have detected no abnormality;

Step 2: Power up on the AC side and manually switch on the AC side circuit breaker QF1;

Step 3: Switch on the AC220V auxiliary power supply circuit breakers QF11-QF12-QF13-QF14-QF15-QF21-QF22 successively; and then switch on the 24V DC circuit breakers QF31~QF34 successively; Next, start the UPS: press and hold the power/mute button "ON/MUTE" for 5 seconds, and the UPS will be in operation;

Step 4: Power on the DC side at high voltage, and the QS disconnecting switch on the BMS HVB is turned to the "ON" position;
Step 5: Wait for about 1 minute to see some electrical parameters of the AC and DC sides through the upper computer software.
Step 6: Confirm the status of the device is normal: the fault warning light is not on, and no fault is displayed on the LCD home screen;
Step 7: Enter the background software to set the relevant operating parameters. If a touch screen is available, set the relevant operating parameters according to 2.5.2 booting guidance. After the parameter setting is complete, set the device to "start";
Step 8: Wait for about 10S, the Device startup will be completed, during which there will be the sound of the contactor closing, which is normal. If the Device is idle for a long time, it will enter the on-grid "standby" state.
Step 9: After the PCS is running (the operation indicator is on), check there is no abnormality in the PCS. For example: Stop the Device immediately for checks in case of any abnormal noise, abnormal odor or smoke.

9.3.2 Power-off procedure

Regular power-off procedure:
Step 1: The background shall be set to the shutdown state, and the PCS enters the automatic shutdown process. The Device will automatically disconnect the contactors on the AC and the DC sides after the power IGBT is sealed. At this time, there will be a sound of contactor disconnection, and about 10S later, the regular shutdown is completed (If the Device is idle for Step 1: turn off the switches on the AC side and the DC side in turn);
Step 2: Power off the DC side at high voltage, and the QS disconnecting switch on the BMS HVB is turned Downstream to the "OFF" position;
Step 3: Disconnect the DC 24V power supply, and disconnect QF34-QF33-QF32-QF31 successively; then disconnect the power supply of the UPS, and press and hold down the "OFF/MUTE" button of the UPS for 2 seconds ; At this time, the UPS is in a shutdown state;
Step 4: Disconnect successively the auxiliary power supply circuit on the AC side: QF22-QF21-QF15-QF14-QF13-QF12-QF11;
Step 5: Disconnect the mains supply, manually disconnect the mains supply circuit breaker QF1, and switch QF1 to the "OFF" state;
Step 6: Pull out the covers of the MSDs of PACK1~PACK5 in sequence;
Step 7: Open the cabinet door, and check the power with a voltage tester (An energy storage Device is installed inside the Device. Before performing other operations, make sure the discharge is complete). Proceed to the next step after checking the power;
Step 8: Maintenance personnel shall perform maintenance and overhaul operations.

9.4 Power-on and power-off mode

PCS power on: The liquid-cooled energy storage cabinet is not equipped with the automatic

power-on function. If the operating conditions are met, it is necessary to start the system manually using the HMI screen. The RUN indicator is always on blue, and the energy storage system is operating. (can be set to enable automatic startup of the Device)

PCS power off: Select the control interface or remote control on the HMI screen to set the Device shutdown, and the Device stops running. This shutdown mode only turns off the operation of the power devices in the system, and the machine is in standby mode and the output terminals are powered. If the Device needs to be powered off, disconnect the DC side disconnecting switch QS and the AC side circuit breaker QF1.

In case of an emergency, press the emergency stop button switch to stop operation, and the liquid-cooled energy storage cabinet will shut down in an emergency. At this time, the liquid-cooled energy storage cabinet will report an ESD fault, and the fault indicator will flash red and sound an alarm.

9.5 Manual/automatic operation

We can set the switch of manual/automatic operation mode through the HMI controller or the remote client. After switching to automatic startup, the Device will automatically start up after being powered on.

9.6 On-grid conditions

Unless otherwise specified, the PCS can operate normally under the following grid conditions:

1) The harmonic voltage of the grid shall not exceed the requirements of local national and grid standards and regulations;

2) The unbalance of the three-phase voltage at the AC output shall not exceed the requirements of local national and grid standards and regulations;

3) The permissible deviation of grid voltage shall meet the requirements of local national and grid standards and regulations;

4) The permissible deviation of grid frequency shall meet the requirements of local national and grid standards and regulations.

9.6.1 Standby state

The standby state is when the on-grid PCS is turned on and waiting for a running instruction. When the running instruction is set as charging (i.e. voltage values for constant voltage charging, current values for constant current charging and power values for constant power charging. It is necessary to determine the charging method as constant voltage, constant current or constant power at the very beginning), it enters the on-grid charging state. When the running instruction is set as discharging (i.e. current values for constant current discharging and power values for constant power discharging. It is necessary to determine the discharging method as constant current or constant power at the very beginning), it enters the on-grid discharging state.

9.6.2 On-grid operation state

1. The DC input of PCS is connected to the DC output of the battery pack, and the AC output is connected to the power grid;
2. Confirm that PCS is in a normal shutdown state (The fault indicator on the PCS panel is off, the running indicator flashes, and no fault is displayed on the real-time fault information interface);
3. PCS will gradually turn off the switch and carry out the "self-test" on both the AC and DC sides to enter the "on-grid" state;
4. Power responds quickly, and the time for PCS charging and discharging conversion is less than 100ms. When there is any abnormality in the power grid, it will be disconnected from the power grid immediately and enter the fault state immediately.
5. In this mode, PCS can convert DC current from the battery into AC current and connect it to the grid; it can also charge AC current from the grid into the battery.

9.6.3 Off-grid operation state

1. The DC input of PCS is connected to the DC output of the battery pack, and the AC output is connected to the load;
2. Confirm that PCS is in a normal shutdown state (The fault indicator on the panel is off, the running indicator flashes, and no fault is displayed on the real-time fault information interface).
3. PCS will gradually turn off the switch and carry out the "self-test" on both the AC and DC sides to enter the "off-grid" state.

Note: The system N wire shall be connected reliably with PE during off-grid operation.

9.6.4 PCS fault state

In the event of a PCS fault, the Power Conversion System will immediately disconnect the AC-side circuit breaker and the DC-side circuit breaker and enter a fault state to ensure system safety. The PCS will then continuously monitor whether the fault is eliminated, and if not, it will remain in the fault state.

10. HMI Operation Guide

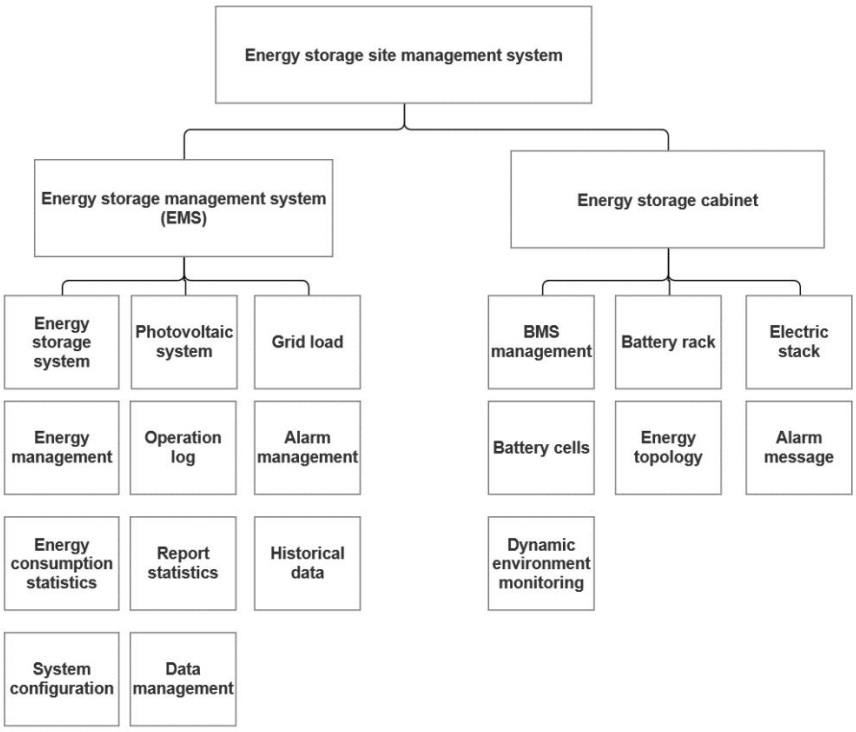
About the Touch Screen

The liquid-cooled energy storage cabinet features a 10.1’ HMI screen with a resolution of 1920x1080. This allows users to check the operation information of, and set operation parameters of the liquid-cooled energy storage cabinet on the HMI screen.

10.1 About Product EMS

The following figure illustrates product operation and control. The whole product is designed with an energy storage site management system, and some functions are reserved:

- EMS: including energy storage system, photovoltaic system, grid load, energy management, operation log, alarm management, energy consumption statistics, report statistics, historical data, system configuration, and data management.
- Energy storage cabinet: including BMS management (e.g. Information on battery rack, electric stack, and battery cells), energy topology, alarm message, dynamic environment monitoring, etc.



10.2 About EMS operation screen and functions

The following illustrates the product EMS operation screen and functions:

10.2.1 System homepage

After the energy storage system is powered on, the SMU energy management screen control system will automatically start and display the homepage.

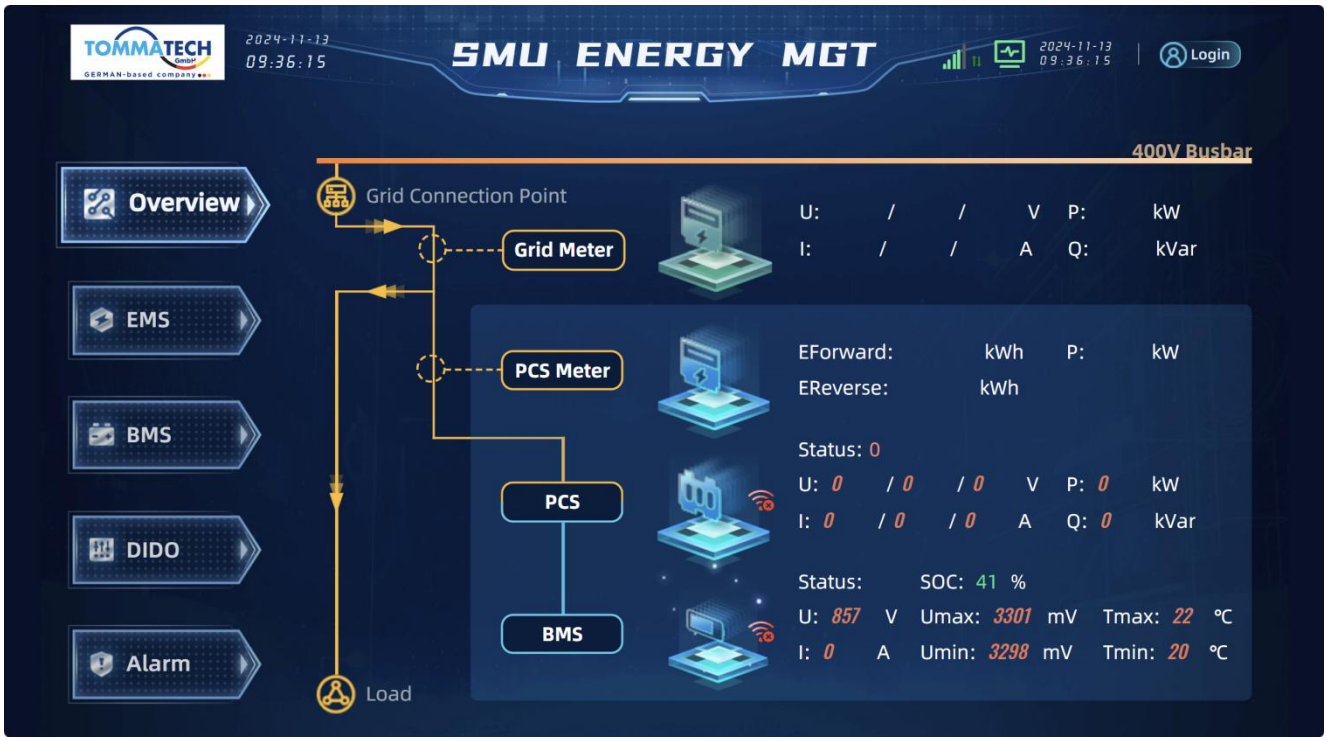


Figure 1: Example of the Homepage of SMU Energy Management Screen Control System

The upper-right corner of the homepage shows the networking status, connection status with the energy storage system, as well as the refresh time and the login button

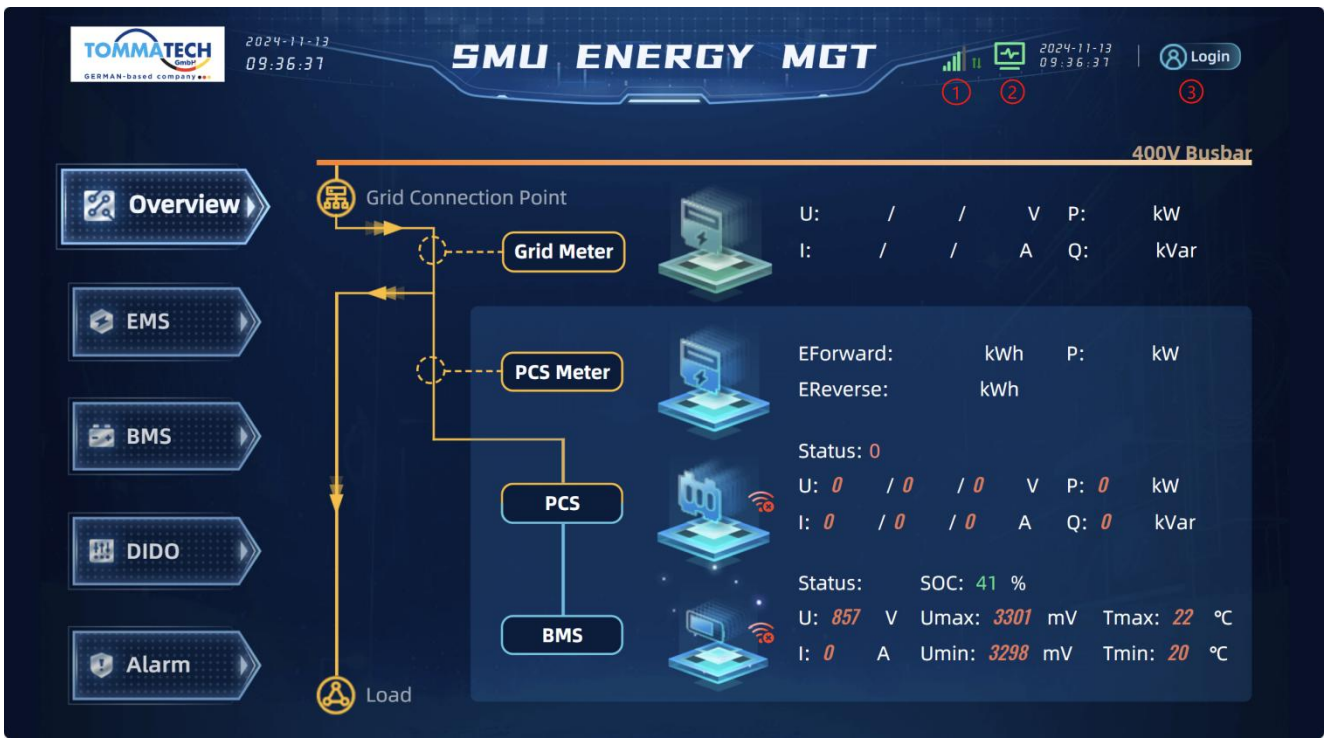


Figure 2: Networking Status, Connection Status with the Energy Storage System, as well as the Refresh Time and Login Button

1) Networking icon: indicates the current networking status of the device connected to the system. Green indicates that the uplink public network is connected and in the networking status; and red indicates that the uplink public network is disconnected and in the network outage status.
2) Clock area: connection status and refresh time with the backend of the energy storage system. After the connection is interrupted, it turns red and displays the disconnection time.
3) Login icon: Users can click this icon to log in the SMU energy management screen control system.
4) The left area of the homepage shows the key status and data, coupled with alarms of the SMU energy management screen control system, including:

- General Overview
- EMS system
- BMS system
- Dry contact

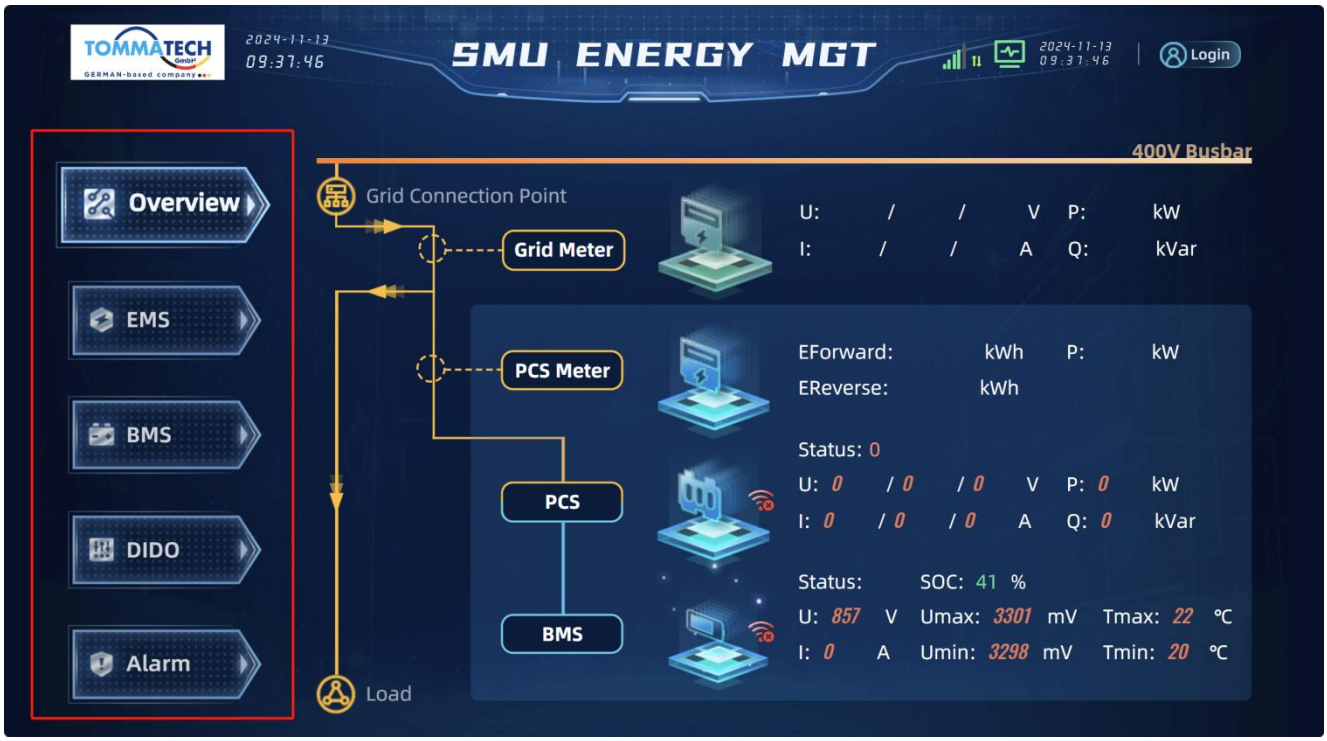
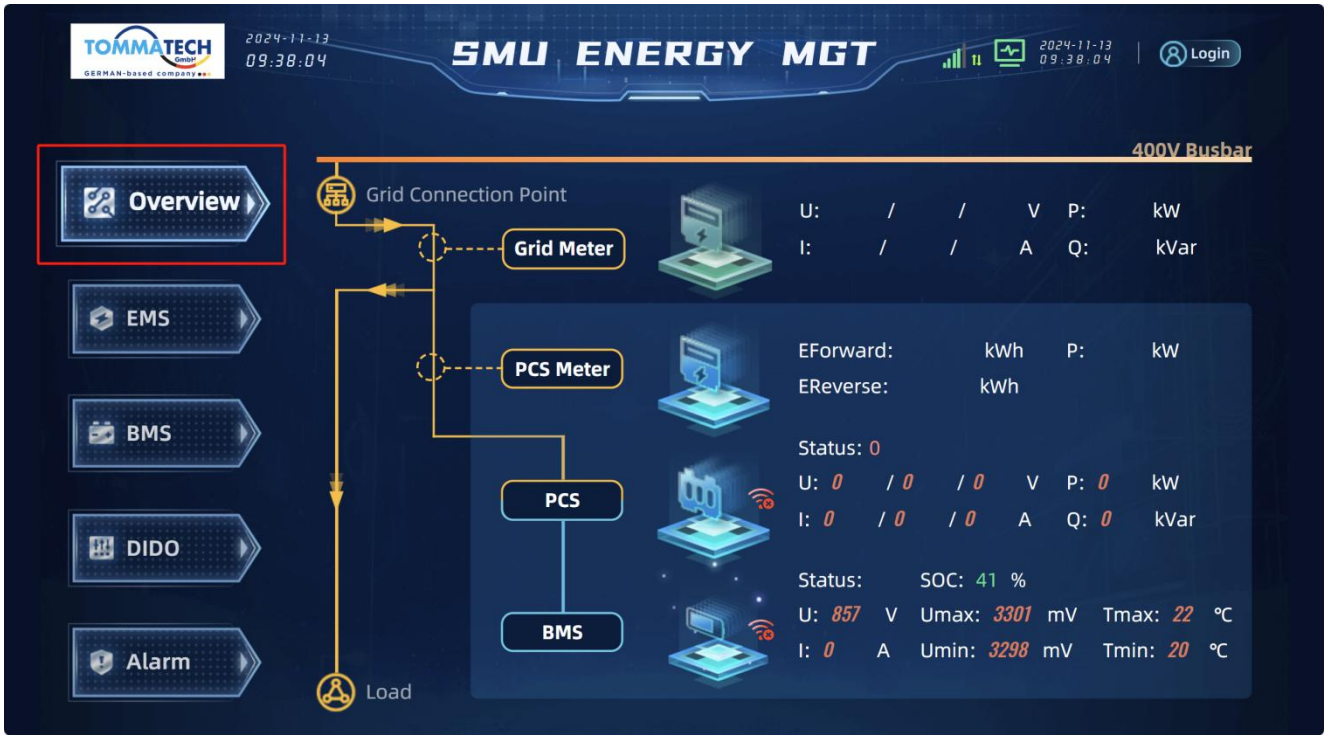


Figure 3: Functional Areas of the SMU Energy Management Screen Control System

1.1.1. General Overview

1.1.2. Users can click on Overall Overview on the left panel to view information on the voltage, current, power, and battery of the current energy storage Device, and grasp the latest status of the energy storage system in real time.



EMS System

Users can click on **EMS System** on the left panel to view the important status of the controller of the current energy storage Device, such as the number of alarms, no-charge protection and no-discharge protection.

BMS System

Users can click on **BMS System** on the left panel to view the management data of the cabinet of

the current energy storage Device.

Click the number of the storage cabinet to be viewed, e.g.#1, to view the information on the corresponding battery cluster, such as the maximum cell voltage, the number of the maximum cell voltage, the minimum cell voltage and the number of the minimum cell voltage.

Dry Contact

Users can click on **Dry Contact** on the left panel to view the current management data of the controller's DI.

Click the desired energy storage cabinet number to view the status of water logging, smoke sensing, and fire extinguishing devices inside the corresponding energy storage cabinet.

System Alarms

Users can click on **System Alarms** on the left panel to view the active alarm data for the current energy storage Device.

System Login

Preparations

- The energy storage system has been powered up.
- The SMU energy management screen control system has been properly wired and installed.

Steps

1. Click **Login** at the upper right corner of the SMU energy management screen control system page.

   Results

   The login window pops up on the current page.

   Examples

Figure: Login Page of the SMU Energy Management Screen Control System

2. Log in to the system as needed.

- To log in to the system as a registered user, enter your user name and password, and then click **Login**.
- To log in to the system anonymously, click **Anonymous Login**. Users who log in to the system anonymously only have access to view system information and cannot edit or modify it.

Results

After logging in, the main interface of the SMU energy management screen control system will be displayed on the screen.

Examples

Figure : Example of Main Interface of the System

- In the center area of the main interface of the SMU energy management screen control system, the following main function modules are displayed:
- System monitoring: responsible for real-time monitoring of the operating status and key parameters of the energy storage system, and displaying fault alarms to ensure the safe and stable operation of the energy storage system.
- Energy management: responsible for optimizing the operation strategy of the energy storage system, realizing the efficient utilization and management of energy through intelligent scheduling and strategy execution, and improving the overall performance of the energy storage system.
- Device data: responsible for connecting all southbound devices, serving as the entry for the underlying data read/write operation, and providing information collection, parameter setting and other functions of each southbound-connected device.
- Device management: responsible for configuring and diagnosing all connected southbound devices, providing functions such as port configuration, device configuration, factory diagnosis and charging/discharging diagnosis to effectively support and maintain each device.
- System setting: allows users to modify parameters of the energy storage system, providing functions such as user management, personalized customized configuration, and connection management.

10.3 Main interface

The upper-right corner of the main interface of the SMU energy management screen control system shows the networking status, connection status with the energy storage system, as well as the refresh time, back to homepage and logout icon.

1 - Networking icon: indicates the current networking status of the device connected to the system. Green indicates that the uplink public network is connected and in the networking status; and red indicates that the uplink public network is disconnected and in the network outage status.

2 - Clock area: connection status and refresh time with the backend of the energy storage system. After the connection is interrupted, it turns red and displays the disconnection time.

3 - Back to home icon: Users can click this icon to back to the home screen of the SMU energy management screen control system.

4 - Exit login icon: Users can click this icon to exit and back to the home page.
Users can enter the function module page by clicking the corresponding module icon to view the submenu and specific content of the function module.

10.4 System Monitoring

10.4.1 Energy storage monitoring

After entering the **System Monitoring** page, users can click on **Energy Storage Monitoring** on the left panel to view the operation of the energy storage system meter, such as three-phase voltage and current, total active power, and total active electrical energy, so as to monitor the energy storage Device in real time, detect problems, and intervene in time to maximize the efficiency of energy utilization.

10.4.2 Power Grid Monitoring

Users can click Power Grid Monitoring on the left panel to view the operating status of the power grid, such as total apparent power, total active power, and total reactive power, which is convenient for users to find out the countercurrent problem and the demand control problem of the energy storage system in time.

10.4.3 Current Alarms

Users can click **Current Alarms** on the left panel to view the alarm message in the energy storage system, such as alarm time, alarm level, and alarm type, so as to timely find out the problems of the system or the Device and take corresponding measures to deal with them, and check potential risks to ensure the normal operation of the energy storage Device.

10.4.4 About

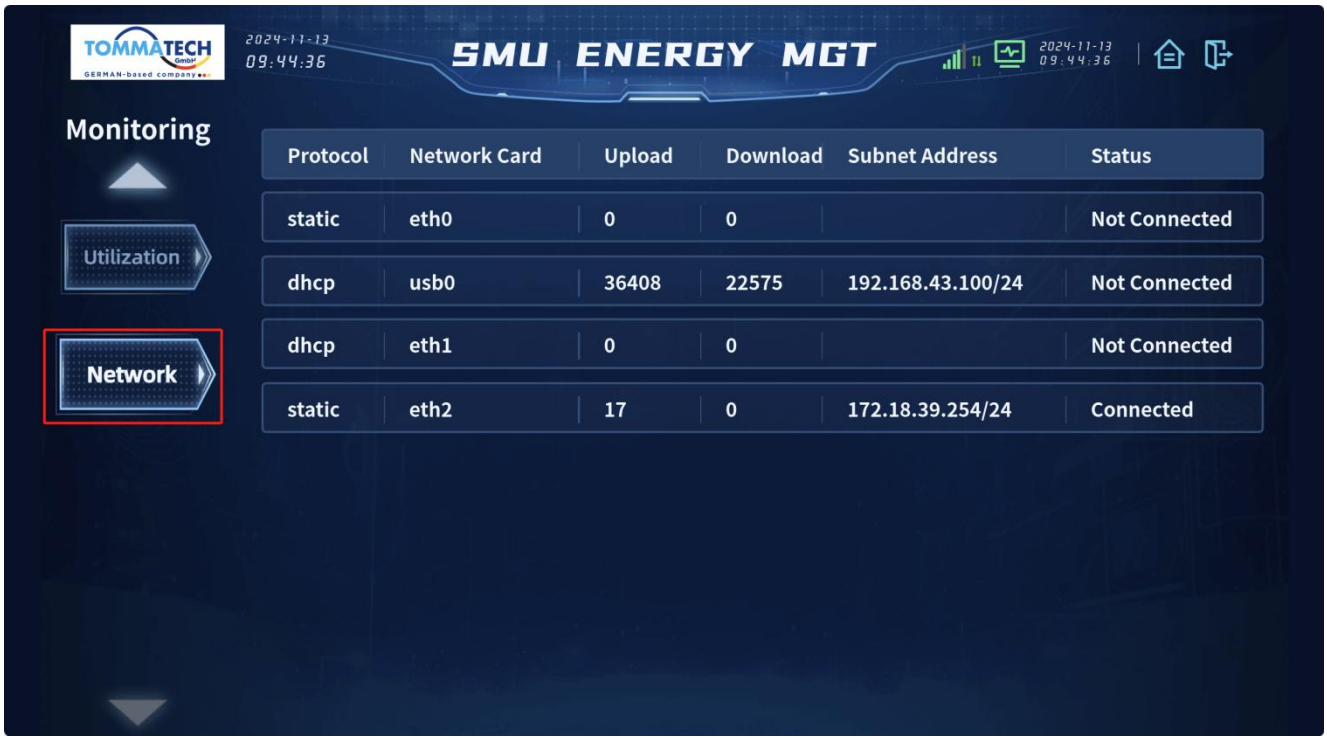
Users can click **About** on the left panel to view information such as SIM card number, site number and controller number.

10.4.5 System Usage

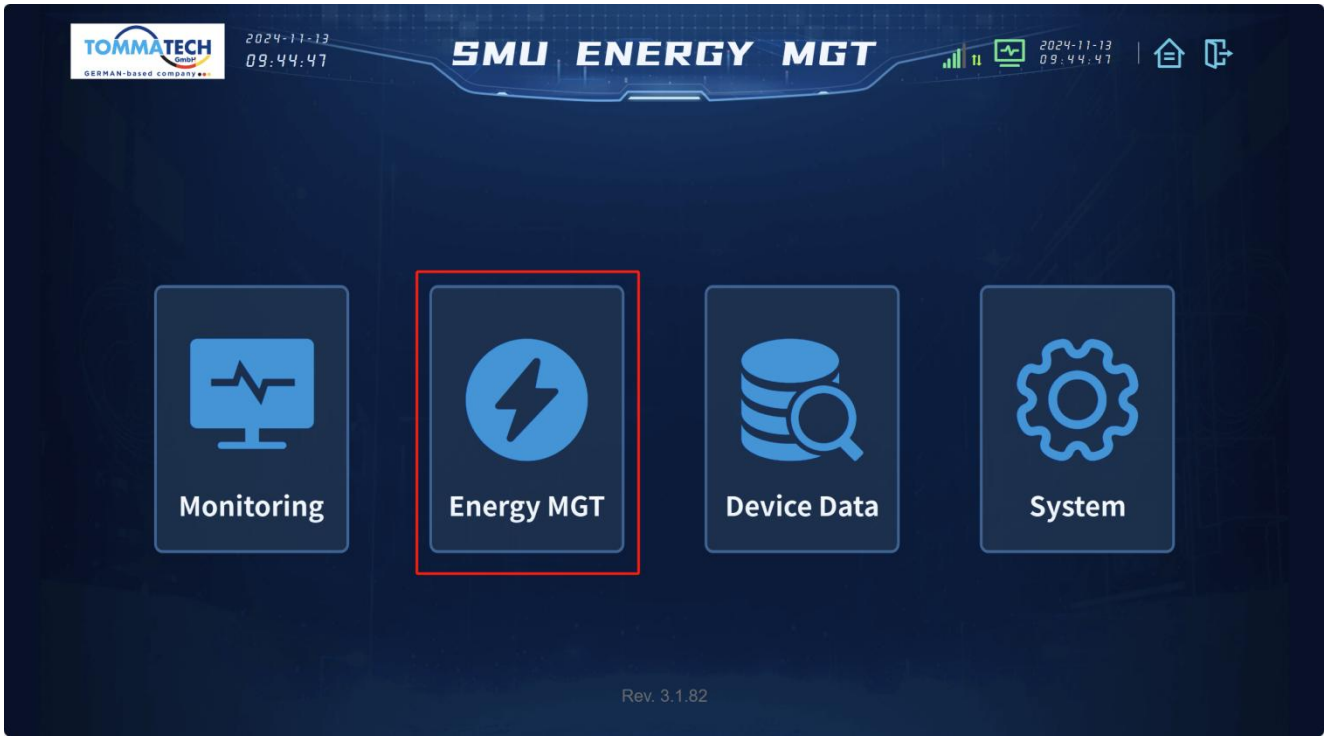
Users can click **System Usage** on the left panel to view the resource usage of the current energy storage system, such as memory usage, hard disk usage, and expansion disk usage, and identify the bottleneck of system usage.

10.4.6 Network Status

Users can click **Network Status** on the left panel to view information on the current network status, the corresponding network card and the number of uplink packets of the current energy storage system.



10.5 Energy management



10.5.1 Strategy Parameter

Users can select **Strategy Parameter** on the left panel to perform operations such as shutdown linkage, demand protection and countercurrent protection.

10.5.1.1 Setting shutdown linkage

Steps

1) Click **Energy Management ► Strategy Parameter.**
2) Select the **Shutdown Linkage** tab.

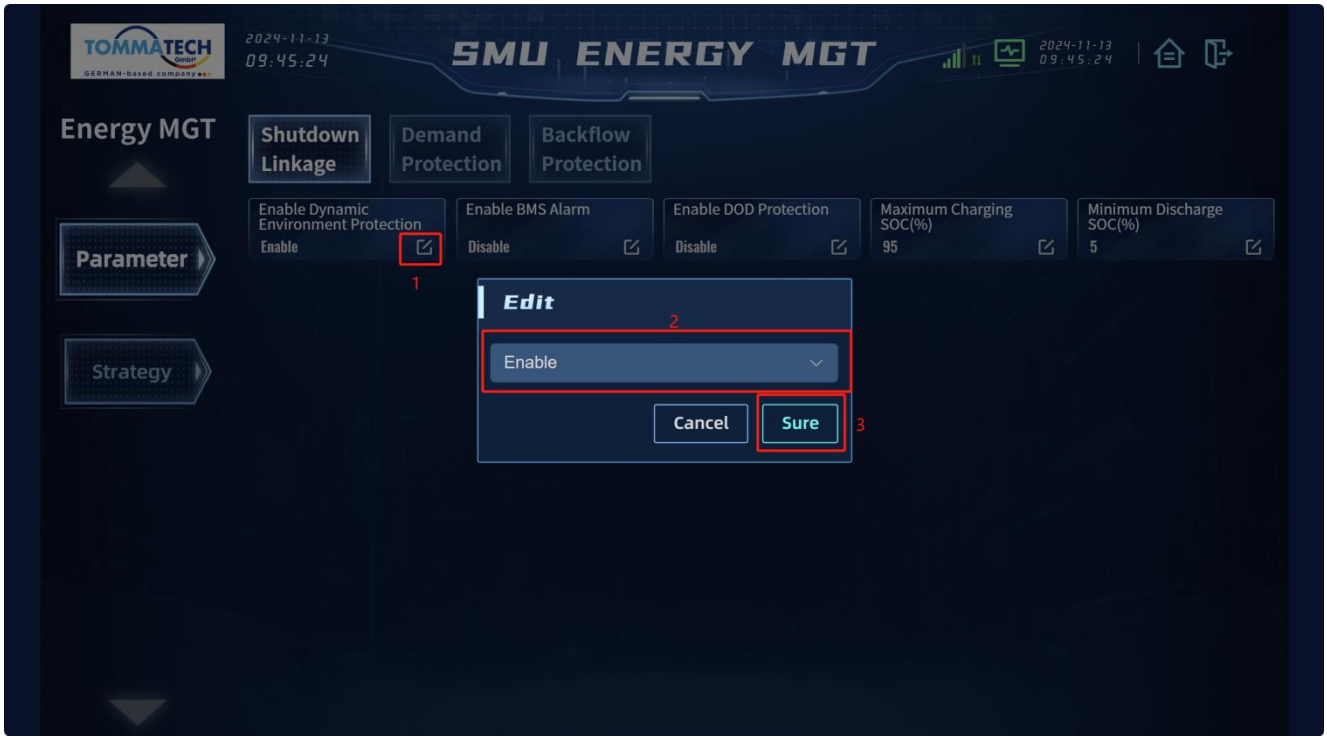
Examples

Figure1: Shutdown Linkage Tab

3) Set the parameters as required.

- 1. Click the "Edit" button at the bottom right corner of the corresponding parameter area.
- 2. Set the parameters in the **"Edit"** dialog box that pops up.
- 3. Click **OK** when the parameter is set.

Examples



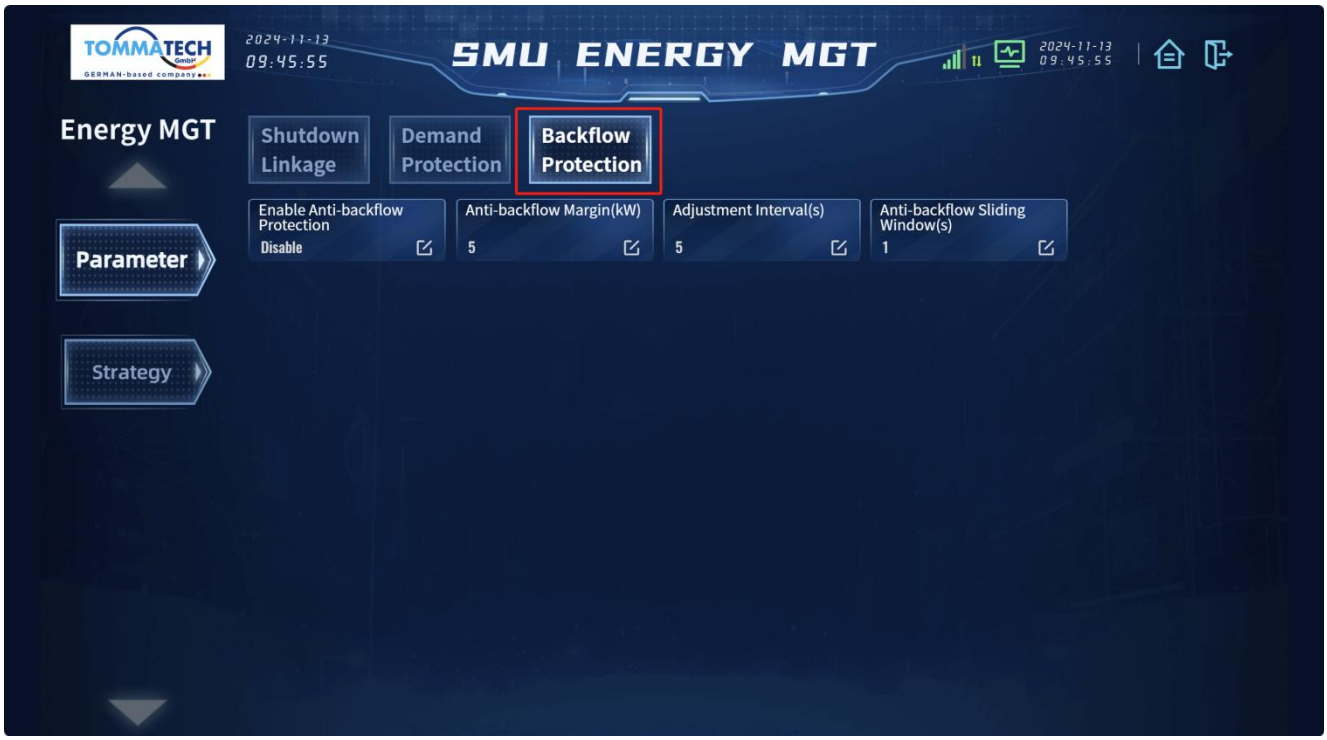
Demand Protection tab

1. Set the parameters as required.

10.5.1.2 Setting countercurrent protection

Steps

Click **Energy Management ► Strategy Parameter.**



10.5.2 Strategy Management

Users can select **Strategy Management** on the left panel to switch management modes and management strategies.

The management comes in two modes that are local and remote, respectively:

- In local mode, users can access and manage the current energy storage Device through the SMU energy management screen control system, EMMS energy storage cloud platform, or Web based on their needs.
- In remote mode, users can configure the use of the northbound interface, and obtain control rights through a third-party cloud platform or software to manage the current energy storage Device.
- The management strategies are categorized into peak-shaving and valley-filling strategies and manual control strategies:
- Peak-shaving and valley-filling strategy, i.e., storing excess power in the trough time and releasing the stored power in the peak time to smooth out load fluctuations and reduce the cost of electricity consumption.
- Transformer capacity increase, i.e., storing and discharging energy during overloaded transformer operation hours to reduce transformer load.
- The manual control strategy is generally used for project testing or debugging, and users can set management modes, switching on/off and other functions.

10.5.2.1 Setting peak-shaving and valley-filling strategy

Steps

1) Click Energy Management ► Strategy Management.
2) Select the **Peak-shaving and Valley-filling** tab.

Examples

Figure 2: Peak-shaving and Valley-filling Tab

3) Click the value area to set the charging/discharging start and stop times and power based on your needs.

a. Set the parameters in the **"Edit"** dialog box that pops up.

b. Click **OK** when the parameter is set.

Examples

10.5.2.2 Setting manual control strategy

Steps

1) Click **Energy Management ► Strategy Management**.

2) Select the **Manual Contro**l tab.

Examples

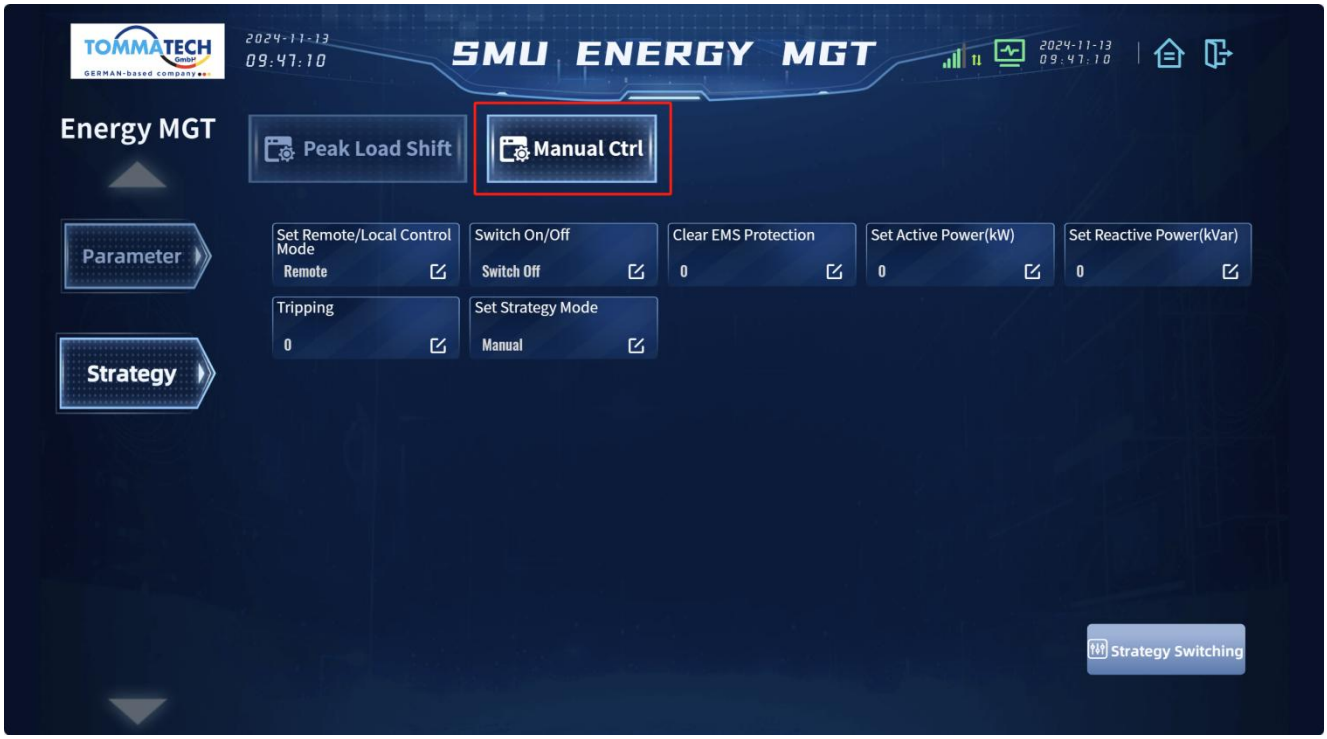


Figure 3: Manual Control Tab

3) Set the parameters as required.

a. Click the **"Edit"** button at the bottom right corner of the corresponding parameter area.

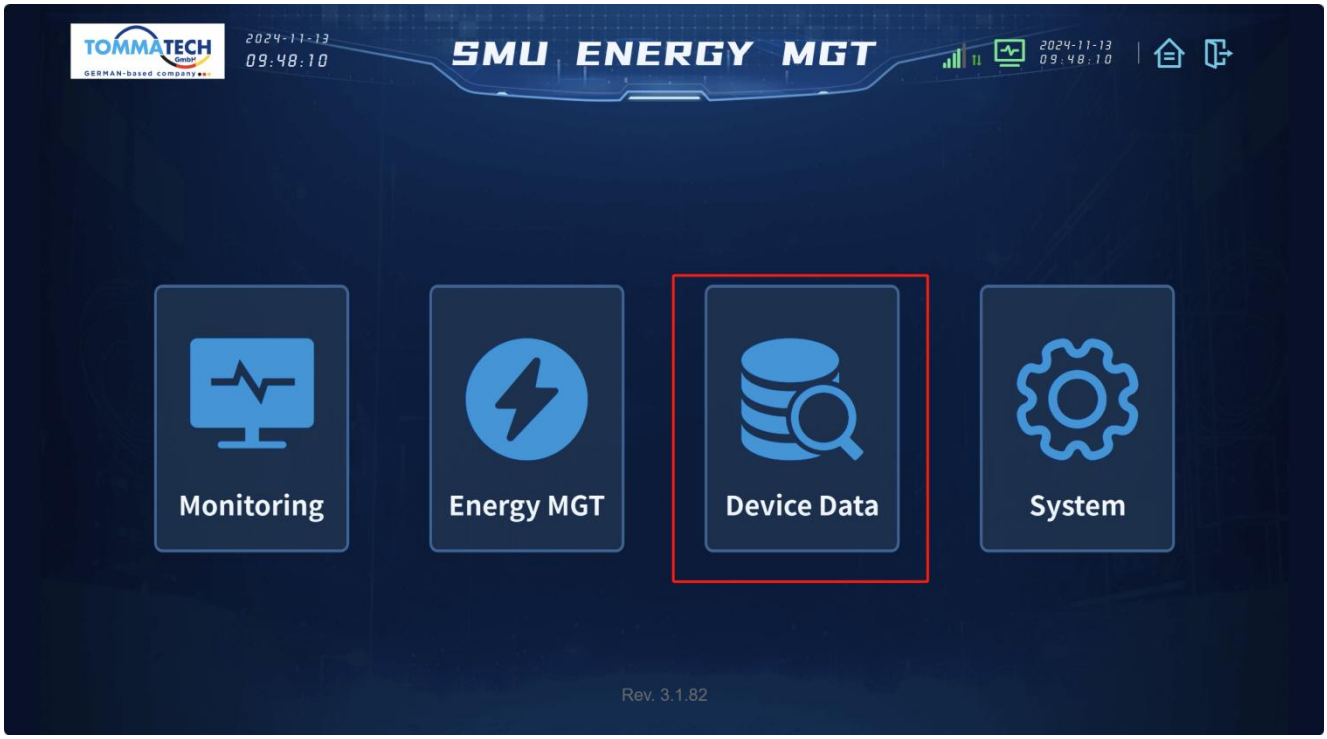
b. Set the parameters in the **"Edit"** dialog box that pops up.

c. Click **OK** when the parameter is set.

Examples

10.6 Device Data

Users can click **Device Data** on the main interface of the system to view the status, data and alarm information of each currently connected device, and set parameters for the operable devices, so as to intuitively monitor the devices and adjust the parameters, which helps reduce the operation complexity.



The device name on the left side of the **Device Data** page will be dynamically generated according to the type of Device connected to the energy storage system, and will be slightly different depending on the project.

Users can check the status, read data service, and set parameter service and alarm.

10.7 System Settings

Users can click **System Settings** in the main interface of the system to set the basic configuration, connection, parameters and system operation of the current energy storage system, which helps users to flexibly set up the energy storage system based on their needs and scenarios, and at the same time, easily carry out a software upgrade to ensure that the energy storage system develops in tandem with the energy storage technology.

10.7.1 Basic Configuration

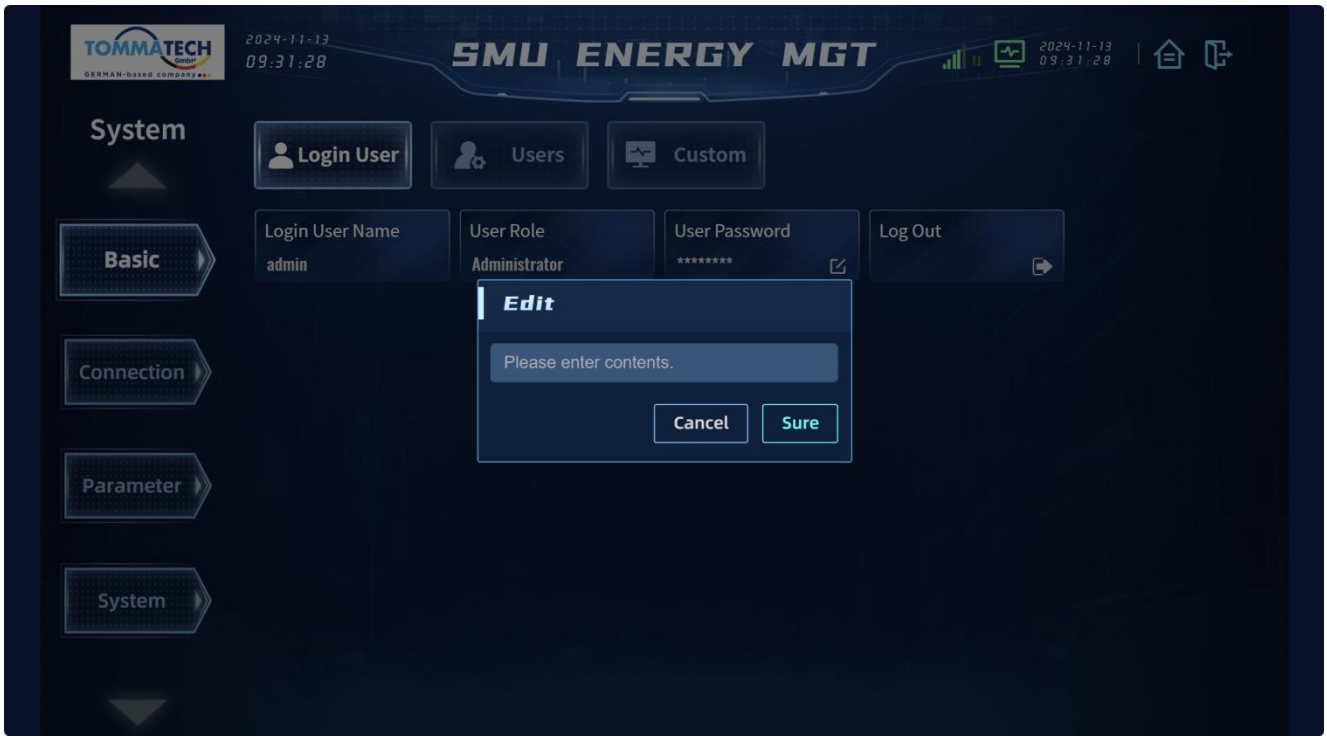
Users can select **Basic Configuration** on the left panel to manage the login account of the current energy storage system, which also supports users to upload the required LOGO and customize the interface display.

10.7.1.1 Setting login user information

Steps:

1) Click **System Settings ► Basic Configuration.**
2) Select the **Login User** tab.
3) Set the parameters as required.
   a. Click the "Edit" button at the bottom right corner of the corresponding parameter area.
   b. Set the parameters in the **"Edit"** dialog box that pops up.
   c. Click **OK** when the parameter is set.

Examples



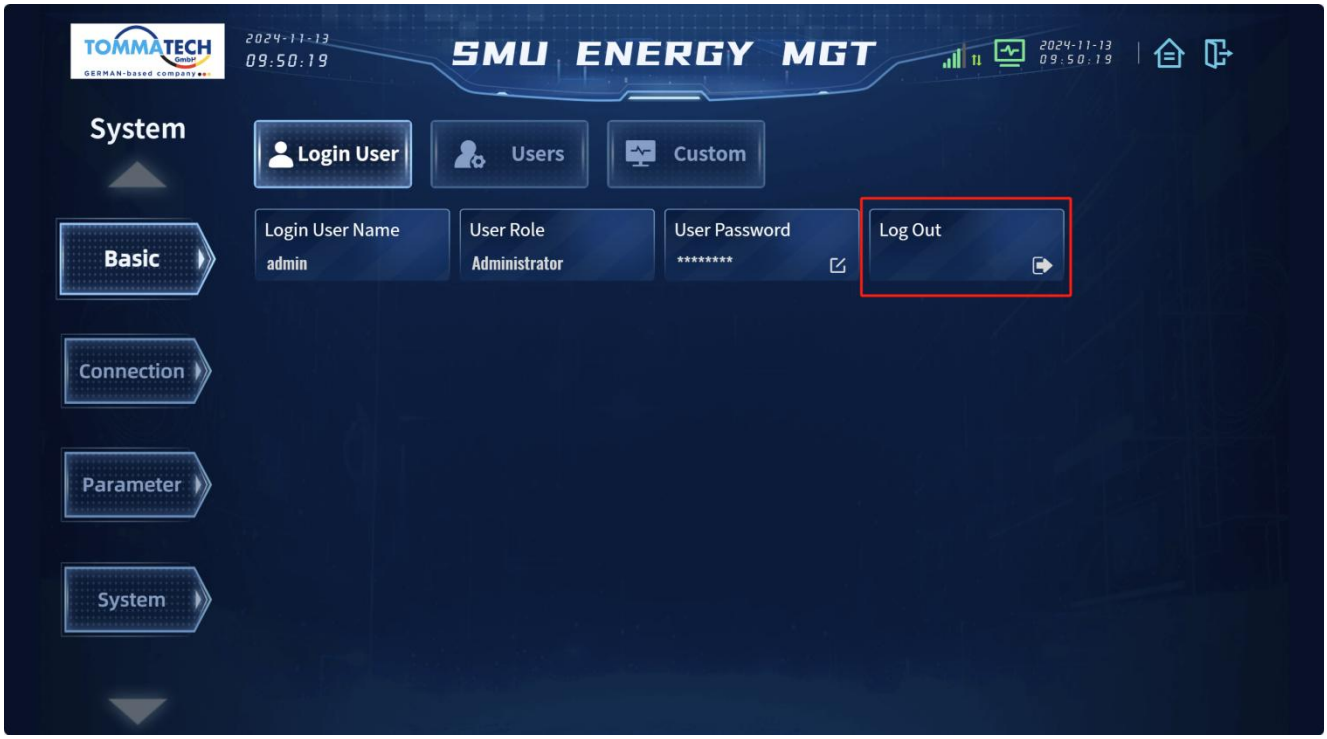
10.7.1.2 Logging Out

Steps:

1) Click **System Settings ► Basic Configuration.**

1) Select the **Login User** tab.
2) Click **Logging Out**.

Examples



10.7.1.3 Reset user passwords

Steps:

1) Click **System Settings ► Basic Configuration**.
2) Select the **Login Administration Tab**.
3) Click **Reset Password** in the corresponding **operation** column for users who need to reset their passwords.

Examples

Figure 4: Resetting Password

4) In the **Operation Confirmation** dialog box that pops up, select **"Confirm"**.

Examples

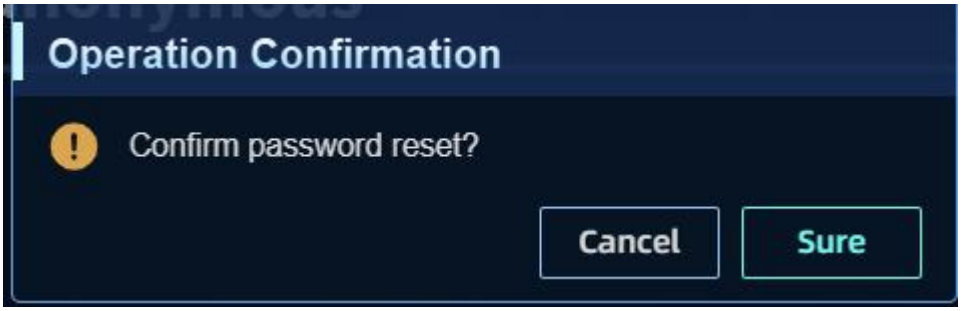


Figure 5: Confirmation Box for Resetting Password

10.7.1.4 Setting a customized LOGO

Steps:

1) Click **System Settings ► Basic Configuration.**
2) Select the **Customized Configuration** tab.
3) Click on the "Upload Files" area for the customized LOGO file.
   It is recommended to use a width of 600 pixels and select a landscape LOGO to ensure clarity and visual effects when scaled in equal proportions.

Examples

10.7.2 Connection Management

Users can select **Connection Management** on the left panel to view information about established network connections, such as name, IP address, port, and user name.

10.8.2.1 Enabling connections

Steps:

1) Click **System Settings ► Basic Configuration**.
2) Select the **Connection Management** tab.
3) Click **Enable** in the **Action** column for the connection to be enabled.

Examples

Title	IP Address	Port	Username	Password	Status	Operate
Local	localhost	4840	admin	********	Enable	Enable

Figure7: Enabling Connection

4) In the **Operation Confirmation** dialog box that pops up, select **"Confirm"**.

Examples

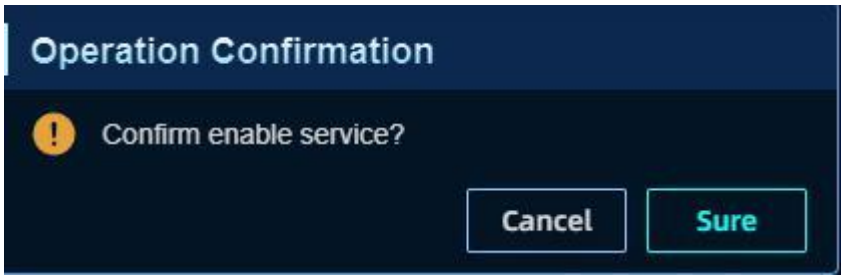


Figure 8: Confirmation Box for Enabling Connection

Only one connection can be enabled in the SMU energy management screen control system. Once one connection is enabled, the others are automatically disabled.

10.8.2.2 Adding a connection

Steps:

1) Click **System Settings ► Basic Configuration.**
2) Select the **Connection Management** tab.
3) Click the cells corresponding to the name, IP address, and port respectively in the blank data row to set the desired parameters.

   Set the parameters in the **Add** dialog box that pops up for each parameter. Click **OK** when the parameter is set.

   Examples

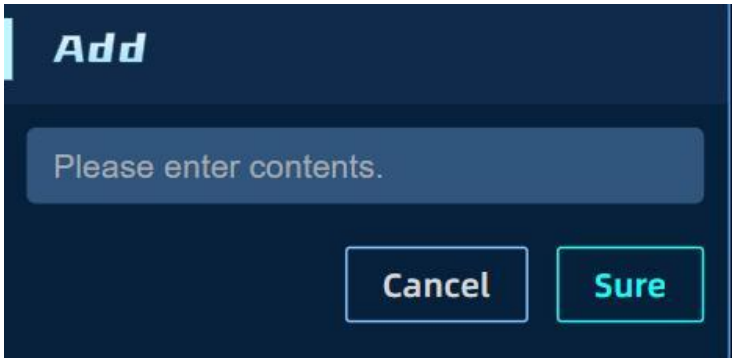


Figure9: Data Row for Adding New Connection Information

4) Click the "Add" button at the bottom right corner of the data table.

Examples

Results

The new connection is added to the connection management data table.

10.8.2.3 Deleting a connection

Steps:

1) Click **System Settings ► Basic Configuration**.
2) Select the **Connection Management** tab.
3) Click the "Delete" button on the right side of the row that corresponds to the connection to be deleted.

Examples

Figure10: Deleting a Connection

4) In the **Operation Confirmation** dialog box that pops up, select "Confirm".

Examples

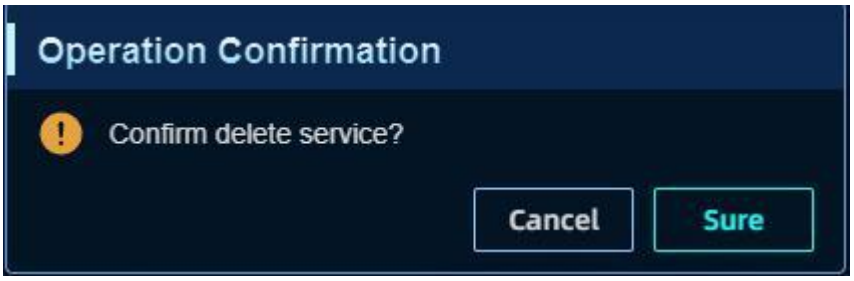


Figure 11: Confirmation Box for Deleting A Connection

The local connection is the default connection enabled by the system and cannot be deleted.

10.8.3 System Parameters

Users can select **System Parameters** on the left panel to view the information on cabinet number, installed capacity and installed power of the current energy storage system.

10.8.3.1 Setting system parameters

Steps:

5) Click **System Settings ► System Parameters.**
6) Set the parameters as required.
   a. Click the **"Edit"** button to the right of the corresponding parameter value.
   b. Set the parameters in the **"Edit"** dialog box that pops up.

c. Click **OK** when the parameter is set.

Examples

10.8.4 System Operation

Users can select **System Operation** on the left panel to perform operations such as Web upgrade, controller upgrade, and format memory hard disk.

Examples

10.8.4.1 Upgrading the SMU energy management screen control system

Steps:

1) Click **System Settings ► System Operation.**
2) Select the **WEB Upgrade** tab.
3) Click the "Upload Files" area to upload the upgraded file.

Examples

4) In the **Open** dialog box that pops up, find the directory where the upgraded files are stored, select the desired ZIP file, and then select **Open**.

Examples

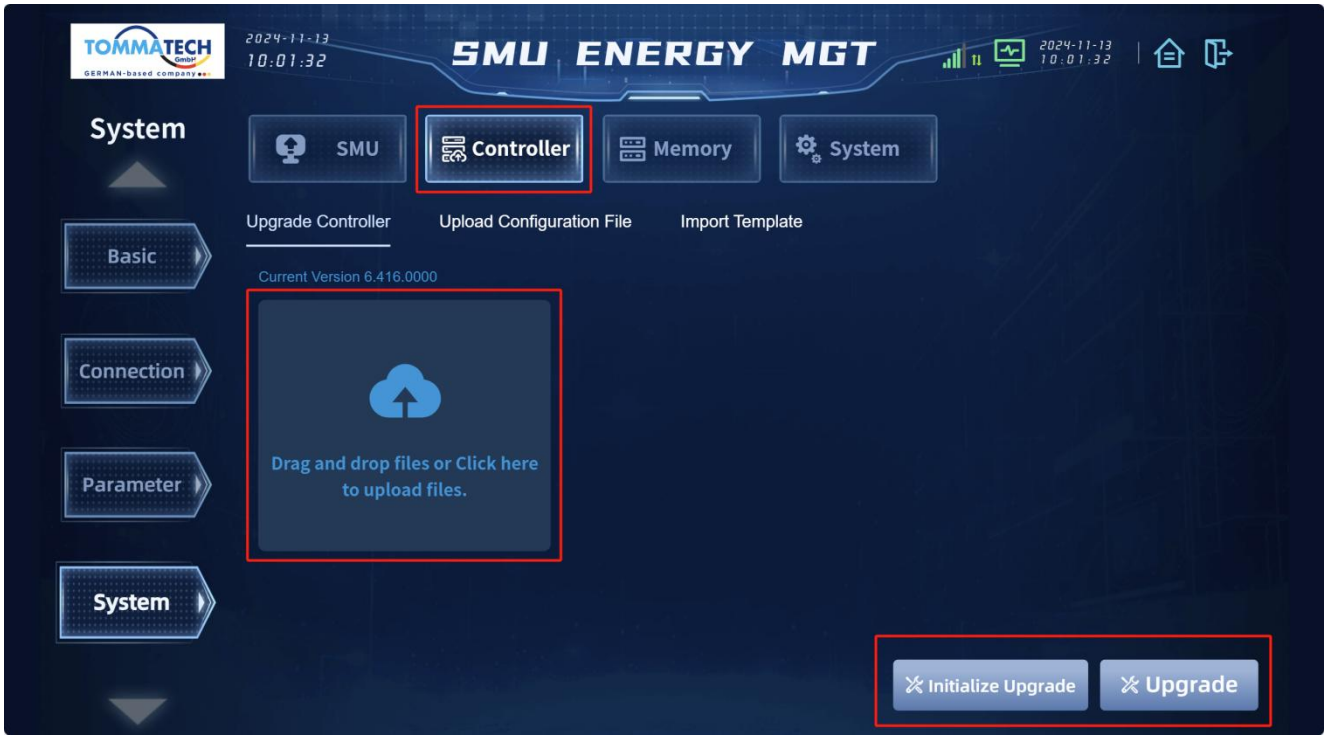
5) Click **Upgrade System**.

10.8.4.2 Upgrading the controller

Steps:

1) Click **System Settings ► System Operation.**
2) Select the **Controller Upgrade** tab.
3) Click the "Upload Files" area to upload the upgraded file.

Examples



Restore factory upgrade

10.8.4.3 Formatting the memory expansion hard disk

Steps:

1) Click **System Settings ► System Operation.**
2) Select the **Memory** tab.
3) Click the "Setting" button at the lower right corner of the F**ormatting Expansion Hard Disk** area.
4) In the **Operation Confirmation** dialog box that pops up, select **"Confirm"**.

Examples

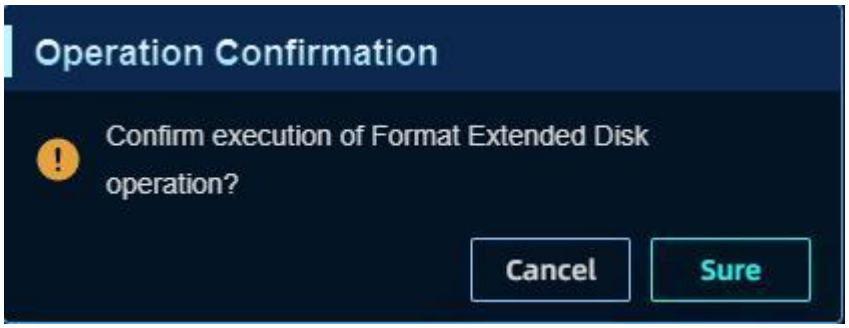


Figure12: Confirmation Box for Formatting Expansion Hard Disk

10.8.4.4 Rebooting the system

Steps:

1) Click **System Settings ► System Operation.**
2) Select the **System** tab.
3) Click the "Setting" button at the bottom right corner of the **Rebooting the System** area.
4) In the **Operation Confirmation** dialog box that pops up, select "**Confirm**".

5) The system will reboot after 20 seconds, and will automatically recover after the reboot is complete.

Examples

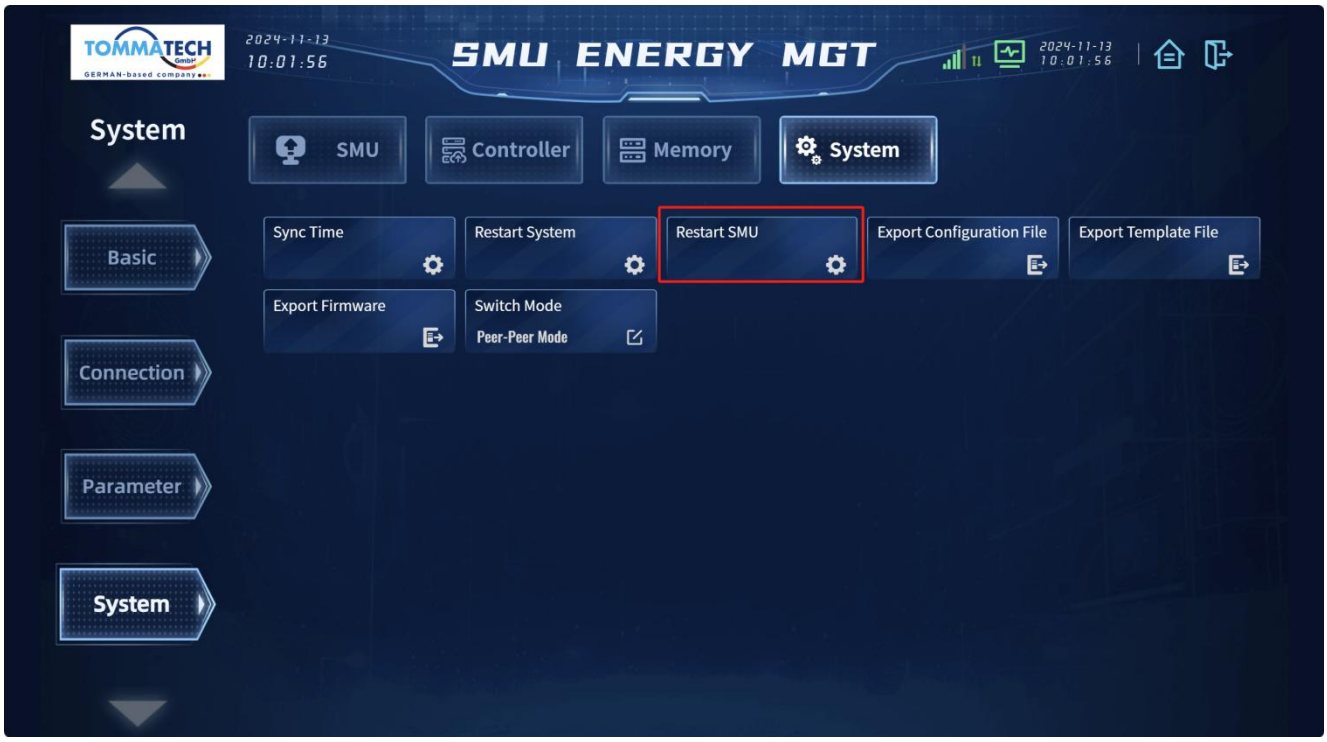


Figure 13: Confirmation Box for Rebooting the System

10.8.4.5 Rebooting WEB

Steps:

1) Click **System Settings ► System Operation**.
2) Select the **System** tab.
3) Click the "Setup" button at the bottom right corner of the **WEB Rebooting** area.
4) In the **Operation Confirmation** dialog box that pops up, select **"Confirm"**.

Examples

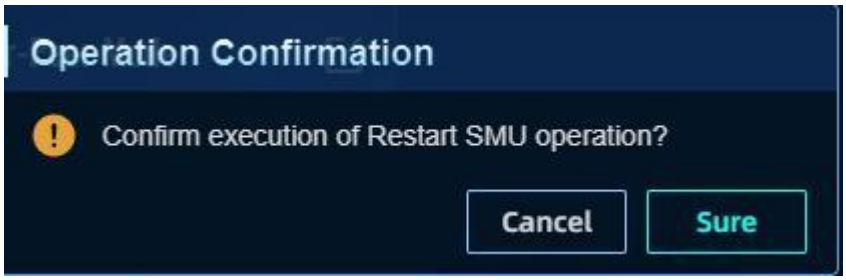


Figure14: Confirmation Box for Rebooting WEB

11. Operation

11.1 Startup steps

The system can be started after the installation and system settings have been checked.

First operation

The steps for the first operation are as follows:

Step 1: The AC and DC switches of the liquid-cooled energy storage cabinet are switched on in sequence: the AC side circuit breaker QF1 is switched on, the DC switch QS of the high-voltage box shall be on, the lightning protection switch shall be on, and the AC load switch shall not be switched on until the system is running normally, so as to avoid any effect on the load;

Step 2: Check there is no abnormality in the screen sampling data, and it is consistent with the actual data;

Step 3: Check the battery parameter setting is consistent with the actual battery parameter; if not, please modify it;

Step 4: If the battery is equipped with BMS, check the BMS enable can be turned on, and the BMS communication is normal;

Step 5: Check the historical information screen, and check there is no serious fault according to 11.3 General troubleshooting.

Step 6: After checking, use the HMI screen or remote client to switch on the machine, see 9.4 Switching on/off methods for details, and wait for the machine to enter the "On-grid Mode"; if the site is in the off-grid environment, the machine will enter the "Off-grid Mode" after being switched on;

Step 7: Observe that the data displayed on the screen is normal, there is no fault message, and there is no strange noise or dour; if there is any abnormality, stop the machine immediately for a check.

Manual switch-off

Refer to **9.4 Switching on/off method**

11.2 Completing the trail operation

Carry out the following test steps after running the liquid-cooled energy storage cabinet:

Step 1: Check there is no abnormality in the liquid-cooled energy storage cabinet, such as excessive noise, excessive heat generation, abnormal odor or smoke;

Step 2: Measure the output voltage and current of the liquid-cooled energy storage cabinet are stable;

Step 3: Operate the HMI screen, and check its working display is normal and accurate.

Step 4: Test it conforms to the preset operation logic.

At this point, all trial operation processes of the liquid-cooled energy storage cabinet are completed, and you can proceed to the routine operation and maintenance process.

11.3 General troubleshooting

If there is a fault during the operation of the machine, please click the "Historical Information" on the HMI screen to check the current fault. The following are the common faults of liquid-cooled energy storage cabinets and the steps to deal with them:

PCS faults and handling:

Type	Alarm Content	Grade	Operator Alarm Handling Measures
PCS fault 1	FPGA hardware fault - phase A hardware overcurrent	Level 2	Reset to restart More than 3 faults in one day require manual intervention to confirm the grid quality on site
	FPGA hardware fault - phase B hardware overcurrent	Level 2	
	FPGA hardware fault - phase C hardware overcurrent	Level 2	
	FPGA hardware fault - phase N hardware overcurrent	Level 2	
	FPGA hardware fault - reserved		/
	FPGA hardware fault - reserved		/
	FPGA hardware fault - unit direct voltage fault	Level 1	Reset to restart Check whether the contactor of the high-voltage box has been disconnected. If the device fails to start after reset, manual intervention is required to check whether the DC fuse is blown.
	FPGA hardware fault - reserved		/
	FPGA hardware fault - reserved		/
	FPGA hardware fault - switching power supply undervoltage	Level 1	Reset to restart Check whether the contactor of the high-voltage box has been disconnected
	FPGA software fault - phase A IGBT failure		No alarm is generated for the current device.
	FPGA hardware fault - phase B IGBT failure		
	FPGA hardware fault - phase C IGBT failure		

	FPGA hardware fault - phase N IGBT failure		
	FPGA hardware fault - overtemperature failure	Level 1	Reset to restart If over-temperature persists, consider whether to derate depending on the ambient temperature: derate 6kW per degree for ambient temperature over 45 degrees. On-site recommendation: Check whether the fan operates normally; Check whether the over-temperature protection threshold has been modified. Check whether the container on site is exposed to sunlight without shade
	FPGA hardware fault - reserved		/
PCS fault 2	ARM software fault - phase A output overcurrent	Level 2	Reset to restart Manual intervention is required in case the fault cannot be rectified More than 3 faults in one day require manual intervention to confirm the grid quality on site
	ARM software fault - phase A output quick disconnection	Level 2	
	ARM software fault - phase B output overcurrent	Level 2	
	ARM software fault - phase B output quick disconnection	Level 2	
	ARM software fault - phase C output overcurrent	Level 2	
	ARM software fault - phase C output quick disconnection	Level 2	
	ARM software fault - phase N output quick disconnection	Level 2	
	ARM software fault - phase N output quick disconnection	Level 2	
	ARM software fault - AC overvoltage	Level 1	Reset to restart When AC undervoltage cannot be recovered: 1. Check whether the AC switch is disconnected or the power grid is blacked out 2. Where there is no disconnection, confirm whether the AC insurance is blown
	ARM software fault - AC undervoltage	Level 1	
	ARM software fault - output overvoltage	Level 1	Cannot reset to restart 1. Off-grid output AC overvoltage. Check whether the Device can work with no load
	ARM software fault - output undervoltage	Level 1	Reset to restart 1. Off-grid output AC undervoltage. Check whether the device is in an overload state
	ARM software fault - voltage THDU exceeds the limit	Level 1	Reset to restart Check whether the THDU of the power grid exceeds 15%; Confirm the instantaneous power of the load is within the design range of the system distribution;

	ARM software fault - system phase loss	Level 1	PCS shall be automatically reset and restarted after the fault is rectified on the site Check whether the wiring misses a phase
	ARM software fault - system phase sequence error	Level 1	PCS shall be automatically reset and restarted after the fault is rectified on the site; Check the correspondence between the ABCN phase sequence and the modules;
	ARM software fault - DC polarity reverse connection	Level 1	PCS shall be automatically reset and restarted after the fault is rectified on the site; Check the voltage polarity of the PCS DC terminal is correct;
PCS fault 3	ARM software fault - DC bus software overvoltage	Level 1	Reset to restart Measure the battery voltage of the PCS DC terminal within the allowable range of the specification; Check whether the contactor of the high-voltage box has been disconnected or there is a DC fuse or DC soft start not switching-off. More than 3 faults in one day require manual intervention
	ARM software fault - DC busbar software undervoltage	Level 1	Reset to restart Measure the battery voltage of the PCS DC terminal within the allowable range of the specification; Check whether the contactor of the high-voltage box has been disconnected or there is a DC fuse or DC soft start not switching-off. More than 3 faults in one day require manual intervention
	ARM software fault - system overfrequency	Level 2	Reset to restart Check whether the frequency of the grid is beyond the range of frequency protection action Check whether an AC disconnection occurs or the device is islanded
	ARM software fault - system underfrequency	Level 2	Reset to restart Check whether the frequency of the grid is beyond the range of frequency protection action Check whether an AC disconnection occurs or the device is islanded
	ARM software fault - DC charging overcurrent	Level 2	Reset to restart Check that the system power settings do not exceed the rated capacity; Check whether the actual battery voltage range is within the rated range of the Device; More than 3 faults in one day require manual intervention

	ARM software fault - DC discharging overcurrent	Level 2	Reset to restart Check that the system power settings do not exceed the rated capacity; Check whether the actual battery voltage range is within the rated range of the Device; More than 3 faults in one day require manual intervention
	ARM software fault - islanding protection	Level 2	Reset to restart Where an islanding is detected, the device is shut down from the on-grid state.
	ARM software fault - DC component exceedance	Level 1	Reset to restart 1. Report the fault to the manufacturer 2. Contact the manufacturer to deal with this fault if it occurs 2 times in one day.
	ARM software fault - AC main connection switching-on failure	Level 2	Reset to restart This fault does not occur on the domestic version of device. If the foreign version of the machine is reported during the startup process for three consecutive times, please report to the manufacturer to confirm the insulation detection logic and whether the contactor is sticked.
	ARM software fault - AC main connection switching-off failure	Level 2	No alarm is generated for the current device.
	ARM software fault - AC soft start switching-on failure	Level 2	No alarm is generated for the current device.
	ARM software fault - AC soft start switching-off failure	Level 2	No alarm is generated for the current device.
	ARM software fault - DC main connection switching-on failure	Level 2	Reset to restart This fault does not occur on the device adopting the "One Cluster, One Management" approach
	ARM software fault - DC main connection switching-off failure	Level 2	Reset to restart This fault does not occur on the device adopting the "One Cluster, One Management" approach
	ARM software fault - DC soft start switching-on failure	Level 1	Cannot reset to restart, manual confirmation required 1. Check whether the deviation of DC voltage sampling and calibration is too large 2. Check whether the DC soft start resistance of the device is damaged
	ARM software fault - DC soft start switching-off failure		No alarm is generated for the current device.
PCS fault 4	ARM software fault - ferroelectric parameter storage error	Level 1	Cannot reset to restart Where PCS internal memory is faulty, contact the manufacturer

	ARM software fault - DC soft start failure	Level 1	Reset to restart Report to the manufacturer where reporting during the startup process occurs for three consecutive times 1. DC contactor switching-on under judgment, and DC voltage difference is too large 2. When running with DCDC Device, DCDC startup is not correct
	ARM software fault - reserved		No alarm is generated for the current device.
	ARM software fault - reserved		No alarm is generated for the current device.
	ARM software fault - start-up conditions are not met	Level 2	Reset to restart Check whether the "off-grid and on-grid setting" meets the actual wiring condition; After disconnecting from the grid with no load, wait for the AC terminal voltage to drop completely to near 0 before starting again
	ARM software fault - switch fault in operation	Level 2	No alarm is generated for the current device.
	ARM software fault - inverter startup timeout	Level 2	Reset to restart
	ARM software fault - parameter delivery setting error	Level 2	Reset to restart
	ARM software fault - BMS communication failure	Level 2	Reset to restart 1. Automatic reset after communication is restored
	ARM software fault - abnormal BMS temperature	Level 2	No alarm is generated for the current device.
	ARM software fault - BMS abort	Level 1	Reset to restart
	ARM software fault - BMS battery alarm	Level 3	Alarm only, the device does not stop
	ARM software fault - DCDC communication failure	Level 2	PCS and DCDC communication timeout
	ARM software fault - EMS communication failure	Level 1	Reset to restart
	ARM software fault - emergency stop or core failure	Level 1	Reset to restart, external dry node signal shall disappear
	ARM software fault - reserved		/
PCS fault	ARM software fault - reserved		/

5	ARM software fault - battery software overvoltage	Level 1	Reset to restart Measure the battery voltage of the PCS DC terminal within the allowable range of the specification; Check whether the contactor of the high-voltage box has been disconnected or there is a DC fuse More than 3 faults in one day require manual intervention
	ARM software fault - battery software undervoltage	Level 1	Reset to restart Measure the battery voltage of the PCS DC terminal within the allowable range of the specification; Check whether the contactor of the high-voltage box has been disconnected or there is a DC fuse More than 3 faults in one day require manual intervention
	ARM software fault - abnormal busbar imbalance	Level 1	Reset to restart 1. Fault elimination lasts for about 1h after the DC is cut off, and lasts for a longer time in the case of constant power 2. If the fault can not be reset, contact the manufacturer to rectify voltage sampling problems and capacitor aging problems 3. If the fault can be reset, but it is repeatedly reported after startup, contact the manufacturer
	ARM software fault - busbar semi-direct voltage overvoltage	Level 1	Reset to restart Measure the battery voltage of the PCS DC terminal within the allowable range of the specification; Check whether the contactor of the high-voltage box has been disconnected or there is a DC fuse More than 3 faults in one day require manual intervention
	ARM software fault - DCDC startup timeout	Level 2	Reset to restart 1. Check the communication cables between PCS and DCDC and the baud rate

Battery faults and handling:

Battery Fault Alarm List								
No.	Internal Fault Code	Fault Name	BMS Fault Level (Higher level represents more severe situation)	SBCU Treatment (If there is a fault lamp, the corresponding pin would be energized, and the fault indicator will light)	Judgment Condition (Continuous)	Cancel Condition	Remarks	Module

1	0x1011	Battery cluster cell overtemperature alarm	1	Send faults externally	Temp_max＞50℃	＜45℃		SBCU
2	0x1012		2	Send faults externally, and limit power	Temp_max＞55℃	＜50℃		SBCU
3	0x1013		3	Send faults externally, limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Temp_max＞60℃	<55℃		SBCU
4	0x1021	Battery cluster undertemperature alarm	1	Send faults externally	Temp_min＜5℃	＞10℃		SBCU
5	0x1022		2	Send faults externally, and limit power	Temp_min＜0℃	＞5℃		SBCU
6	0x1023		3	Send faults externally, limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Temp_min＜-30℃	＞0℃		SBCU
7	0x1031	Battery cluster cell overvoltage alarm	1	Send faults externally	＞3,650mV	＜3,600mV		SBCU
8	0x1032		2	Send faults externally, and limit power	＞3,700mV	＜3,650mV		SBCU
9	0x1033		3	Send faults externally, limit power and request to lower high voltage, and immediately cut off the main circuit relay	＞3,800mV	＜3,700mV		SBCU
10	0x1041	Battery cluster cell undervoltage alarm	1	Send faults externally	＜2,500mV	＞2,600mV		SBCU
11	0x1042		2	Send faults externally, and limit power	＜2,400mV	＞2,500mV		SBCU
12	0x1043		3	Send faults externally, limit power and request to lower high voltage, and immediately cut off the main circuit relay	＜2,300mV	＞2,400mV		SBCU
13	0x1051	Battery cluster charging current exceeding limit alarm	1	Send faults externally	＞105%*AllowCurr See remarks for details	＜100%*AllowCurr See remarks for details	Allowable current ≤ 2A: overcurrent fault determination current = 5 + (2, 3, 4)*(105, 110, 130)/100; Allowable current≤30A: overcurrent fault determination current = 5 + allowable current *(105, 110, 130)/100; Allowable current＞30A: overcurrent fault determination current = allowable current *(105, 110, 130)/100; Recovery: at actual target values	SBCU
14	0x1052		2	Send faults externally, and limit power	＞110%*AllowCurr See remarks for details	＜105%*AllowCurr See remarks for details		SBCU
15	0x1053		3	Send faults externally, limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	＞130%*AllowCurr See remarks for details	/		SBCU
16	0x1061	Battery	1	Send faults externally	＞105%*AllowCurr See remarks for details	＜100%*AllowCurr		SBCU

		cluster discharging current exceeding limit alarm				See remarks for details		
17	0x1062		2	Send faults externally, and limit power	＞110%*AllowCurr See remarks for details	＜105%*AllowCurr See remarks for details		SBCU
18	0x1063		3	Send faults externally, limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	＞130%*AllowCurr See remarks for details	/		SBCU
19	0x10A1	Cell voltage accumulation and overvoltage alarm in battery cluster	1	Send faults externally	Vsum＞3.65V*N	Vsum＜3.6V*N	N indicates the number of battery strings	SBCU
20	0x10A2		2	Send faults externally, and limit power	Vsum＞3.7V*N	Vsum＜3.65V*N	N indicates the number of battery strings	SBCU
21	0x10A3		3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Vsum＞3.8V*N	Vsum＜3.7V*N	N indicates the number of battery strings	SBCU
22	0x10B1	Cell voltage accumulation and undervoltage alarm in battery cluster	1	Send faults externally	Vsum＜2.50V*N	Vsum＞2.60V*N	N indicates the number of battery strings	SBCU
23	0x10B2		2	Send faults externally, and limit power	Vsum＜2.40V*N	Vsum＞2.50V*N	N indicates the number of battery strings	SBCU
24	0x10B3		3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Vsum＜2.30V*N	Vsum＞2.40V*N	N indicates the number of battery strings	SBCU
25	0x10C1		1	Send faults to EMS	≤1000Ω/V	＞1100Ω/V		SBCU
26	0x10C2		2	Send faults to EMS,and limit power	≤500Ω/V	＞600Ω/V		SBCU

27	0x10C3	Low insulation fault (single cabinet with no MBCU)	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	≤100Ω/V	/		SBCU
28	0x10D1	Battery cluster excessive temperature difference alarm	1	Send faults externally	＞8℃	＜6℃		SBCU
29	0x10D2		2	Send faults externally, and limit power	＞13℃	＜8℃		SBCU

30	0x10D3		3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	＞15℃	＜13℃		SBCU
31	0x10E1	Battery cluster cell excessive voltage difference alarm	1	Send faults externally	＞500mV	＜300mV		SBCU
32	0x10E2		2	Send faults externally, and limit power	＞3600mV	＜500mV		SBCU
33	0x10E3		3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	＞4000mV	＜3600mV		SBCU
34	0x10F1	Low battery cluster SOC alarm	1	Send faults externally	＜3%	＞5%	The threshold is subject to the actual operating conditions	SBCU
35	0x1103	Battery cluster voltage mismatch fault	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	|Slave plate voltage sum - internal bus voltage| >40V	/		SBCU
36	0x1183	Low battery cluster SOH alarm	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	SOH<60%	/	Latch Administrator permissions are required to troubleshoot	SBCU
37	0x2013	Loss of communication	3	Send faults externally,limit power	No signal received || life	Life signal changed		SBCU

		between the battery cluster SBCU and the BMU		and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	signal unchanged			
38	0x2083	Loss of communication between the battery cluster SBCU and the BMCU	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	No signal received || life signal unchanged	Life signal changed		SBCU
39	0x20B1	Battery cluster SBCU internal bus voltage sampling fault (after applying high voltage)	1	Sent faults externally, and the cluster disables the insulation detection function	Invalid internal bus voltage sampling	Normal sampling		SBCU
40	0x20B3	Battery cluster SBCU internal bus voltage sampling fault (before applying high voltage)	3	Send faults externally, and the cluster disables the insulation detection function, with high voltage prohibited	Invalid internal bus voltage sampling	Normal sampling		SBCU
41	0x20C3	Battery cluster SBCU external bus voltage sampling fault	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Invalid external bus voltage sampling	Normal sampling		SBCU
43	0x20D3	Battery cluster SBCU insulation sampling circuit fault (before applying high voltage)	3	Send faults externally, and the cluster disables the insulation detection function, with high voltage prohibited	Invalid insulation sampling partial voltage value	Normal sampling		SBCU
44	0x20E3	Battery cluster high-voltage box current sampling module fault	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Current sampling value reading fails	Current sampling value reading succeeds		SBCU
45	0x20F1	SBCU-EE storage failure	1	Send faults externally	Communication of EE fails while reading or writing	Communication of EE succeeds while reading or writing		SBCU
46	0x2153	Communication loss between SBCU and EMS (for liquid-cooled	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high	No signal received || life signal unchanged	Life signal changed		SBCU

		single cabinet)		voltage is not received within 5s, cut off the main circuit relay				
47	0x2133u	Fire system communication loss	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	No signal received || life signal unchanged	Life signal changed		SBCU
48	0x2163u	PCS communication loss	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	No signal received || life signal unchanged	Life signal changed		SBCU
48	0x30B3	Battery cluster high-voltage box NTC failure	1	Send faults externally	SBCU detects BJB_NTC sampling value as invalid	SBCU detects BJB_NTC sampling value as valid		SBCU
49	0x3173	33772 communication loss	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Unsuccessful reboot for 10 times within 1s	Communication recovered		SBCU
50	0x4013	Failure to connect the main positive circuit relay in the battery cluster high-voltage box	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Open-circuit fault	/		SBCU
54	0x40F2	Failure to disconnect the main positive circuit relay in the battery cluster high-voltage box	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Sticking failure	/		SBCU

58	0x4143	Battery cluster relay sticking detection circuit failure	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	After low voltage is applied, without enabling the relay: DO4 input voltage is not 20-32V or DI1/2 feedback state is 0; and after enabling the relay: DO4 input voltage is not	/		SBCU

					20-32V or DI1/2 feedback state is 1.			
61	0x5182	Battery cluster SBCU wakeup loss	3	Send faults externally ① Non-high-voltage state dormant ② Normal high-voltage state hold ③ Anomalous high-voltage state (wakeup loss & EMS communication loss) cut-off with 5s delay and dormant	<9V	≥9V		SBCU
62	0x5192	Battery cluster system voltage mismatch fault	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Actual voltage quantity does not match software configuration	Actual voltage quantity matches software configuration	Detection starts 10s after the Device is powered on	SBCU
64	0x8023	Battery cluster thermal runaway alarm	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	1. Vmin＜ 0.5V&Tmax >65℃; 2. Vmin＜ 0.5V&Tmax-Tmin＞ 30℃; 3. Vmin＜ 0.5V&dT/dt＞1 ℃/s; 4. Voltage sampling disconnection fault setting &Tmax >65 ℃; 5. Voltage sampling disconnection fault setting &Tmax-Tmin >30℃; 6. Voltage sampling disconnection fault setting &dT/dt >1℃/s; Vmin <0.5V&NTC sampling break or short circuit; Aerosol operation (AI1>9V on any BMU as judged by SBCU) & Tmax >65 °C; Any BMU air pressure change rate ≥ 0.1kPa/s (after initialization, air pressure difference judgment = (Tn+10)-Tn, 50 times/40 times increase upward)	/	Latch Manual troubleshooting is required	SBCU

					and Tmax>65°C; Tmep6 or 14 or 20 on any BMU as judged by SBCU			
65	0x8051	Aerosol operation alarm in battery pack	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Aerosol operation (AI1 >9V on any BMU as judged by SBCU)	/		SBCU
70	0x9012	Manual disconnect switch (QS) in the high-voltage box of the battery cluster is disconnected	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	QS feedback signal anomaly detected inside SBCU	/	Judgment is made only after receiving the applying high voltage command	SBCU
71	0x9022	Fuse (FU1) in the battery cluster high-voltage box is disconnected	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	FU1 feedback signal anomaly detected inside SBCU	/		SBCU
73	0x9052	Excessive temperature in the high-voltage box of the battery cluster	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	SBCU detects BJB_NTC >60°C	SBCU detects BJB_NTC <50°C		SBCU
74	0x9062	Battery cluster SBCU relay drive supply voltage differences	3	Send faults externally,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	<22V	≥22V		SBCU
75	0x90A3	PACK high-voltage connector overtemperature	3	Send faults to EMS,limit power and request to lower high voltage; if the command to lower high voltage is not received within 5s, cut off the main circuit relay	Temp21 or 22 on any BMU as judged by SBCU: T＞90 ℃	/	Latch Manual troubleshooting is required	SBCU

Special instructions:

1. The alarm messages of the battery management system shall come in level 1, level 2 and level 3 by severity. Among them:

① Level 1 alarm messages are those that need to be monitored, and those of restoration of lever 2 and lever 3 alarm messages;

② Level 2 alarm messages are those that need to take immediate emergency measures for;

③ Level 3 alarm messages are those that need for an immediate shutdown or switching off;

2. The rate of change of discharge power limit and charge power limit is united at 100A/s (taking into account the current reduction speed of PCS), and the full power can be reduced to 0 in not more than 50ms;
3. "-" means: no power limit, only alarm.
4. The BMS fault list does not specify that the entries of fault grading are filled with "/";
5. The current non-recoverable means it is unrecoverable before powering off the low-voltage power; non-recoverable means it can be recovered by maintenance or diagnostic tools;

Temperature-controlled unit faults and handling:

Fault Symptom	Cause of Failure	Solution
Fan does not run	Fan failure	Check the motor, and replace it immediately if defects are found.
	Fan stuck	Check whether any foreign matters are stuck in the fan.
Abnormal noise of fan	Worn fan bearings	Replace the fan.
	Fan blades scrape against other objects	Check whether any cables interfere with the fan blades.
Compressor does not start	The power is off	Check the main power switch, and check the operation display screen to make sure it is turned on
	Loose circuit connection	Tighten the circuit connector.
	Compressor damaged	Check the compressor and replace the damaged one immediately.
Compressor does not work	The water temperature is set too high, and no cooling is required	Check the inlet and outlet temperature display and reset the control temperature.
	Shutdown delay	The compressor has a minimum shutdown time under normal conditions. If the temperature rises again to the start point during this period, the compressor will still turn on with a delay.
High voltage protection fault	Condenser dirty plugging	Clean the condenser.
	External circulation fan does not operate	Check the fan.
Low voltage protection fault	Leakage of fluorine or insufficient refrigerant of the system	Leak check and repair and replenish refrigerant.
	Filter drier clogging	Replace the filter drier.
	Thermal expansion valve failure	Check whether the expansion valve is clogged, whether the temperature sensing package leaks, and repair or replace where necessary.
	Water flow rate too low	Check the water system to fix the problem.
Poor cooling	Insufficient refrigerant	Leak check and repair and replenish refrigerant.

effect	Insufficient water flow	Clean the water filter, check whether the water pump is faulty.
	Serious dust accumulation in condenser	Clean the condenser.
	Refrigeration system clogged	Check or replace the filter drier.
Circulating water pump does not start or operates improperly	The power is off	Check the main power switch, and check the operation display screen to make sure it is turned on
	Loose circuit connection	Tighten the circuit connector.
	Damaged water pump	Check the compressor and replace the damaged one immediately.
	There is air in the cooling medium or there is no cooling medium	Detect whether there is air or there is no cooling medium. If there is air or there is no cooling medium in the system, it is necessary to evacuate the air or replenish the cooling medium.
Electric heating tube does not work	The water temperature is set too low, and no heating is required	Check whether the outlet temperature and heating set point are set reasonably.
	Loose circuit connection	Tighten the circuit connector.
	Electric heating tube burnout	Check the electric heating tube and replace it immediately if it is found to have burned out.

A Emergency Response

In the event of a hazardous accident at the site, including but not limited to those listed below, please ensure the safety of the personnel at the site and contact our service engineer promptly.

In case the battery is dropped or strongly impacted

- If there are distinct odors, damage, smoke or fire, evacuate people immediately, alarm in a timely manner and contact professionals, and they will use fire-fighting facilities for fire suppression and other treatments in the case of ensuring safety.
- If there is no obvious deformation or damage to the exterior and no distinct odor, smoke or fire, operate under the premise of ensuring safety:
  - Warehouse: evacuate people, move the battery to an open and safe place by professional personnel using mechanical tools, contact our service engineers, and stand the battery for 1h and monitor the temperature of the battery within the range of room temperature ±10℃, then handle it.
  - Energy storage system site: evacuate people, close the door of the energy storage system, move the battery to an open and safe place by professional personnel using mechanical tools, and contact our service engineers to handle it after standing it for 1 hour.

In case of flooding

DANGER

- In the event of a fire, the system shall be de-energized when it is safe.
- Use carbon dioxide, FM-200 or ABC dry powder extinguishers to extinguish the fire.
- Firefighters shall avoid touching high-voltage components in extinguishing a fire, as this may result in electric shocks.
- Excessive battery temperatures may cause deformation, damage and electrolyte spillage, and leakage of toxic gases. Always wear respiratory protective Device and stay away to avoid skin irritation and chemical burns.

When the audible and visual alarm is activated

When the device's warning light flashes or buzzes:

- Keep away from the device immediately
- Do NOT approach the device
- Do NOT open the door
- Cut the power from remote

In the event of a fire extinguishing agent eruption or fire

- Recommendations for on-site O&M personnel:
  a. In case of a fire, evacuate the building or Device area and press the fire alarm; then call the fire department immediately to notify the fire protection professionals of the fire, and provide them with relevant product information, including but not limited to: the type of battery packs, the capacity of the energy storage system, and the distribution of battery packs.
  b. Do NOT re-enter the burning building or the Device area, and do NOT open the cabinet door of the energy storage system under any circumstances. The site shall be isolated and guarded, and no unrelated personnel shall be allowed to approach it.
  c. After calling the fire department, power down the system from remote (e.g. intelligent box-type substation, intelligent energy storage controller, auxiliary power supply Device, and bus box power supply.) under the condition of guaranteeing the personnel's safety.
  d. When the fire protection professionals arrive at the scene, provide them with relevant product information, including but not limited to: the type of battery packs, the capacity of the energy storage system, the distribution of battery packs, the User's Manual, etc.
  e. After the fire protection professionals confirm the extinguishing of the fire, in accordance with local regulations, the professional personnel shall deal with it. Do NOT open the door of the energy storage system without permission.
  f. Post-disaster product maintenance: contact our service engineers for evaluation.

- Recommendations for fire protection professionals:
  a. Refer to information provided by the O&M personnel on product, including but not limited to: the type of battery packs, the capacity of the energy storage system, the distribution of battery packs, and the User's Manual.
  b. Do NOT open the door of the energy storage system until the interior of the energy storage system is secured.
  c. Follow local fire codes for fire extinguishing operations.

B How to Recycle Used Batteries

NOTICE

- We do Not recycle batteries. Customers need to contact local recycling organizations to dispose of the batteries themselves.
- If there is no local recycling organization, it is recommended that the customer contact the nearest national recycling organization for their disposal.

Step 1: Contact the nearest recycling organization.

Step 2: The recycling organization assesses the cost of recycling.

Step 3: The recycling organization carries out recycling, which comes in two types.

- On-site recycling: The recycling organization can collect the lithium batteries on site, but the price will be subject to the actual traveling distance/transportation costs.
- Centralized recycling: The customer places all the lithium batteries to be recycled in one place, and the recycling organization conducts centralized processing.

Description

Any traveling expense incurred as a result of recycling shall be at the customer's expense.

Step 4: The recycling company handles the recycling at its sole discretion. The recycling company handles the recycled lithium batteries at its sole discretion, and the customer does not need to be involved any further.

----Ended

C Contacts

Please contact us should you have any questions about this product. **Table F-1** Customer Service Contacts

Country	Service Support Email	Tel
China		

D Abbreviations

A

AI Analog Input 模拟量输入

APP application 应用

B

BMU Battery Monitoring Unit 电池包监控单元

C

CAN control area network 控制区域网络

CMU Central Monitoring Unit 储能系统监控单元

COM cluster communication port COM 口

D

DC direct current 直流电

DO Digital Output 数字量输出

E

ESM Battery Pack 电池包

ESR Battery Rack 电池簇

ESU energy storage unit 储能单元

I
IO input&output 输入输出

L
LAN local area network 局域网
LED Light-emitting Diode 发光二极管

P

PSU Power Supply Unit 供电单元

R
RST Reset 复位

S

SIM Subscriber Identity Module 用户识别模块

SOC state of capacity 容量状态
SOH state of health 健康状况

U
UPS uninterruptible power system 不间断电源

USB Universal Serial Bus 通用序列汇