SOFAR

USER MANUAL

PowerMagic – C&I ESS

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Content

1 About this manual

1.1 Notice

The products, services or features you have purchased are subject to the commercial contracts and terms agreed with our company. Some or all of the products, services or features described in this document may not fall within the scope of your purchase. Unless otherwise stipulated in the contract, our company makes no express or implied statement or warranty regarding the contents of this document.

This document primarily provides information on the installation, electrical connections, and related aspects of the PowerMagic commercial and industrial energy storage system (hereinafter referred to as the "energy storage system" or "ESS"). Before installing or operating the energy storage system, please read this manual carefully, familiarise yourself with the safety information, and understand the system's functions and characteristics.

1.2 Target group

This manual is intended for plant operators and qualified electrical technicians. As an integral part of the energy storage equipment, the manual may be printed from the electronic version where necessary. Please keep both the printed and electronic copies properly for future reference. The equipment must always be operated strictly in accordance with the requirements set out in this manual.

1.3 Copyright statement

the right of final interpretation. This manual may be updated based on feedback from users or customers. Please visit our website at www.sofarsolar.com for the latest version.

1.4 Presentation of warnings

This manual contains information on safe operation and uses symbols to ensure the safety of persons and property as well as the efficient operation of the inverter.

- Read through the following symbol explanations carefully in order to prevent injury or property damage.

Warning symbol

	The general danger symbol warns of the risk of serious injury when used with the signal words CAUTION, WARNING, and DANGER.

Signal word

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a danger that results in damage to or destruction of the device.

Sectional warnings

Sectional warnings refer to a complete section and are structured as follows:

⚠ WARNING
Type and source of danger **Consequences for non observance** ▸ Avoiding the danger

Embedded warnings

Embedded warnings are part of an action sequence and are placed right before the dangerous step.

WARNING Combination of the type/source of danger, consequences for non-observance and avoiding the danger.

1.5 Presentation of action instructions

This table shows the sequence of Action steps:

Symbol	Function
✓	This describes an action requirement
1. 2. 3.	This is the sequence of action steps that must be followed step by step
▶	This is a single action step
↳	This describes the result of the action

1.6 Note

Notes are presented in a grey bar.

Provides tips essential to the optimal operation of the product.

1.7 Abbreviations

Abbreviation	Full Term
PowerMagic	PowerMagic Commercial and Industrial Energy Storage System
SOFAR	Guangdong Sofar Smart Solar Technology Co., Ltd.

1.8 Revision history

The revision history records the details of each document update. The latest version incorporates all updates from previous versions.

2 Safety precautions

Statement

Before transporting, storing, installing, operating, using and/or maintaining this product, please read this manual carefully. Strictly follow the instructions contained herein and comply with all safety precautions marked on the product and described in this manual.

In addition to all safety instructions marked as “Danger”, “Warning”, “Caution”, “Notice” and “Note” in this manual, you must also comply with the relevant international, national, or regional standards.

The company shall not be held liable for any consequences resulting from failure to observe safe operating requirements or failure to comply with safety standards relating to the design, manufacture and use of the equipment.

The company assumes no responsibility for the following situations or any consequences arising therefrom:

- Product damage caused by force majeure events, including but not limited to earthquakes, floods, volcanic eruptions, mudslides, lightning strikes, fire, war, armed conflict, typhoons, hurricanes, tornadoes, or other extreme weather conditions.
- Product installation or operating environments that do not comply with applicable international, national, or regional standards.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Damage caused by you or a third party entrusted by you during transportation.
- Damage caused by storage conditions not meeting the product requirements.
- Damage caused by your negligence, intentional act, gross misconduct, improper operation, or any reason not attributable to the company, including that of third parties.

2.1 Personal safety

⚠ DANGER

- Fatal high voltage exists inside the equipment.
- Observe and follow all warning labels affixed to the equipment.
- Comply with the safety precautions listed in this manual and in other related documents for this equipment.
- Follow the relevant protection requirements and safety instructions for the battery.
- Risk of electric shock if you touch live parts such as power terminals, contact points, or connectors inside the equipment.
- Always use appropriate protective equipment during operation, such as protective clothing, insulated footwear, safety goggles, safety helmets, and insulated gloves.

⚠ WARNING

- Always operate the energy storage system in strict accordance with the requirements of this manual.
- To prevent accidents, observe the following precautions:
  Place prominent warning signs around the energy storage system to prevent accidental switching on and possible accidents.
  Install warning signboards or safety warning tapes near the equipment.

NOTICE

- If the device indicator light is flashing red, evacuate the site immediately.

The lifting and transportation, installation and wiring, operation, and maintenance of the energy storage system must be carried out by professional technical personnel who meet the requirements of local regulations. Personnel

responsible for the installation and maintenance of the equipment must meet the following requirements:

- ✓ Must receive strict training beforehand, master the correct operating methods, be familiar with the structure and working principles of the energy storage system and its upstream and downstream equipment, and understand all safety precautions as well as the relevant standards of the country/region.
- ✓ Must have undergone professional training related to the installation and commissioning of electrical equipment, and be capable of identifying the potential hazards and their severity during equipment installation, operation, and maintenance.
- ✓ Must possess knowledge in electronics, electrical wiring, and mechanical engineering, and be familiar with electrical and mechanical schematics.
- ✓ Must be capable of responding promptly and effectively to emergencies or hazardous situations that may occur during installation or commissioning.
- ✓ Personnel engaged in special tasks such as electrical operations, working at height, or operating specialised equipment must hold special operation qualifications required by the local country/region.
- ✓ Operators of medium-voltage equipment must hold a valid high-voltage electrical work licence.
- ✓ Only personnel authorised to operate the equipment may approach it. Unauthorised persons must not come near the equipment.
- ✓ Live operation during installation is strictly prohibited. The installation or removal of cables under live conditions is forbidden. Contact between cable conductors and live terminals may cause arcs, sparks, or fire/explosion, leading to fire hazards or personal injury.
- ✓ Incorrect or improper operation while the equipment is energised may result in fire, electric shock, or explosion, leading to injury, loss of life, or property damage.
- ✓ Do not wear watches, bracelets, bangles, rings, necklaces or any other conductive items during operation to avoid electric shock or burns.

- ✓ Always use dedicated insulated tools during operation to prevent electric shock or short circuits. The insulation and voltage rating of tools must comply with local laws, regulations, standards, and codes.
- ✓ Do not disable protective devices or ignore warnings, cautions, and preventive measures indicated in this manual or on the equipment.
- ✓ If any fault occurs during operation that may result in personal injury or equipment damage, stop operation immediately, report to the person in charge, and take effective protective measures.
- ✓ Do not energise the equipment before installation is complete or before confirmation by qualified personnel.
- ✓ Do not directly touch, use other conductors to touch, or indirectly contact the powered equipment via wet objects. Measure the voltage at any contact points before touching terminals or conductive surfaces to ensure there is no risk of electric shock.
- ✓ The equipment enclosure may become hot during operation. Do not touch to avoid burns.
- ✓ Do not allow fingers, components, screws, tools, or circuit boards to come into contact with running fans to avoid injury or equipment damage.
- ✓ In the event of fire, evacuate the building or equipment area immediately, activate the fire alarm, or call the fire emergency number. Under no circumstances should anyone re-enter a burning building or equipment area.

2.2 Equipment safety

2.2.1 Energy storage system safety

⚠ DANGER

- In the event of a fault in the energy storage system, do not stand in front of the cabinet doors (including the area covered by the open doors).
- Do not open the cabinet doors while the system is in operation.

- ✓ The installation layout of the energy storage system must comply with local regulations regarding fire separation distances or firewalls, including but not limited to the requirements of GB 51048-2014: Design code for electrochemical energy storage station and NFPA 855: Standard for the Installation of Stationary Energy Storage Systems.
- ✓ The energy storage system should undergo regular fire inspections at least once per month.
- ✓ During live inspections, pay attention to the warning labels on the equipment and avoid standing in front of cabinet doors.
- ✓ After replacing power components or modifying wiring, manually perform wiring checks to prevent abnormal system operation.
- ✓ It is recommended that users prepare a camera or recording device to document the detailed process of installation, operation, and maintenance.
- ✓ The energy storage system must be enclosed with fences, walls, or other protective measures, and display safety warning signs to restrict access. This is to prevent unauthorised personnel from entering the area during system operation, which could result in personal injury or property damage.

2.2.2 Battery safety

⚠ DANGER

- Do not expose the batteries to high-temperature environments or near heat-generating equipment, such as direct sunlight, fire sources, transformers, or heaters. Overheating may cause leakage, smoke, release of flammable gases, thermal runaway, fire, or explosion.
- Do not disassemble, modify, or damage the batteries (e.g., inserting foreign objects, applying external pressure, immersing in water or other liquids), as this may result in leakage, smoke, release of flammable gases, thermal runaway, fire, or explosion.
- Do not subject the batteries to mechanical shock, drops, collisions, punctures, or pressure impacts, as this may cause battery damage or fire.
- Do not allow the battery terminals to come into contact with other metal objects, which may result in overheating or electrolyte leakage.

For the safe use of the product, technical personnel must carefully read and comply with the following safety requirements. The company shall not be held responsible for any product malfunction, component damage, personal injury, or property loss resulting from the following:

- Failure to charge the battery on time, resulting in capacity loss or irreversible damage due to the customer's actions.
- Battery damage, drops, leakage, or other issues caused by improper operation or failure to follow battery handling instructions.
- Over-discharge damage caused by failure to power on the battery in a timely manner.
- Battery damage caused by charging or discharging with inappropriate equipment.
- Frequent over-discharge due to improper maintenance, on-site system expansion, or inability to fully charge the battery over time.

- Damage caused by the incorrect configuration of battery operating parameters by the customer.
- Direct damage caused by environmental conditions that do not meet the battery's operational requirements.
- Alteration of the battery usage scenario by the customer, including but not limited to connecting additional loads to the battery.
- Failure to perform proper maintenance according to the manuals of associated equipment.
- Continued use of batteries beyond their warranty period results in product damage.
- Use of defective or deformed batteries causes product damage.
- Mixing the company's batteries with other batteries, including but not limited to batteries of other brands or different rated capacities.
- Storing or installing batteries together with flammable or explosive materials, causing product damage or other property loss.
- Battery-related operations performed by personnel without proper protective equipment, resulting in personal injury or property damage.
- Damage caused by eating, drinking, or smoking near the battery.
- Theft of the battery.

2.3 Environmental requirements

⚠ DANGER

- It is strictly forbidden to store flammable or explosive materials in the equipment area.
- Do not place the equipment in environments containing flammable or explosive gases or fumes, and never operate the equipment in such environments.
- Do not position the equipment near heat sources or open flames, such as fireworks, candles, heaters, or other heating devices, as excessive heat may cause equipment damage or fire.

- ✓ The equipment must be stored in a suitable temperature and humidity environment, in a clean, dry, and well-ventilated area, protected from dust and condensation.
- ✓ Do not install or operate the equipment outside the limits specified in the technical specifications, as this may compromise performance and safety.
- ✓ It is strictly forbidden to install, operate, or handle outdoor equipment and cables (including but not limited to equipment handling, cable operations, plugging and unplugging outdoor signal interfaces, working at height, outdoor installation, or door opening) during adverse weather conditions such as lightning, rain, snow, or strong winds above level 6.
- ✓ Do not install the equipment in environments containing dust, smoke, volatile gases, corrosive gases, infrared or other radiation, organic solvents, or areas with excessive salinity.
- ✓ Do not install the equipment in environments with conductive metallic dust or magnetic dust.
- ✓ The installation site must have solid ground free from soft soil, rubber soil, or subsidence-prone foundations. Avoid low-lying or flood-prone areas; the installation level must be higher than the region's historical maximum water level.
- ✓ If the equipment is installed in an area with dense vegetation, in addition to routine weeding, the ground beneath the equipment must be reinforced, for example, by paving with cement, gravel, or similar materials.
- ✓ Before opening the equipment door during installation, operation, or maintenance, remove any standing water, ice, snow, or debris from the top surface to prevent foreign objects from falling inside.
- ✓ Ensure the installation surface is firm and capable of bearing the weight of the equipment.
- ✓ All cable entry points must be sealed. Use sealing compound for cable entries already in use, and use the supplied covers to seal unused entries.
- ✓ After installation, remove all packaging materials from the equipment area, such as cartons, foam, plastic, and cable ties.

3 About the product

3.1 Overview

The PowerMagic Commercial and Industrial Battery Energy Storage System (BESS) is designed for applications such as stand-alone energy storage, PV and BESS integration scenarios, BESS charging stations, and microgrid scenarios.

Its primary functions include reducing electricity costs for enterprises by utilising peak-valley electricity price differences and serving as a reliable backup power supply.

A typical application diagram of the PowerMagic C&I BESS is shown below:

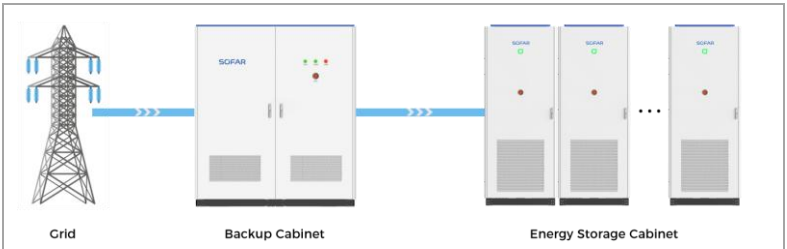


Figure 3.1: Schematic diagram of a typical PowerMagic application

3.2 Functions and features

- **Solution**

The C&I ESS includes the energy storage cabinet (with PCS and liquid cooling unit), junction cabinet, and backup cabinet, providing a one-stop, full-scenario solution for customers.

- **Flexible capacity design**

The system supports flexible parallel connection and capacity expansion.

- **Cabinet parallel design**

To reduce the installation footprint, energy storage cabinets (with integrated PCS and liquid cooling units) in a C&I ESS can be connected in parallel configuration. This approach increases system energy density while reducing overall system costs.

- **Upper-lower compartment design**

The commercial and industrial energy storage cabinet adopts an upper-lower compartment design. The battery PACKs are concentrated in the upper battery compartment, while the liquid cooling unit, PCS, auxiliary power modules, and other electrical components are integrated into the lower electrical compartment. Dedicated safety protection measures are designed separately for the battery compartment and the electrical compartment, enabling compartmental isolation and reducing coupling effects.

Compared with a left-right compartment layout, the upper-lower compartment design requires a smaller footprint and enables higher power and energy density.

- **3 + 2 Safety system**

Designed for ultimate safety:

3 Levels of Fire Protection

- Level 1: Pack-level perfluorohexanone gas fire suppression (optional).
- Level 2: Compartment-level perfluorohexane gas fire suppression (or aerosol).
- Level 3: Water-based fire suppression.

2 Additional Safety Measures

- Explosion venting design.
- Directional combustible gas exhaust system.

Note: The system with a standard compartment-level aerosol fire suppression solution, with the option to select Pack-level or compartment-level perfluorohexane gas fire suppression.

- **Intelligent liquid cooling system**

The liquid cooling system ensures temperature uniformity, longer lifespan, and higher efficiency of battery modules. Using a local intelligent controller, the liquid cooling system can automatically adjust heating, cooling, and self-circulation modes in real time, ensuring stable operation of the energy storage system under various harsh conditions.

- **On/off-grid switching**

By incorporating a backup cabinet, the commercial and industrial energy storage system can meet the requirements of both grid-connected and off-grid applications, as well as the need for quick switching between the two modes.

- **Local EMS functions**

The local controller inside the energy storage cabinet integrates a basic Energy Management System (EMS) for grid-connected applications. The key functionalities include:

1. Anti-backflow protection
2. Peak shaving
3. Self-consumption optimization
4. Overload protection
5. Flexible charging and discharging strategies for different time periods

.....

- **Remote & Local monitoring & O&M**

The system supports on-site monitoring, upgrades, and installation configuration via a local web interface. It also enables remote access through a web platform or mobile app, allowing real-time monitoring of system operating status.

- **High efficiency & Reliability**

Easy to install and operate, the system features high conversion efficiency, comprehensive protection functions, long service life, and compliance with grid interconnection requirements in China, Europe, and other regions.

3.3 Model description

The main product models involved in this article are follows:

Table 3.1 Product model

System configuration	Energy storage cabinet
5 Pack, 261 kWh	ESS-261KLC-SA1

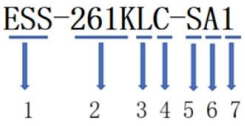


Figure 3.2: Model identification

Table 3.2 Description of energy storage cabinet/battery cabinet model

No.	Name	Meaning	Take value description
1	ESS	Product series name	Energy storage system
2	261K	Energy grade	Rated energy is 261kWh
3	L	Liquid cooling	Thermal management mode
4	C	Battery cell capacity	Example: A-280Ah, C-314Ah
5	S/B	With the PCS/battery	Whether the PCS module is included
6	A/D	AC/DC	Voltage type
7	1	Product version	The first generation of products

3.4 System description

- **Single-unit grid-connected scenario:** Single energy storage cabinet

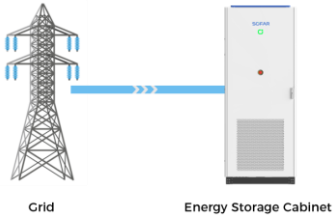


Figure 3.3: Single cabinet scenario

- **Multi-unit expansion on-grid scenario:** Multiple energy storage cabinets + junction cabinet

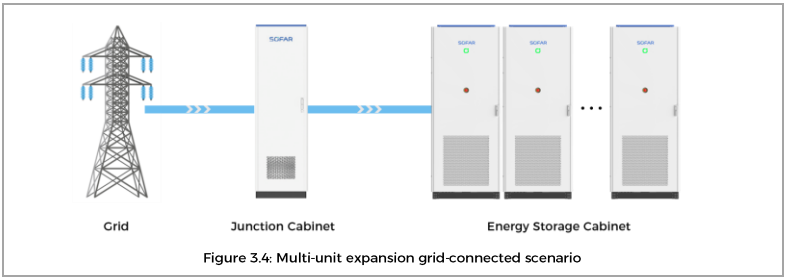


Figure 3.4: Multi-unit expansion grid-connected scenario

- **Multi-unit expansion on/off-grid scenario:** Multiple energy storage cabinets + backup cabinet

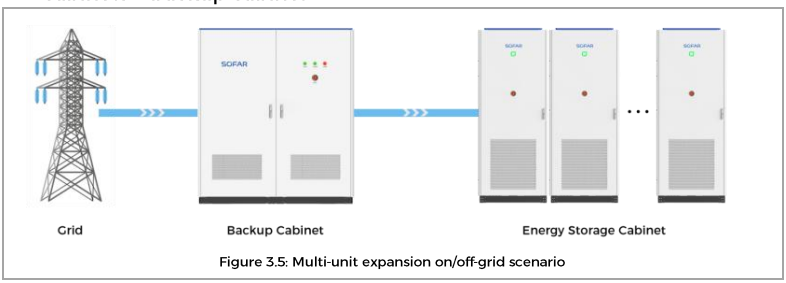


Figure 3.5: Multi-unit expansion on/off-grid scenario

- **PV + Storage microgrid scenario:** Multiple energy storage cabinets + PV inverters + backup cabinet

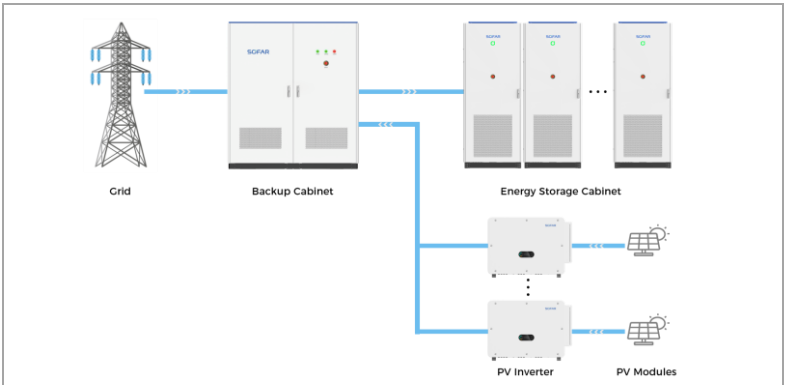


Figure 3.6: PV + Storage microgrid scenario

3.5 Dimension

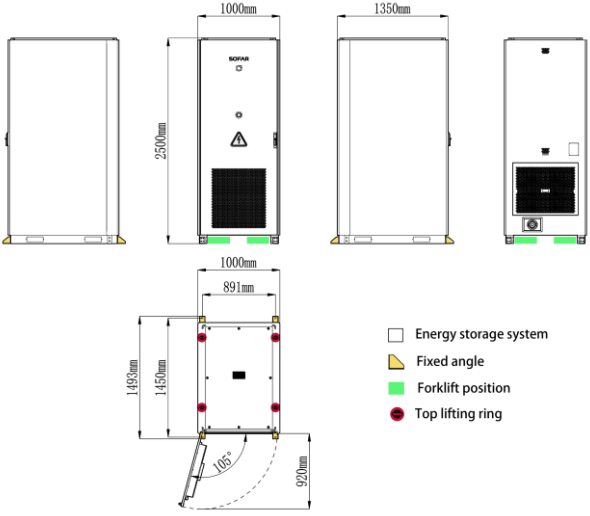


Figure 3.7: Dimensions of energy storage cabinet and maximum door opening size

3.6 Component introduction

Table 3.3 Introduction of energy storage cabinet components

NO.	Name	Qty.	Description
A	Cabinet	1	
B	Temperature/smoke/ combined detectors	1	
C	Aerosol	1	
D	Logo indicator	1	
E	Emergency stop button	1	
F	PACK	5	
G	Liquid Cooling piping	1	

NO.	Name	Qty.	Description
H	Liquid cooling machine	1	
I	PCS	1	
J	Distribution module	1	
K	Buzzer	1	
L	Miniature circuit breaker (MCB)	2	
M	Water immersion electrode plate	1	
N	Lighting/Access control switch	1	
O	Water fire sprinkler	1	
P	Fuse	1	
Q	Electrical compartment flame detection tube	1	
R	Signal terminals	1	
S	Water fire protection interface	1	
T	Directional smoke exhaust outlet	1	

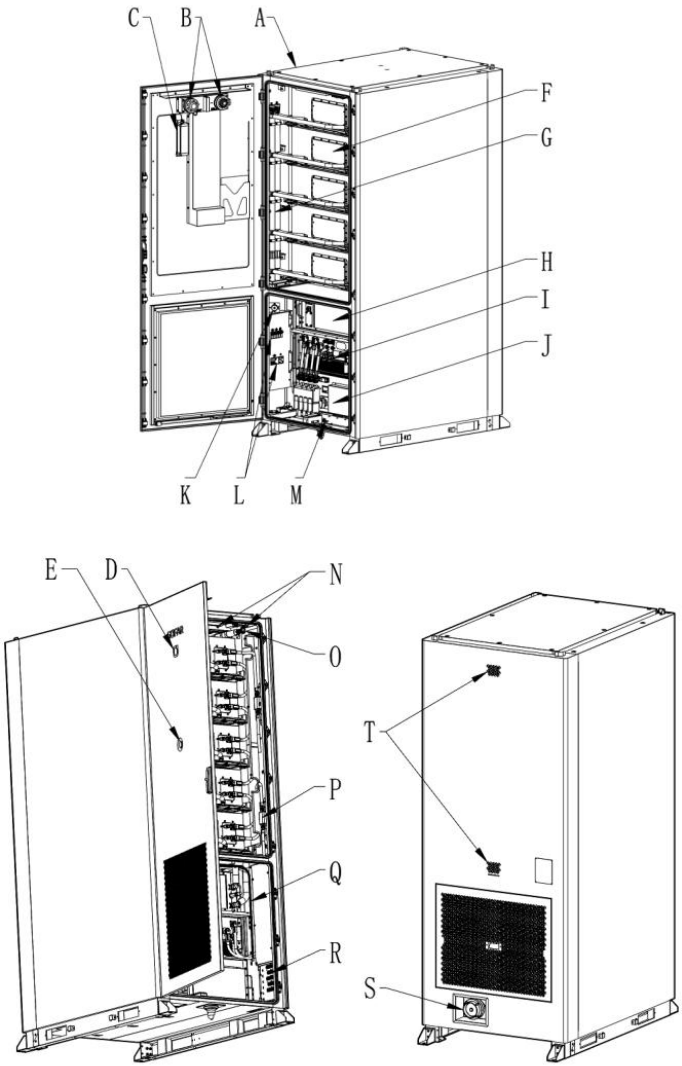


Figure 3.8: Components of the energy storage cabinet

The above pictures are for reference only, please refer to the physical objects received!

4 Transport and storage

4.1 Transport precautions

⚠ WARNING

- In the whole process of loading, unloading, transport, must comply with the project in the country/region of the container operation safety regulations!
- In the whole process of loading, unloading and transport, must meet the transport origin country, route country, destination country transport container operation specification and regulatory requirements!
- The energy storage system mechanical parameters (dimensions and weights) should be kept in mind during the operation.
- All personnel involved in loading, unloading and bolting should receive appropriate training, especially in safety.

⚠ CAUTION

- Failure to transport and store in accordance with the requirements of this manual may void the warranty.

- The energy storage system can be shipped directly to site, meeting the transportation requirements for road vehicles and vessels. For sea transport, the system complies with the IMDG Code and the International Maritime Dangerous Goods Regulations. For land transport, it complies with ADR or JT/T 617 requirements.
- Air transport is currently not permitted, and railway transport is not supported.
- The system features an integrated design, then the cabinet can be lifted and transported as a whole using a forklift.

Conditions for transportation and handling:

- ✓ All cabinet doors must be securely locked, and no objects may protrude from the box.
- ✓ Depending on site conditions, select appropriate forklifts and tools. All tools used must meet the handling requirements of the system.
- ✓ During handling, warning signs or safety barriers must be set up to prevent unauthorised personnel from entering the operation area and avoid accidents.
- ✓ Handling must be suspended under adverse weather conditions such as heavy rain, fog, or strong winds.
- ✓ Before operation, ensure the forklift meets the load-bearing requirement: capacity ≥ 4 t.
- ✓ Recommended fork dimensions: length ≥ 1.5 m, width 100–180 cm, thickness 25–55 cm.

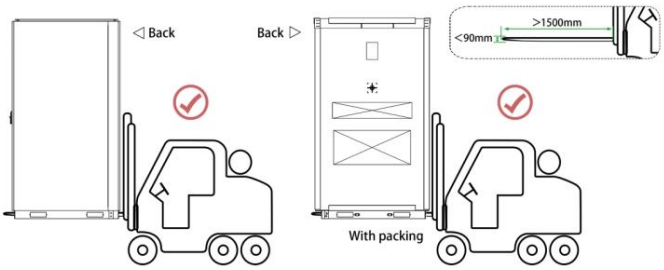


Figure 4.1: Forklift transport front side

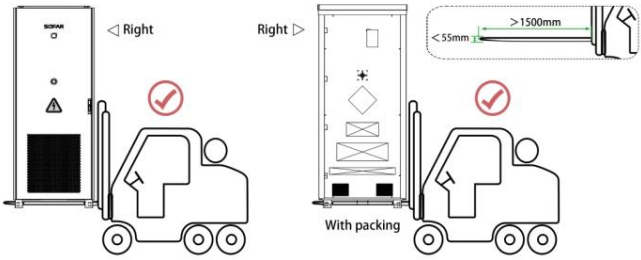


Figure 4.2: Forklift truck side transport

4.2 Storage requirements

NOTICE
▸ Before storage, the energy storage system should be checked and data recorded. Ensure that the cabinet door and the door of each device inside are locked, and the power switch is in a safe state. ▸ During storage, it is necessary to provide relevant proof of compliance with product storage requirements, such as temperature and humidity log data, storage environment photos and inspection reports. ▸ The energy storage system and transport time is not more than 6 months in total (counting time from the start of shipment), and should be used promptly; otherwise, lithium long-term storage will result in capacity loss.

Storage environment requirements:

- ✓ Recommended storage temperature: 20℃~30℃;
- ✓ Relative humidity: 5%RH~80%RH;
- ✓ Dry, ventilated and clean;
- ✓ Avoid contact with corrosive organic solvents, gases and other substances;
- ✓ The distance from the heat source should not be less than two meters;

Storage location requirements:

- ✓ The storage location of the energy storage system should have sufficient bearing capacity (single cabinet ≥ 4t), the ground needs to be level, the flatness should be ≤ 3mm, no slope, and there is no accumulation of materials around.
- ✓ Before storage, the energy storage system should be reasonably padded according to the local meteorological conditions, to avoid rain or ground water erosion;
- ✓ The storage location should avoid mechanical impact, heavy pressure and strong magnetic field action.

Regular inspection:

- ✓ Inspect at least once every half a month to check whether the packaging is intact and undamaged to avoid insects and rodents, and replace it immediately if it is found to be damaged. Before installing the energy storage system for long-term storage (more than 6 months), it should be inspected and tested by professional personnel before it is put into use.
- ✓ Long-term storage of batteries is not recommended due to the capacity degradation that occurs when batteries are stored for long periods of time. In addition to this, even if the battery is stored at the recommended optimal storage temperature, there will be irreversible capacity degradation due to calendar effects. The longer the storage time, the greater the irreversible degradation. Please refer to the technical agreement for specific degradation values. Stock batteries are shipped on a first-in-first-out basis.
- ✓ Calculated from the date of shipment, energy storage systems with a storage period of more than 8 months under the above conditions should be charged and discharged once to bring the system SOC up to 30%~40%, and the SOC needs to be consistent after replenishment.
- ✓ The air inlet and outlet of the energy storage system should be protected, and effective measures should be taken to prevent the intrusion of rainwater, sand and dust into the interior of the energy storage system.

5 Installation

5.1 Installation requirements

5.1.1 Installation environment requirements

- ✓ The external environment meets the requirements of GB 51048-2014: Design code for electrochemical energy storage station in China. The global compliance with NFPA 855 Standard for the Installation of Stationary Energy Storage Systems or IEC 62933-5-2: Safety Requirements for Grid-Integrated BESS Systems.
- ✓ The equipment should be installed in an area away from liquids, and should not be installed under water pipes, air outlets and other locations that are prone to condensation; it should not be installed under air conditioning outlets, vents, server room outlet windows and other locations that are prone to water leakage to prevent liquids from entering the interior of the equipment and causing equipment malfunctions or short circuits.
- ✓ It is prohibited to place the equipment in an environment with flammable or explosive gases or fumes, and to perform any operation in such an environment.
- ✓ Installation of an energy storage system in a salt-affected area will cause corrosion and may result in a fire, so do not install an energy storage system outdoors in a salt-affected area. Salt-affected areas are areas within 2km of the coast or affected by sea breezes. The area affected by sea breeze varies depending on meteorological conditions (e.g. typhoons, seasonal winds) or topography (presence of dykes, hills).

5.1.2 Installation operation requirements

- ✓ The operation area should be well marked with warning signs, and there should be at least one qualified supervisor responsible for industrial safety on site.

- ✓ Operators must undergo relevant training and obtain relevant certificates of competency before taking up their duties.
- ✓ Operators should do a good job of personal protection, wear helmets and safety belts; use all kinds of tools in a reasonable and compliant manner; any tools used in the operation should undergo maintenance and quality inspection.
- ✓ If special operations or work at height are required, they should report to the safety personnel in advance and take precautionary measures.
- ✓ In case of bad weather or an unexpected situation, the work should be stopped immediately.

5.2 Foundation

5.2.1 Foundation construction requirements

Improper foundation design can lead to major issues in system placement, door operation, and long-term performance. The foundation must therefore be designed and constructed in accordance with defined standards to ensure adequate mechanical support, proper cable routing, and convenient access for maintenance.

⚠ WARNING

- The energy storage system is relatively heavy. Before constructing the foundation, a detailed assessment of site conditions—particularly geological and environmental factors—must be carried out. Foundation design and construction may only commence once these conditions have been verified.
- An integrated foundation is mandatory.

Site Selection Requirements:

- ✓ The installation site must not be located in low-lying areas. The installation level shall be at least 300 mm above the historical maximum water level in the region.

- ✓ The minimum distance to airports, underground landfill sites, riverbanks, or dams shall be ≥ 2 km.
- ✓ The site should be open and unobstructed, ensuring a clear area of at least 10 m around the system.
- ✓ For safety, the system shall be installed at least 12 m away from residential buildings and more than 30.5 m from densely populated facilities such as schools or hospitals. If these safety distances cannot be achieved, a fire-rated wall shall be constructed between the system and the building.
- ✓ The site shall provide sufficient land for current installation needs and allow space for future expansion over the system's life cycle.
- ✓ The site must be well ventilated.

Sites not recommended by industry standards and regulations shall be avoided, including but not limited to:

- ✓ Areas subject to strong vibration, high noise, or intense electromagnetic interference.
- ✓ Locations with dust, oil smoke, harmful or corrosive gases.
- ✓ Facilities that produce or store corrosive, flammable, or explosive materials.
- ✓ Areas with existing underground facilities.
- ✓ Sites with problematic geological conditions, such as rubber soil, weak soil layers, waterlogging, or subsidence-prone ground.
- ✓ Seismic fault zones or earthquake-prone areas with a seismic intensity rating higher than IX.
- ✓ Areas exposed to direct geological hazards such as mudslides, landslides, quicksand, or karst caves.
- ✓ Mining subsidence or displacement zones.
- ✓ Blast hazard zones.
- ✓ Areas at risk of flooding due to dam or levee failure.
- ✓ Protected zones of important drinking water sources.
- ✓ Historical and cultural heritage protection areas.
- ✓ Densely populated sites, high-rise buildings, or underground structures.

Foundations shall be constructed to meet, as a minimum, the following requirements:

- ✓ The energy storage system must be mounted on concrete or other non-combustible surfaces, and the mounting plane must be level, firm, and flat, with sufficient bearing capacity to prohibit depressions or tilting.
- ✓ The equipment foundation is configured according to the total weight of the equipment n*4t ("n" indicates the number of energy storage cabinets), and when the load-bearing capacity of the foundation is not satisfied, it needs to be reviewed.
- ✓ The bottom of the pit for the equipment foundation must be compacted and filled.
- ✓ Equipment foundation excavation is strictly prohibited after soaking water disturbance, if soaking water disturbance should continue to excavate and refill.
- ✓ Equipment foundation and cabinet contact surface level error ≤ 3mm.
- ✓ Foundations must be above the local historic highest water level and at least 300mm above grade.
- ✓ Construct drainage facilities in conjunction with local geological and municipal drainage requirements to ensure that water does not accumulate at the equipment foundations. The foundations should be constructed to meet the local historical maximum rainfall drainage requirements, and the discharged water needs to be treated in accordance with local laws and regulations.
- ✓ When constructing equipment foundations, it is necessary to consider the cable outlet of the energy storage system and to reserve a trench or an inlet hole.
- ✓ The holes reserved for the foundation of the equipment and the holes in the bottom of the equipment for incoming wires should be blocked.
- ✓ The foundation is made according to the foundation plan provided by SOFAR, or the foundation plan confirmed by our company, and the tolerance of the upper surface of the foundation is required to be ±3mm.

5.2.2 Requirements for installation space

In order to ensure that the air inlet can be better air intake and maintenance, it is recommended to reserve enough space around the cabinet installation position. A minimum clearance of 600 mm is recommended on all sides, and a fire emergency access passage of not less than 1000 mm shall be provided. The minimum space requirement is shown in the figure below:

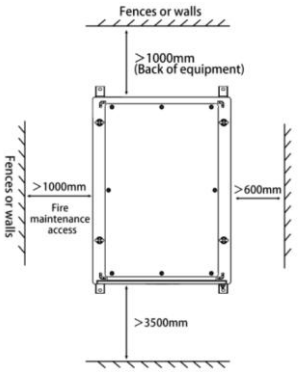


Figure 5.1: Single-unit energy storage system installation

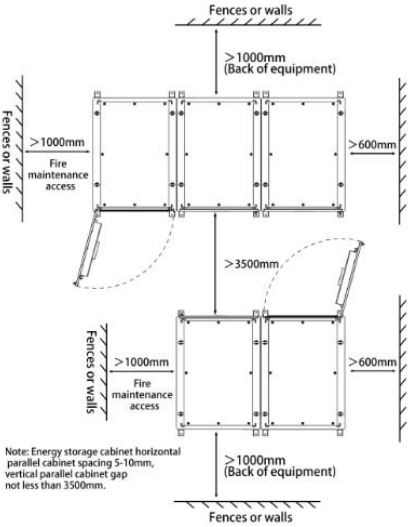


Figure 5.2: Parallel cabinet installation (face-to-face)

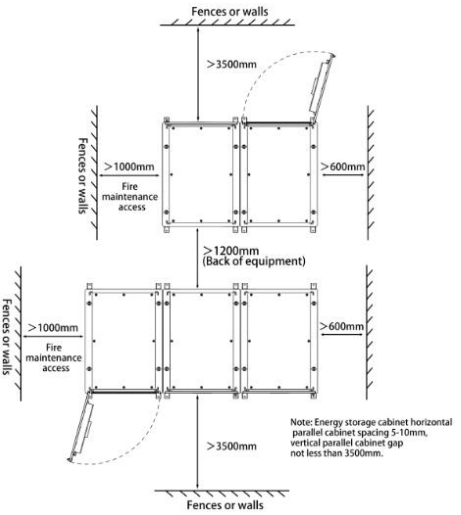


Figure 5.3: Parallel cabinet installation (back-to-back)

5.2.3 Recommended foundation drawing

The figure below is a simplified illustration only. Detailed foundations must be constructed in accordance with foundation drawings supplied by SOFAR or with drawings approved by the Company.

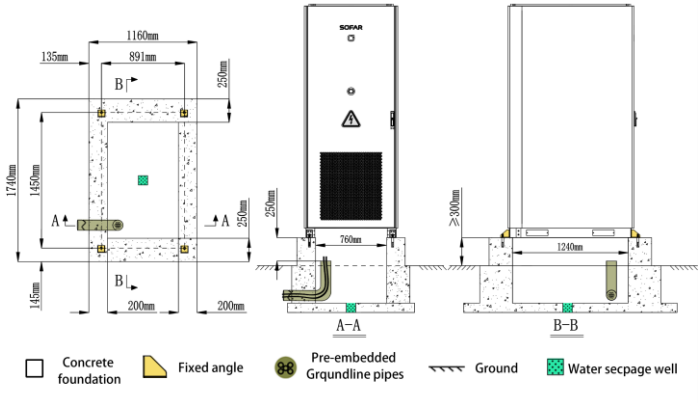


Figure 5.4: Single energy storage cabinet foundation

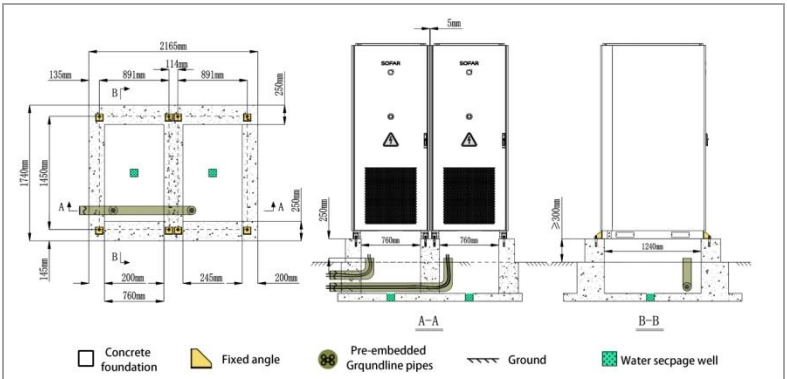


Figure 5.5: Foundation for two energy storage cabinets installed in parallel

5.2.4 Optional customised steel base

The figure below shows an optional steel foundation.

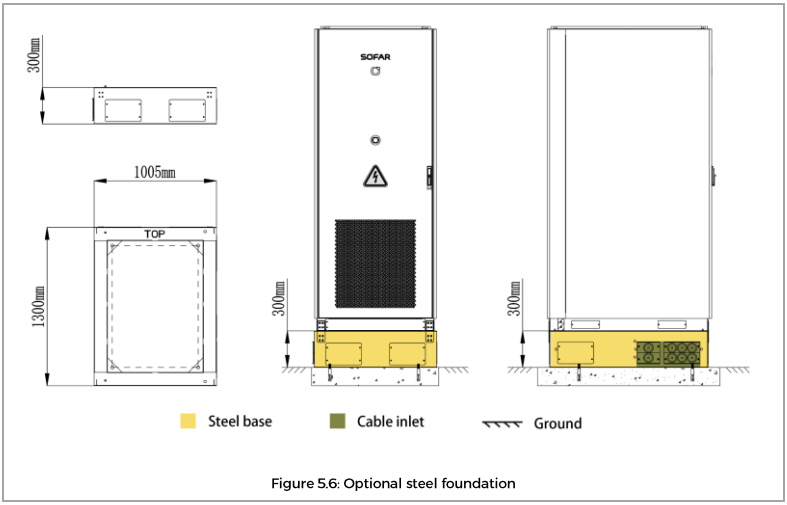


Figure 5.6: Optional steel foundation

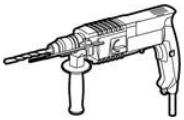
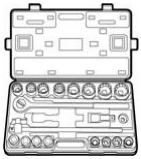
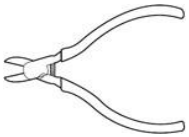
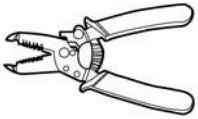
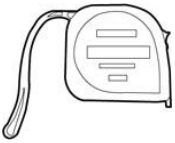
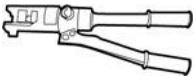
5.3 Hoisting and fixing

5.3.1 Preparation tools

NOTICE
▸ The tools used, such as socket wrenches, torque wrenches, and screwdrivers, must have insulated handles or be insulated tools.

The tools to be prepared before the installation of the equipment are as follows.

Table 5.1 Tools Required Before Installing the Energy Storage System.

 Hammer drill (drill bit: Φ20mm)	 Torque socket wrench	 Moment of force spanner	 Diagonal pliers
 Wire strippers	 One-word screwdriver Knife head: 0.6mm× 3.5mm	 Rubber mallet	 Utility knife
 Marker	 Steel measuring tape	 Level	 Hydraulic tong

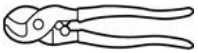
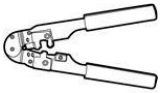
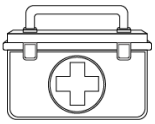
 Cable cutter	 Crystal head clamp	 Vacuum clear	 Multimeter DC voltage range ≥ 1500V DC
 Heat-shrinkable sleeve	 Heat gun	 Tie-line belt	 Insulation ladder
 Crane	 Lifting rope	-	-

Table 5.2 Personal protection tools

 Safety gloves	 Safety goggles	 Dust mask	 Safety boots

 Reflective waistcoat	 Safety helmet	 Field medical chest	-

5.3.2 Check before installation

Verify Delivery Items

- Check all delivered items against the accompanying packing list to ensure completeness.

Inspect the Equipment

- Confirm that the received cabinets match the models specified in the order.
- Examine the energy storage system and internal components for any signs of damage, such as holes, cracks, or other potential defects.
- If any issues are identified, or if the model does not match the order, please contact your distributor immediately.

5.3.3 Installation and fixing work

⚠ WARNING

- Only a complete and undamaged energy storage system may be installed!

Prerequisites:

- ✓ Before installation, make sure that the crane, sling, forklift, etc., meet the load-bearing requirements;
- ✓ Preparation of steel cables for lifting has been completed;
- ✓ Foundations have been constructed as required;

- ✓ Meet the weather requirements for lifting and forklift transport; when installing outdoors, lifting work should be stopped in case of bad weather conditions, such as heavy rain, fog, strong winds, etc.

Installation considerations:

Table 5.3 Precautions for Installation of energy storage system

Installation process	Precautions
Pre-installation	The lifting capacity of the crane exceeds 6t, and the working radius is not less than 5m. The carrying capacity of the forklift truck is at least 4t. If the working conditions at the site do not meet the requirements, it is necessary to find a professional to carry out an assessment.
	Personnel carrying out forklift transport and lifting operations are required to undergo relevant training and be qualified before taking up their duties.
	Forklifts and lifting tools need to be inspected and qualified, and tools are complete before use.
	Ensure that the lifting tool is securely fixed to a load-bearing fixture or wall.
	Confirm that the crane and cable meet the requirements before lifting.
	The doors of the energy storage cabinets are all closed and locked.
	Ensure that the steel cable is connected safely and reliably.
	A left-to-right or right-to-left lifting sequence is recommended to ensure smooth lifting.
Installation	It is strictly prohibited for unrelated persons to enter the forklift truck transport area, lifting area, or to stand under the boom.
	Ensure that the crane is in the right position and cannot be lifted for long distances.
	Keep smooth, the cabinet diagonal tilt ≤ 5°.

Installation process	Precautions
	Ensure that the angle between the two lifting cables is <60°.
	Forklift trucks transport and lift equipment gently, lift the equipment slowly, and the energy storage system should be lifted slowly and smoothly to avoid impact on the internal equipment.
	When the energy storage system is in contact with the concrete support platform, wait until the four support force surfaces are relatively uniform before removing the lifting cable and forklift arm.
	It is prohibited to drag the wire rope and spreader, and prohibited to use hard objects to hit.

Procedure:

1. Mark the installation reference point of the energy storage system on the concrete support platform using a marker. Based on this point, use a chalk line and a long measuring tape to outline the positions of the four cabinet corners.
2. Use appropriate tools to remove the external corner protectors, cardboard packaging, sheet metal parts, and protective covers from the equipment.

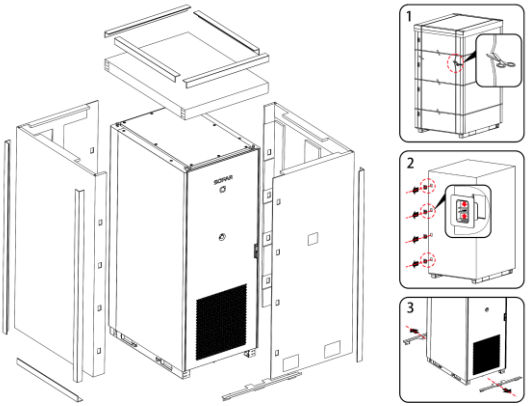


Figure 5.7: Energy storage cabinet packaging

3. Open the cabinet door and remove the accessory kit supplied with the equipment. Check the delivered items and quantities against the *Packing List*. If any items are missing, please contact your distributor as soon as possible.

Figure 5.8: Illustration of packing list

4. Secure the M20 lifting eye bolts supplied in the accessory kit to the lifting holes on the top of the energy storage cabinet, close the cabinet door, and remove any surrounding obstacles. Adjust the cabinet orientation to match the intended installation direction, and use a crane to slowly lift the cabinet onto the concrete support platform.
   Upon completion of lifting, ensure that the cabinet base is accurately aligned with the base outline marked on the concrete support platform.
   (If a forklift is used to move the cabinet onto the concrete support platform, installation of the lifting eye bolts is not required.)

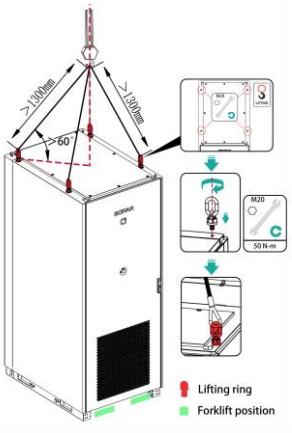


Figure 5.9: Lifting Diagram

⚠ WARNING

- When using a forklift truck to move the equipment, please tie down and secure it according to the actual situation to ensure that there is no risk of the equipment tipping over.

5. Secure the energy storage system using the four corner brackets. Pre-position the angle brackets against the cabinet base. Mark the expansion bolt fixing positions using a marker. Drill the bolt holes with an impact drill. Insert the bolts into the holes and remove the nuts. First, use bolts to fasten the angle brackets to the cabinet base, and then tighten the bolt nuts to secure the cabinet to the foundation.

NOTICE

- When hoisting the energy storage system, it is necessary to ensure that the four corners of the energy storage system coincide with the corners drawn on the concrete support platform.

During transportation, the energy storage system is additionally protected with a safety cover.

Checklist:

After the energy storage system has been hoisted and installed, a post-installation inspection must be carried out to ensure proper operation and smooth progress of subsequent installation work.

Table 5.4 Checks after installation

No.	Check the content	Method	Standards
1	Are the bolts and nuts tight?	Use a spanner to tighten again.	Bolts and nuts are tightened.

2	Does the energy storage system door open and close properly?	Perform an open and close operation on the energy storage system door.	All doors of the energy storage system can be opened and closed smoothly.

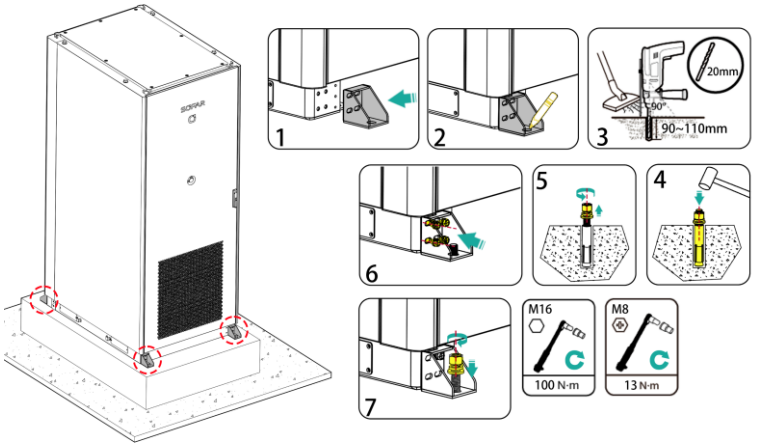


Figure 5.10: Secure the energy storage system with angle steel

6. Open the accessory kit, take out the front and rear base panels, and secure them to the designated positions on the base.

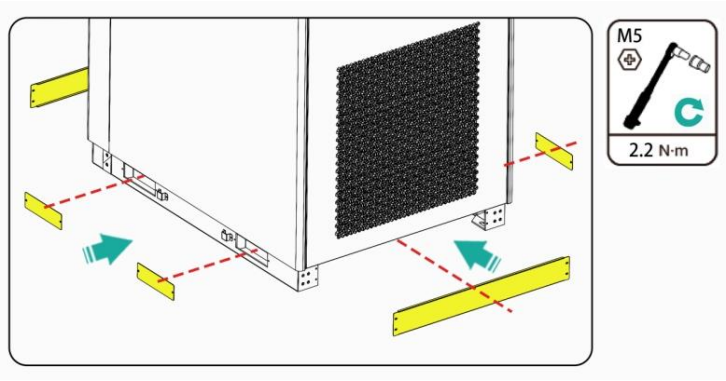


Figure 5.11: Installation diagram of front and rear base panels

5.3.4 Customised steel base installation

1. Lift the steel base into position using a crane or transport it with a forklift, and ensure that the **"Black"** side of the steel base faces opposite to the preset cabinet door opening direction.
2. Use expansion bolts to secure the steel base to the concrete floor. Mark the expansion bolt installation positions with a marker, drill the installation holes using an impact drill, install the expansion bolts, and tighten the expansion bolt nuts to the specified torque to firmly fix the steel base to the concrete foundation. (See Figure 5.12, items 1–4).
3. Secure the energy storage cabinet firmly to the steel base using bolts. Lift the energy storage cabinet onto the steel base, ensuring the base is fully aligned with the positioning lines. Using the specified torque, secure the mounting plate to both the cabinet base and the steel base with bolts (See Figure 5.12, items 5–7).
4. After completing the wiring, install the front and rear base panels to seal the cabinet base. (See Figure 5.12, item 8).

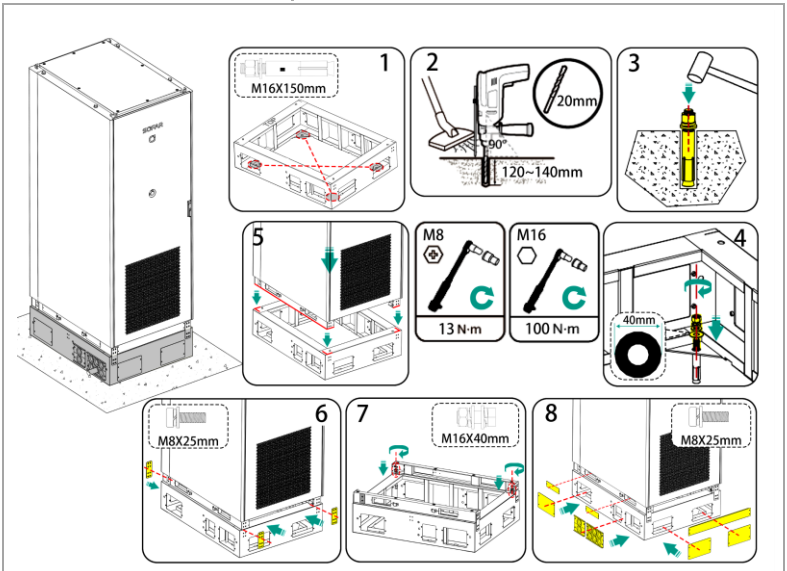


Figure 5.12: Steel Base Installation

6 Electrical connection

DANGER

Danger of high voltage! Electric shock hazard!

- Do not touch electrically charged parts!
- Please make sure that the AC and DC sides are not charged before installation.
- Do not place the device on flammable surfaces.

WARNING

- Before wiring, check and ensure that the polarity of all input cables is correct.
- During electrical installation, do not forcibly pull any wires or cables, as this may compromise the insulation performance.
- Ensure that all cables and wires have sufficient space for any bends.
- Adopt the necessary auxiliary measures to reduce the stress applied to cables and wires.
- After completing each connection, carefully check and ensure that the connection is correct and secure.

6.1 Safety precautions

6.1.1 Wiring requirements

- ✓ The selection, installation, and routing of cables must comply with local laws, regulations, and standards.
- ✓ Power cables must not be coiled or twisted during installation. If the cable length is insufficient, it must be replaced; joints or soldering points in power cables are strictly prohibited.
- ✓ All cables must be firmly connected, properly insulated, and of appropriate specifications.

- ✓ Cable trays and cable entry holes must be free of sharp edges. Protective measures must be applied when cables pass through conduits or entry holes to prevent damage from sharp edges or burrs.
- ✓ Cables of the same type should be bundled together, arranged neatly, and kept free from sheath damage. Different types of cables must be routed at least 30 mm apart; crossing or intertwining is strictly prohibited.
- ✓ After wiring is completed, or when work is suspended, cable entries must be sealed immediately with sealing clay to prevent moisture and small animals from entering.
- ✓ Buried cables must be reliably fixed with cable brackets and clamps. In backfill areas, cables must be laid close to the ground to avoid deformation or damage caused by soil pressure.
- ✓ When external conditions (e.g., laying method or ambient temperature) change, cable selection and verification must comply local regulations and standards, ensuring current-carrying capacity meets requirements.
- ✓ High temperatures may cause insulation aging or damage. The distance between cables and heating elements or heat sources must be at least 30 mm.
- ✓ At very low temperatures, strong impacts or vibrations may cause cable sheaths to crack due to brittleness. To ensure installation safety, the following must be observed:
  - All cables must be installed at ambient temperatures above 0°C. During handling, especially in low-temperature conditions, cables must be handled with care.
  - If cables are stored at temperatures below 0°C, they must be kept at room temperature for at least 24 hours before installation.
  - Improper handling, such as pushing cables directly off vehicles, is prohibited, as this may damage the cables and affect current capacity and thermal performance.

6.1.2 Short-circuit protection

- During installation and maintenance of battery PACKs, wrap exposed cable terminals on the battery with insulating tape.
- Prevent foreign objects (e.g., conductive materials, screws, liquids, etc.) from entering the battery to avoid short circuits.

DANGER

- Before making electrical connections, ensure that the equipment is free from damage; otherwise, electric shock or fire may occur.
- Improper or incorrect operation may cause accidents such as fire or electric shock.
- Prevent foreign objects from entering the equipment during operation, as this may cause short circuits, equipment damage, load derating or power loss, and even personal injury.

WARNING

- For equipment requiring grounding, the protective earth (PE) conductor must be connected first during installation and disconnected last during removal.

NOTICE

- Do not route cables across the equipment's air inlet or outlet to prevent blockage.

6.1.3 Grounding requirements

- ✓ The grounding impedance of the equipment must comply with local electrical standards.
- ✓ The equipment must be permanently connected to protective earth. Before operating the equipment, check the electrical connections to ensure proper grounding.

- ✓ Do not operate the equipment without a connected grounding conductor.
- ✓ Do not damage or remove the grounding conductor.
- ✓ For equipment using a three-pin socket, ensure the grounding pin is reliably connected to protective earth.
- ✓ For equipment with high touch current, connect the protective earth terminal of the chassis before connecting the input power supply to prevent electric shock hazards.

6.1.4 ESD (electrostatic discharge) protection

Electrostatic charges generated by the human body can damage electrostatic-sensitive components on boards, such as large-scale integrated circuits (LSI).

- ✓ Before touching equipment, handling boards, modules with exposed circuit boards, or application-specific integrated circuits (ASIC), comply with ESD protection requirements: wear anti-static clothing, and use anti-static gloves or wrist straps. The wrist strap must be properly grounded.
- ✓ When holding boards or modules with exposed circuits, grasp only the edges that do not contain components. Do not touch components with your hands.
- ✓ Boards or modules that are removed must be packaged with anti-static materials before storage or transport.

6.2 Wiring preparation

6.2.1 Installation tools

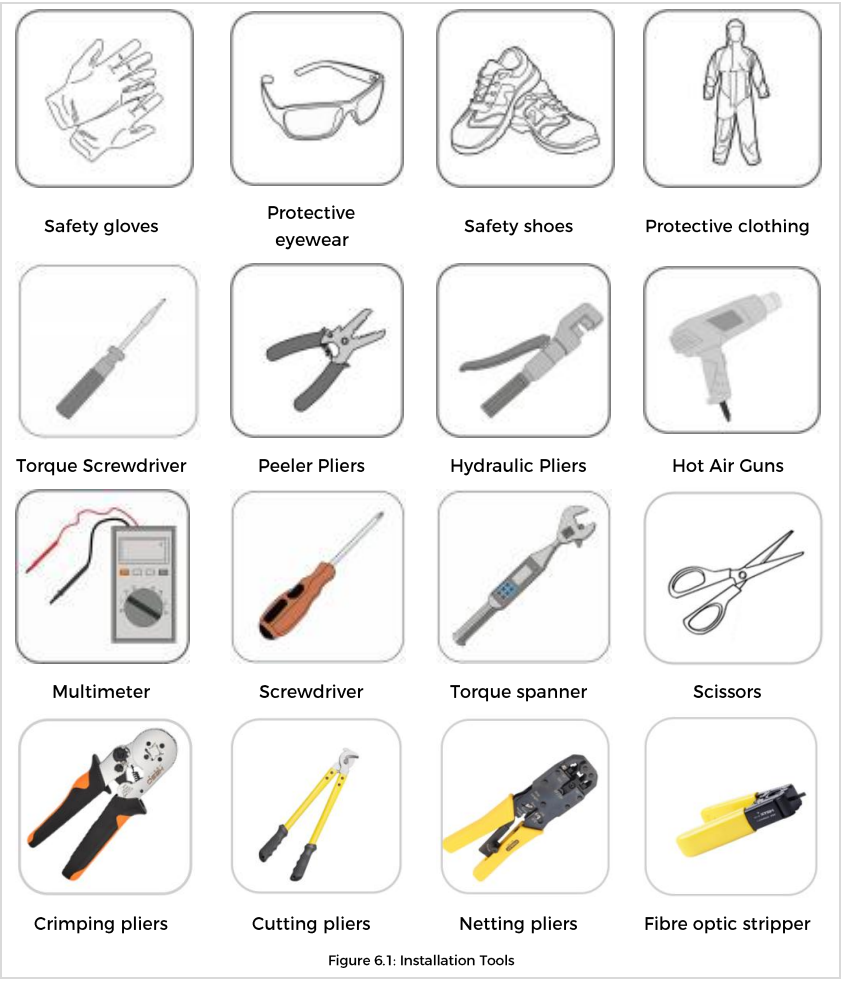


Figure 6.1: Installation Tools

6.2.2 Prepare Cables

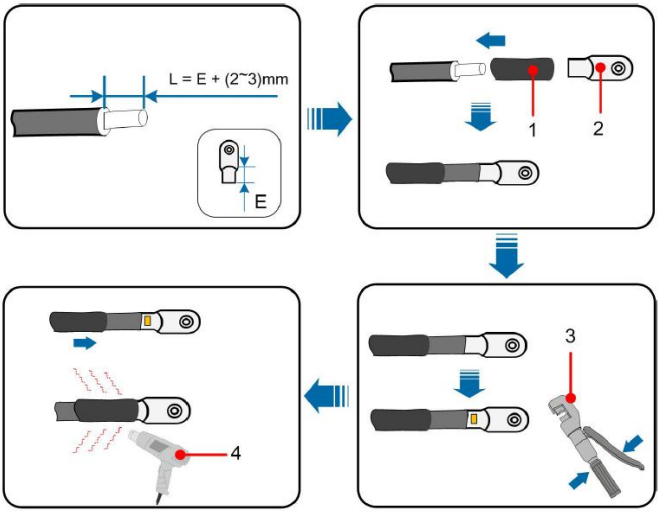
Table 6.1 Recommended Cable Specifications

Name	Type	Scope of cross-sectional area selection	Terminal	Remarks
AC input power cable	5 core (A, B, C, N, PE) outdoor copper core wire or choose armored cable	95mm²*4 + 50 mm²*1	OT / DT terminal: A/B/C/N: M12 PE: M8	Energy storage cabinet AC input three-phase power cable
Parallel cabinet signal cable	2 Core shielding cable	(0.5~1mm²) *2	Tubular terminal, 8mm	Connecting energy storage cabinets in parallel (for PWM communication and parallel synchronization I/O signals)
RS485 communication cable	2 Core shielding line	(0.5~1mm²) *2	Tubular terminal, 8mm	For communication between the energy storage cabinet, external PCC, and PV meter
CSU communication network cable	CAT 5E Outdoor shielded network cable, with an internal resistance of 1.5 Ω / 10m	—	Shield of the RJ 45 crystal head	Local management or EMS communication
DRM signal cable	CAT 5E Outdoor shielded network cable, with an internal resistance of 1.5 Ω / 10m	—	Shield of the RJ 45 crystal head	PCS DRM signal
I/O dry contact signal cable	2 Core cable	(0.5~1mm²) *2	Tubular terminal, 8mm	External fault output signals from the energy storage cabinet, external fault input signals to the energy storage cabinet, PCS NS protection signals, etc.
Protective Grounding (PE) Cable	Single-core outdoor copper core wire or grounding flat steel	Copper core wire: (25mm²~50mm²) or ground flat steel: (section (40mm * 4mm)	M10 OT / DT terminal	The specific size of the grounding wire / flat steel is subject to the design of the design institute

6.2.3 Cable crimping and connection

OT/DT terminal crimping

NOTICE
▸ The cables used must comply with local laws and regulations. ▸ The cable colors shown in this manual are for reference only; please select cables according to local standards. ▸ Cable cross-sectional area must be selected based on the maximum current-carrying capacity, and the length must include sufficient margin. ▸ All DC input cables must be of the same specification and material. ▸ All cables listed in the cable schedule shall be provided by the customer.



(1) Heat-shrink tubing (2) OT/DT terminal
(3) Hydraulic pliers (4) Hot air gun
Figure 6.2: OT/DT Terminal crimping

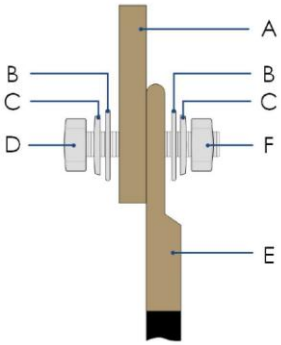


Figure 6.3: Cable connection

Table 6.2 Cable Connection Description

No.	Name	No.	Name
A	Copper row	D	Bolt
B	Flat pads	E	Copper Terminal Block
C	Spring pads	F	Nuts

6.2.4 Opening the cabinet door and equipment box door

1. Open the doors of the energy storage cabinet. Insert the key into the lock cylinder and rotate it. When the handle pops out, turn it clockwise to open the door.

Figure 6.4: Opening the cabinet door

2. Fix the cabinet door

   When the door is opened, the double-headed bolt of the door support will slide naturally. Once the bolt reaches the hole position (see Fig. A), the limit bar will automatically secure the door.

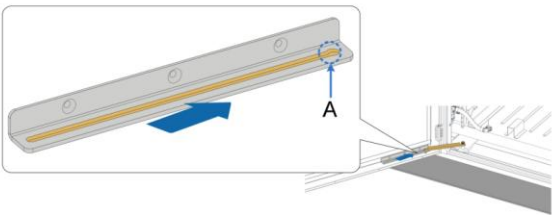


Figure 6.5: Fix the cabinet door

Images are for reference only. Please refer to the actual product received.

6.2.5 Cable entrance design

All external connection cables to the energy storage cabinet shall enter and exit through the bottom of the cabinet.

All exposed external cables must be properly protected (e.g., routed through conduits) to prevent damage by rodents. After the wiring work is completed, the cabinet's cable entry/exit holes must be tightly sealed with fireproof putty or other suitable sealing materials.

The design of the cable entry/exit holes at the bottom of the energy storage cabinet is illustrated below.

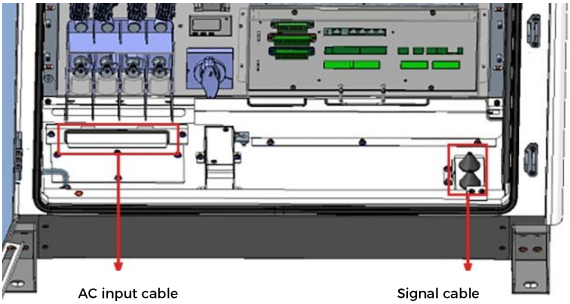


Figure 6.6: Diagram of Cable Entry and Exit Holes at the Bottom of the Energy Storage Cabinet

Images are for reference only. Please refer to the actual product received.

6.3 Grounding connection

The energy storage cabinet has both internal and external grounding. The internal grounding wire is connected to the cabinet's main grounding bar together with the AC input cable. The external grounding can be achieved nearby via grounding.

There are two kinds of grounding methods: fixed with grounding flat steel or fixed by grounding cable.

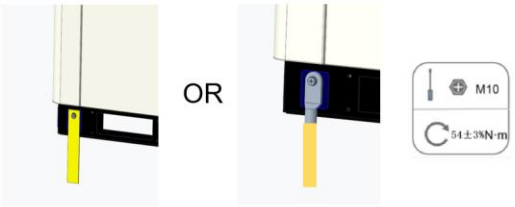


Figure 6.7: Cabinet external grounding

Images are for reference only. Please refer to the actual product received.

Ground flat steel

- Fix the grounding flat steel to the two grounding points of the energy storage base with M10×30 screws, the whole fixing surface needs to be sprayed after completion.

Grounding cable

- Use a 25 mm² to 50 mm² grounding cable to reliably connect the two grounding points of the energy storage cabinet to the grounding point of the grounding grid on site.
- The cable is crimped to the DT terminal and when crimping is complete, it is tightened using M10×30 screws.
- Please take into account the actual situation of the project site and follow the instructions of the power station staff to install the external grounding. The grounding resistance shall be measured after the grounding connection is completed, and the resistance value shall not be greater than 4 Ω.

NOTICE
▸ The grounding resistance values are subject to relevant national/local standards and regulations.

6.4 AC input power cable connection

The AC input power cables of the energy storage cabinet are connected to the power terminals on the distribution module at the bottom of the cabinet. The wiring diagram for the AC input power cables is shown in the figure below.

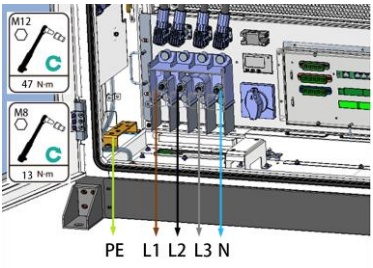


Figure 6.8: AC power cable connection

Procedure:

1. Switch off the upstream AC breaker and verify with a multimeter that there is no voltage on the cables leading to the energy storage cabinet.
2. Route the cables through the bottom entry holes of the cabinet, guiding them to the designated connection points according to cable markings.
3. Trim excess cable length using cable cutters.
4. Strip the insulation with wire strippers to expose the copper conductor.
5. Crimp the OT terminals (see section 6.2.3 *Cable crimping and connection*).
6. Use M12 (A/B/C/N) bolts and M8 (PE) bolts to secure the OT terminals.
7. After completing the connections, gently pull each cable to ensure sufficient slack remains. Neatly bundle and secure the cables along the routing path with cable ties.

NOTICE
▸ The AC input power cables must be connected strictly according to the designated terminal phase sequence.

6.5 Signal terminal wiring

The energy storage cabinet is equipped with external signal terminals, primarily used for transmitting IO signals between the cabinet and external devices, PCS parallel PWM communication, PCS parallel synchronization IO signals, and communication with meters via RS485, among others. On-site wiring should be done according to the actual configuration and the interface definition table provided below. The wiring diagram for the external connections of the energy storage cabinet is shown in the figure below.

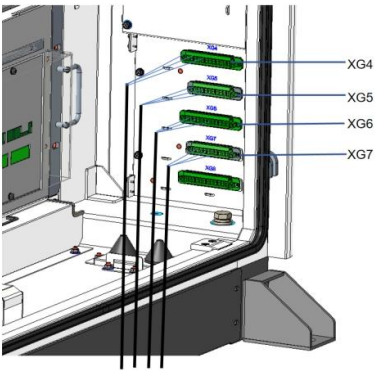


Figure 6.9: External wiring of storage cabinet signal terminals

Table 6.3 Definition of external interface terminals

External interface terminal	Pins	Description	Recommended cable size	Remark
XG4	1	PCS Parallel CAN2_H	(0.5~1 mm²) *2	According to the actual configuration requirements
	2	PCS Parallel CAN2_L		
	3	PCS Parallel CAN2_H		
	4	PCS Parallel CAN2_L		
	5	Shield Ground		
	6	PCS Parallel Sync IO+		
	7	PCS Parallel Sync IO-		
	8	PCS Parallel Sync IO+		
	9	PCS Parallel Sync IO-		
	10	N/A		
	11	N/A		
	12	Shield Ground		
XG5	1	PCS Parallel Carrier Synchronization PWM_H	(0.5~1 mm²) *2	According to the actual configuration requirements
	2	PCS Parallel Carrier Synchronization PWM_L		

External interface terminal	Pins	Description	Recommended cable size	Remark
	3	PCS Parallel Carrier Synchronization PWM_H		
	4	PCS Parallel Carrier Synchronization PWM_L		
	5	Shield Ground		
	6	PCS NS Protection IO Signal+		
	7	PCS NS Protection IO Signal-		
	8	N/A		
	9	N/A		
	10	Shield Ground		
XG6	1	External Alarm Signal Input to CSU+	(0.5~1 mm^2) *2	According to the actual configuration requirements
	2	External Alarm Signal Input to CSU-		
	3	CSU Alarm Signal Output to External+		
	4	CSU Alarm Signal Output to External-		
	5	PV Meter RS485_A		
	6	PV Meter RS485_B		
	7	Grid Meter RS485_A		
	8	Grid Meter RS485_B		
	9	Shield Ground		
	10	CSU and Junction Cabinet IO Board and Dehumidifier Communication RS485_A		
	11	CSU and Junction Cabinet IO Board and Dehumidifier		

External interface terminal	Pins	Description	Recommended cable size	Remark
		Communication RS485_B		
	12	Shield Ground		
XG7	1	EPO Emergency Stop Feedback to PCS Signal+	(0.5~1 mm^2) *3	According to the actual configuration requirements
	2	Jumper		
	3	Emergency Stop Button NC		
	4	Emergency Stop Button C		
	5	Jumper		
	6	EPO Emergency Stop Feedback to PCS Signal-		
	7	N/A		
	8	N/A		
	9	N/A		
	10	N/A		

Procedure:

1. According to the actual system configuration, perform signal terminal wiring of the energy storage cabinet in line with the above interface definition table. Route the cables through the signal cable entry hole at the bottom of the energy storage cabinet and, based on the cable identification, connect them to the corresponding terminal plug pins.
2. Use cable cutters to trim any excess length of the cables.
3. Use wire strippers to remove the protective insulation and expose the copper conductor.
4. Use a crimping tool to crimp the cable to termina, the terminal is inserted to a depth of 8 mm.

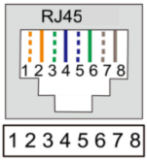
5. Insert the crimped pin with cable into the corresponding pin hole of the plug according to the wiring sequence defined in the interface definition table. Secure the signal cables with the plug's matching cable clamp.
6. After wiring is completed, gently pull the cables to ensure there is sufficient slack.

6.6 Communication connection

DRMs/Logic Interface Wiring

The PCS module is equipped with a reserved DRMs/logic interface. If the customer requires DRM functionality, on-site wiring is needed from the PCS DRM interface to the client's control equipment.

Table 6.4 PCS DRM Interface Definition

Port	PIN	Description	Function
	1	DRM 1/5	DRMs logic interface
	2	DRM 2/6	DRMs logic interface
	3	DRM 3/7	DRMs logic interface
	4	DRM 4/8	DRMs logic interface
	5	CGND	Case ground
	6	DRM0	DRMs logic interface
	7	--	N/A
	8	--	N/A

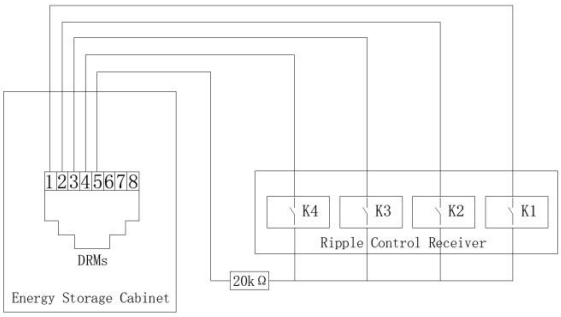


Figure 6.10: VDE-AR-N 4105:2018-11 Logic interface wiring diagram

Power level setting:

No.	Name	Parameter	Power setting value
1	DRM1	K1	0%
2	DRM2	K2	30%
3	DRM3	K3	60%
4	DRM4	K4	100%

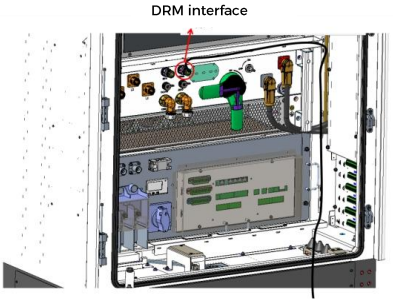


Figure 6.11: DRM signal cable connection diagram

1. Route the DRM signal cable through the signal entry hole at the bottom of the energy storage cabinet, and lead it to the corresponding DRMs port on the PCS.
2. Use cable cutters to trim any excess cable length.
3. Use a crimping tool to attach the cable to a crystal head according to the DRM interface definition wiring sequence.
4. Insert the crimped crystal head into the corresponding DRM port on the PCS.
5. After completing the wiring, gently pull the cable to ensure it is securely locked and that sufficient slack is reserved.

CSU Communication Cable

The CSU control box is integrated within the energy storage cabinet. On-site, a communication network cable must be routed from the CSU's ETH1 port to the client-side WEB or EMS. The CSU communication cable connection is shown in the figure below.

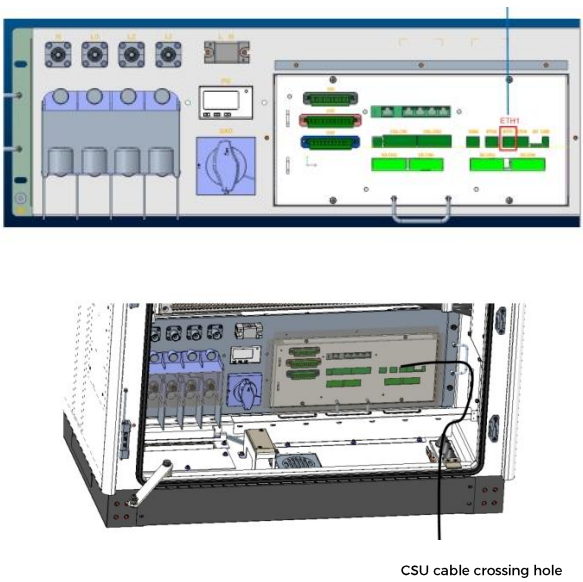


Figure 6.12: CSU communication network cable connection

1. Route the communication network cable through the signal entry hole at the bottom of the energy storage cabinet, and lead it to the CSU ETH1 port.
2. Use a network cable cutter to trim any excess cable length.
3. Terminate the cable with an RJ45 connector using a crimping tool. The wiring sequence at both ends can follow either the 568A or 568B standard.
4. Insert the terminated RJ45 connector into the corresponding ETH1 port on the CSU.

5. After completing the connection, gently pull the cable to ensure proper seating and leave some slack. Secure the communication cable along the routing path using cable ties.

6.7 Wiring completed

After all electrical connections are completed, perform a thorough and careful inspection of all wiring. In addition, the following actions must be taken:

- Seal the energy storage cabinet's cable entry holes and surrounding gaps tightly using fireproof and waterproof materials.
- Reinstall all panels, doors, and screws that were removed during wiring to restore the cabinet to its original state.

⚠ WARNING

- Improper sealing may allow moisture to enter.
- Improper sealing may allow rodents to enter.

7 Power on/off operation guidelines

⚠ WARNING

- The BESS can only be put into operation after confirmation by a professional and approval by the local power department.
- For BESS with a long shutdown time, check the equipment thoroughly and carefully to ensure all indexes are acceptable before powering it on.

7.1 Indicator lights and status descriptions

Table 7.1 SOFAR LOGO indicator status information

Type	Indicator status	Meaning	Note
Green	Green always on	Running (AC/DC relay fully closed)	
	Green flashing (1 Hz)	Standby detection	
	Green flashing (2Hz)	Upgrade	
Yellow	Yellow always on	First level alarm	
	Yellow flashing (2Hz)	Secondary alarm	
Red	Red always on	Trip alarm	
	Red flashing (2Hz) + Buzzer	FFS alarm	Fire-activated faults, not faults in the FFS itself
Off	Off	Power off	

Table 7.2 PCS indicator status information

Type	Indicator status	Meaning	Note
POWER	Green light always on	DC side energized	
	Red light always on	DC side fault	Leakage current, DC side reverse connection, bus over-undervoltage
	Red light flashing	Master-slave disconnect	
RUN	Green light always on	Normal operation	
	Green light flashes	Non-grid-connected but trouble-free operation	1s on,1s off
	Red light always on	Grid-side faults	Abnormalities in grid phase, frequency, amplitude; phase loss, unbalance
ALARM	Red light always on	Device alarm	DC-side faults, grid-side faults, and alarms generated by the PCS itself
	Red light flashing	communication alarm	1s on,1s off
	Off	No alarm	

7.2 Power-on operation

The prerequisite for this part of the operation is that the storage cabinet is in a normal un-started state, specifically all switches of the energy storage cabinet are in the off state, the positive and negative buses of the battery clusters have not yet been connected to the battery PACKs (this step is for the first time when the power is turned on), and the three-phase AC input power cables are connected and have a normal voltage input.

7.2.1 Pre-power-on check

Before powering on the energy storage system, carefully verify the following items:

- Check whether the wiring is correct.
- Check whether the protective covers inside the equipment are installed firmly.
- Check whether the emergency stop button is released.
- Check and ensure that there is no grounding fault.
- Check whether the AC and DC voltages meet startup conditions and ensure that there is no over-voltage with a multimeter.
- Check and ensure that no tools or components are left inside the equipment.
- Check all air inlets and outlets are free of foreign objects that may be obscuring or blocking them.
- Check the connections of the liquid cooling piping for any signs of leakage. Then, open the automatic air vent valve caps at the top of the primary piping inlet and outlet (rotate counterclockwise).

Figure 7.1: Automatic air vent valve cap at the top of the liquid cooling piping outlet

- Check whether the cabinet door is closed.

7.2.2 Normal power-on procedure

The energy storage system is in its default powered-off state. All switches of the cabinet are in the off state, the positive and negative buses of the battery clusters have not yet been connected to the battery PACKs, and the three-phase AC input power cables are connected and have a normal voltage input. Personnel performing the power-on procedure must wear proper insulation protection.

1. After making sure that all the power cables between PACKs are connected correctly in the storage cabinet, the operator need to wear insulated gloves and insert the positive and negative power wire plugs into the battery cluster corresponding terminals (the other ends have already been connected to the PCS DC terminals, DC+ and DC- at the factory) and then make sure the plugs are fully inserted into place.

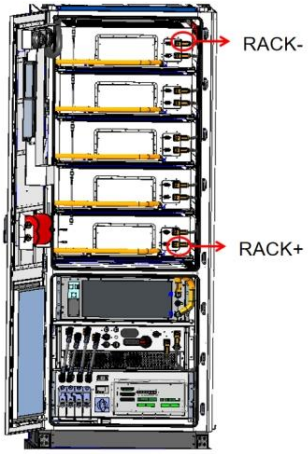


Figure 7.2: Battery cluster positive and negative plug locations

2. Use a multimeter to check whether there is a normal AC 400V voltage at the total input terminal of the energy storage cabinet's distribution module. Once the input voltage is confirmed to be normal, manually close the QA1 auxiliary power switch in the side switch box of the

cabinet. Use a multimeter to check that the output voltage of QA1 is normal and without issues.

Sequentially close QA2 → QA3 → QA0:

↳ QA2: Powers the liquid cooling system.

↳ QA3: CSU module, fire protection system, lighting, LED, etc.

↳ QA0: PCS indicator light will turn on (Power light steady green, RUN light flashing green, ALARM light steady red), and the cabinet logo light will remain steady green.

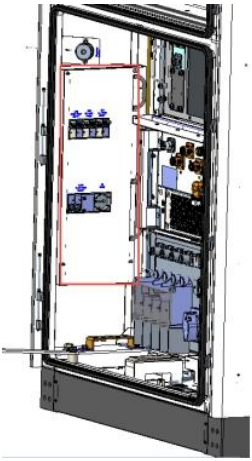


Figure 7.3: Switch box position

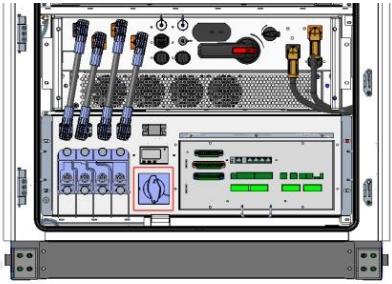


Figure 7.4: AC input switch QA0 position

3. Set the battery isolation switch QB on PCS panel in energy storage cabinet to the ON position.

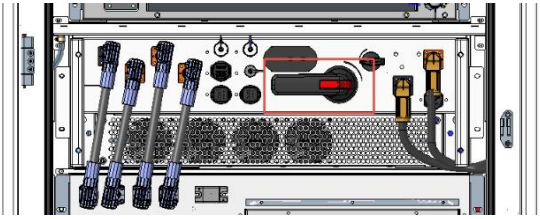


Figure 7.5: Battery isolation switch QB position

At this point, the manual power-on of the energy storage system is complete. Subsequent control logic will be coordinated and executed by the CSU, BCU, BMU, fire protection system, liquid cooling units, and other modules.

7.2.3 Normal power-off operation

During the power-off operation, the AC input circuit breaker QA0 in the energy storage cabinet's distribution module, the battery isolation switch QB in the PCS, and the battery cluster positive and negative bus plugs should be avoided to be switched on and off or plugged in with load. Insulation protection measures are required for the personnel performing the power-off operation. The procedure for normal power-off operation is as follows:

1. Perform the power-off operation first via the WEB interface. Once the power-off command is issued, if a PCS is connected, it will first stop charging and discharging. Then the battery rack will automatically power down, and the two positive/negative main relays (KF1 and KF2) inside the PCS, as well as the auxiliary power relay (KF4), should open.
2. Manually turn off the battery isolation switches (QB) in the PCS.

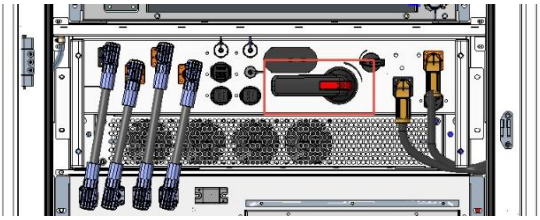


Figure 7.6: Battery isolation switch QB position

3. Wearing insulated gloves, disconnect the connectors between the PACK and the PCS in the energy storage cabinet.

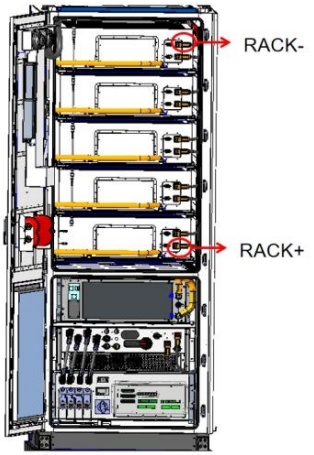


Figure 7.7: Battery cluster positive and negative plug locations

4. Manually disconnect the AC circuit breaker (QA0) in the distribution compartment of the energy storage cabinet, setting the breaker handle to the "OFF" position.
5. Manually disconnect the QA3, QA2, and QA1 circuit breaker in the side switch box of the energy storage cabinet. At this point, the BCU, BMU, CSU, liquid cooling unit, fire sensor, LED indicators, and lighting in the cabinet will all stop working. The auxiliary power shutdown for the commercial and industrial energy storage system is now complete.
6. Manually disconnect the external three-phase AC main circuit breaker of the cabinet. At this point, the power-off of the commercial and industrial energy storage system is complete.

7.3 Emergency power-off operation

The premise of this step is that the energy storage system is powered up and running in the process of emergencies that require emergency power down, such as smoke, fire, electric shock and so on.

The procedure for powering down in an emergency is as follows:

1. In case of emergency, press the emergency stop button on the front door of the storage cabinet. When the emergency stop button is pressed, the PCS should stop charging and discharging the batteries, and all the positive and negative main relays (KF1/KF2) inside the high voltage box and the auxiliary relay (KF4) inside the high voltage box should be disconnected immediately.

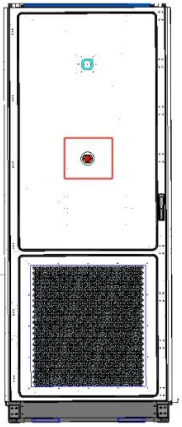


Figure 7.8: Emergency stop button switch (subject to actual design)

2. Disconnect the battery isolation switch QB of PCS in the energy storage cabinet.

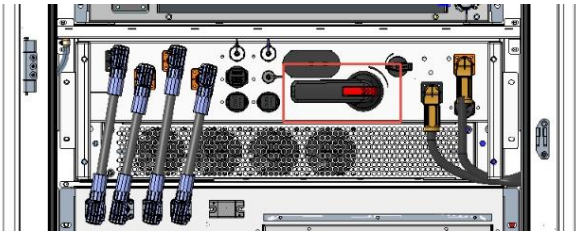


Figure 7.9: Battery isolation switch QB position

3. Disconnect the AC input switch QA0 in the internal distribution module of the energy storage cabinet. If necessary, continue to disconnect the external three-phase AC input upstream circuit breaker of the energy storage cabinet.

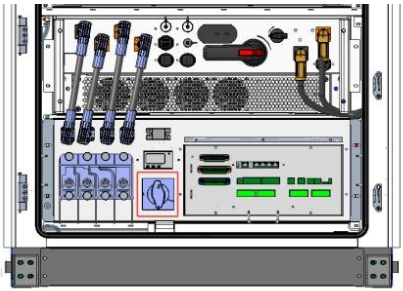


Figure 7.10: AC input switch QA0 position

4. Disconnect the QA1 main power switch in the switch box. After this step, the liquid cooling unit will stop running, and devices including the CSU, BMU, BCU, fire protection system, and lighting will also lose power. For emergency power-down, this step marks the completion.

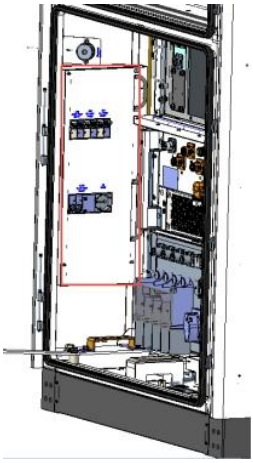


Figure 7.11: Switch box position

8 Maintenance

⚠ WARNING

- Please do not open the door of the battery cabinet for maintenance in rainy, wet or windy weather, if you fail to avoid it, we will not be responsible for any damage caused.
- Avoid opening the door in rain, snow or foggy weather when humidity is high, and make sure that the seal around the door does not curl when the door is closed.
- To reduce the risk of electric shock, do not perform any maintenance or overhaul operations other than those described in this manual. If necessary, contact our customer service personnel for maintenance and overhaul.

8.1 Maintenance work (once every six months to a year)

Item	Check method
Safety function	▸ Check the emergency stop button stop function. ▸ Simulated shutdown. ▸ Check the body warning labels and other equipment markings and replace them if you find them blurred or damaged.
Software maintenance	▸ View the settable parameters of the Web.
Internal Component Inspection	▸ Check the cleanliness of the circuit board as well as the components. ▸ Check the temperature of the heat sink as well as the dust. If necessary, use a vacuum cleaner to clean the heat sink module, etc. ▸ If necessary, replace the air filter. ▸ Caution! The ventilation of the air intake must be checked. Otherwise, if the module

Item	Check method
	is not cooled effectively, it will malfunction due to overheating.
Device Maintenance	▸ Routine inspection of all metal components for corrosion (every six months). ▸ Annual inspection of contactors ensures that they are mechanically well functioning. ▸ Checking of operating parameters (especially voltage, insulation, etc.).

8.2 Maintenance work (once every one to two years)

Item	Check method
Outside the container	▸ Look for flammable objects on top of the box. ▸ Check that the joints between the box and the foundation steel plate are secure and that there is no rust or corrosion. ▸ Look for damage, paint loss, oxidation, etc. on the box enclosure. ▸ Check that cabinet door latches etc. can be opened flexibly. ▸ Check that seals etc. are well fixed.
Inside the container	▸ Check the inside of the energy storage integration system for foreign objects, dust, dirt and condensation.
Air inlet and outlet	▸ Check the temperature of the heat sink as well as the dust. If necessary, use a vacuum cleaner to clean the heat sink module, etc.
Wiring and cable layout	Wait until all internal devices of the energy storage system are completely powered off before beginning the inspection! During the inspection, any nonconformities must be corrected immediately.

Item	Check method
	▸ Check that the cable routing is proper and there are no short circuits. Any abnormalities must be corrected immediately. ▸ Check that all cable entry and exit holes in the enclosure are properly sealed. ▸ Inspect the interior of the enclosure for any water ingress. ▸ Check whether the power cable connections are loose and retighten them according to the previously specified torque. ▸ Inspect power cables and control cables for any damage, especially the insulation in areas contacting metal surfaces for signs of cuts or abrasions. ▸ Check that the insulation tape on power cable terminals is intact and not peeling off.
Ground connection and equipotential connection	▸ Check that the grounding connection is correct and that the grounding resistance resistance value is not greater than 4Ω. ▸ Check for correct equipotential connections within the energy storage system. ▸ Check the operating parameters (especially voltage as well as insulation, etc.).
Fan	▸ Check the operating status of the fan. ▸ Inspect whether the fan is clogged. ▸ Listen for any abnormal noise when the fan is running.

8.3 Maintenance work (once every two years)

Item	Check method
System status and cleanliness	Inspect the following items and correct immediately if any issue is found:

Item	Check method
	▸ Check for any damage or deformation of the cabinet and internal equipment. ▸ Listen for abnormal noises from internal equipment during operation. ▸ Check if the internal cabinet temperature is excessively high. ▸ Inspect internal humidity and dust levels; clean if necessary. Ensure that cabinet air inlets and outlets are not blocked.
Warning labels	▸ Check whether the warning labels and tags are clear and visible, without any dirt or damage. If necessary, they should be replaced.
Air inlet and outlet	▸ Check the temperature of the heat sink as well as the dust. If necessary, use a vacuum cleaner to clean the heat sink module, etc.
Cable shielding and grounding	▸ Ensure that cable shielding and insulating sleeves are in good contact, and that grounding copper bars are properly fixed.
Surge protection devices and fuses	▸ Verify that surge protection devices and fuses are firmly secured and in good condition.
Corrosion	▸ Inspect outdoor cabinets for signs of oxidation or rust.

9 Monitoring system commissioning

The parameters shown in the images in this manual are for functional explanation and operational examples only and do not represent the actual performance of the equipment. Please refer to the real operating status of the equipment.

This manual primarily demonstrates the master cabinet of the parallel scenario. Other application scenarios may have slight differences. Please refer to the actual display interface of the system.

9.1 Communication connection

9.1.1 Communication cable connection

Use the network communication cable to connect the energy storage system to the computer:

- Connect one end of the communication cable to the WEB communication port of the energy storage system.
- Connect the other end to the Ethernet interface (LAN) of the computer.

This operation is used to establish a communication link between the energy storage system and the computer.

Power the energy storage system to ensure that the auxiliary power supply is functioning properly (check the status of the indicator light on the cabinet door; if the light is steady, it indicates that the auxiliary power supply is working normally).

Waiting for about 1 minute:

- If the computer's network port indicator light flashes, it indicates that the communication between BESS and the computer has been established.
- If the indicator light is not on, check the network connection.

9.1.2 Communication settings

Network parameter setting on the computer:

1. Open "Control Panel" → "Network and Internet" → "Network and Sharing Center."
2. In the left menu, click "Change adapter settings."
3. Right-click the currently used network adapter and select "Properties."
4. Double-click "Internet Protocol Version 4 (TCP/IPv4)."

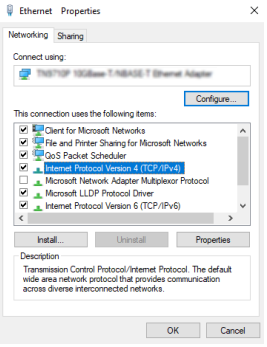


Figure 9.1: Computer ethernet properties

5. Select "Use the following IP address" and change the IP address, subnet mask.

   IP address: 192.168.1.10

   Subnet mask: 255.255.255.0

   All other parameters remain at their default settings.

   Click OK to complete the settings.

Once the settings are complete, the computer will be able to communicate with the energy storage system via the local area network.

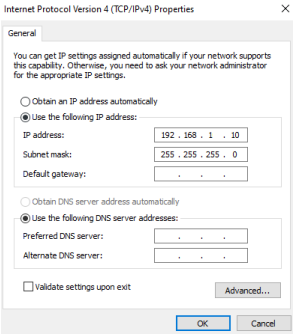


Figure 9.2: Computer IP address settings

9.2 Login

1. Open a computer browser, enter the IP address of the energy storage system "192.168.1.100" in the search field, and click the Enter key to enter the login interface.

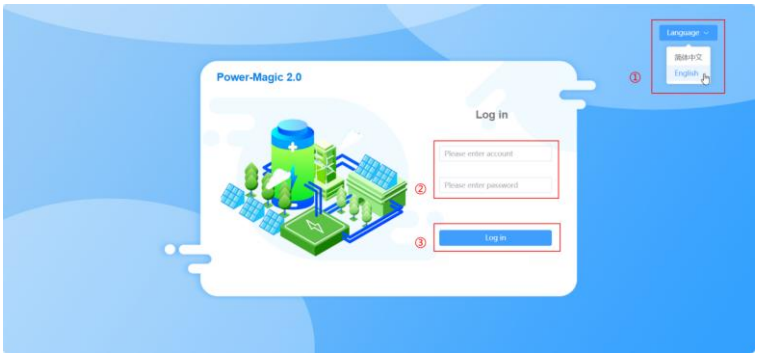


Figure 9.3: Login interface

2. Switching language.
3. Enter the user name and password, click the “login” button. If this is the first time entering the system, the initial setup guide page will appear; otherwise, the topology page will be displayed.

9.3 Navigation bar

9.3.1 General navigation

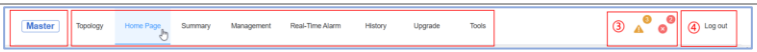


Figure 9.4: General navigation

All pages adopt a "top-fixed navigation bar" layout structure. Depending on the current page's functionality and scenario, the content displayed in the navigation bar and the interactive options may slightly vary.

1 **Device Name**: This module is only displayed in the parallel cabinet scenario. When accessing the parallel cabinet host, clicking on it will pop up the shortcut navigation.

2 **Menu Bar**: Clicking on the respective menu item allows you to switch between different tabs. Some pages do not have a menu bar.

3 **Real-time Alarm Quick Tip**: The first icon displays the number of current tips and alarms occurring on the device. The second icon displays the number of ongoing faults. The corresponding icon is only displayed when the number is non-zero. Clicking any of the icons will navigate to the real-time alarm page.

4 **Log out**.

9.3.2 Shortcut navigation

Figure 9.5: Shortcut navigation

In the parallel cabinet master station scenario, clicking the device name will pop up the shortcut navigation at the top of the page.

1 **Language Switch**.

2 **Device Switch**: Quickly switch to access different devices.

9.4 Topology

9.4.1 Overview

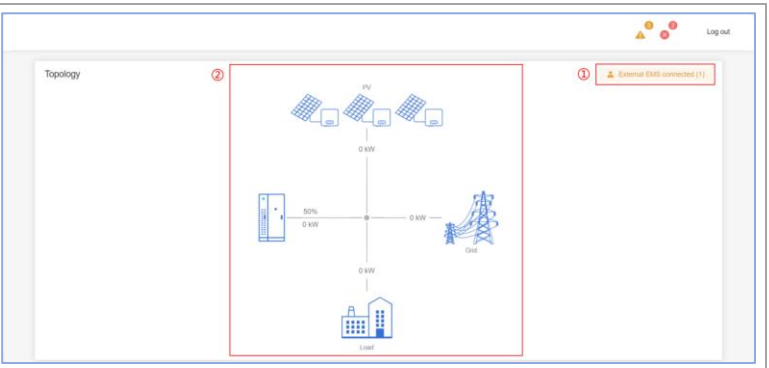


Figure 9.6: Overview

1 When the external EMS is connected to the system, a prompt will appear in the top right corner; otherwise, it will not be displayed. The number in parentheses indicates the current connection count.

2 Topology Display Area: This area is used to show the overall structure and operating status of the system. The content displayed in this area will dynamically change based on factors such as the application scenario, parameter configuration, and device status. The topology diagram includes the following modules: power grid, photovoltaic, load, energy storage cabinet, and control center. Users can click on the energy storage cabinet icon to further enter the corresponding device page.

9.4.2 Module introduction

This section explains the display methods and changes of each module on the topology page under different configurations and operational states.

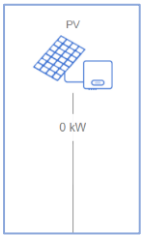
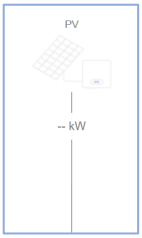
Photovoltaic Meter

When at least one photovoltaic meter is offline, its corresponding icon will appear in gray, and the photovoltaic power will display as '--kW.'

- Not Configured:

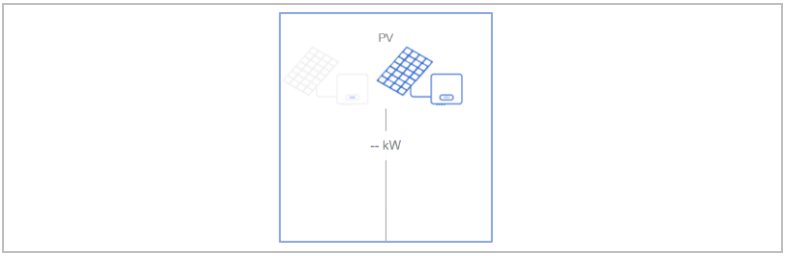
  The photovoltaic module will not be displayed.

- One Meter Configured:

Online:	Offline:
	

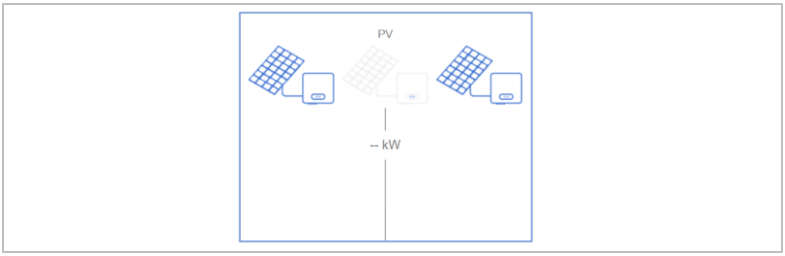
- Two Meter Configured:

  The icons of the two meters are shown as follows, with Photovoltaic Meter 1 offline and Photovoltaic Meter 2 online:

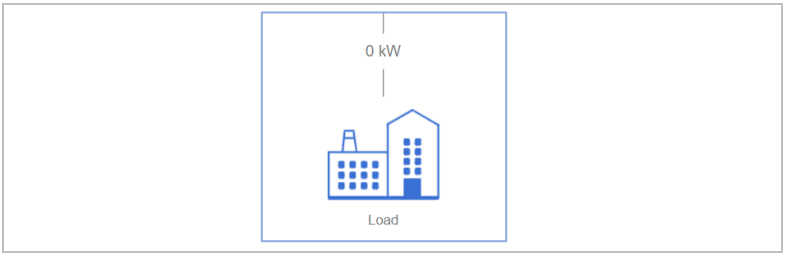


- Three Meter Configured:

  The icons of the three meters are shown as follows, with Photovoltaic Meter 1 online, Photovoltaic Meter 2 offline, and Photovoltaic Meter 3 online:



Load



Energy Storage Cabinet

- Offline:

- Online:

Fault State

Non-Fault State

Single Cabinet / Parallel Master

Parallel cabinet slave unit

Control Center

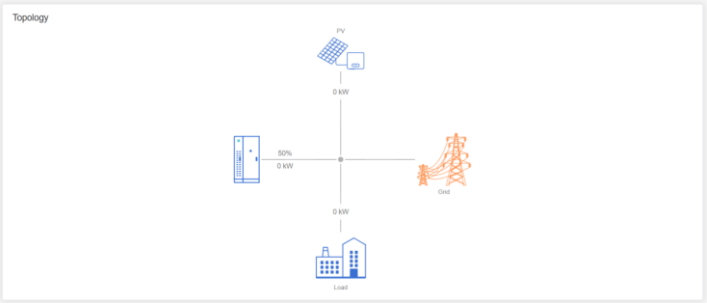
This will only appear in the parallel cabinet scenario. Clicking the parallel cabinet master unit will quickly navigate to the management page.

Scenario Example

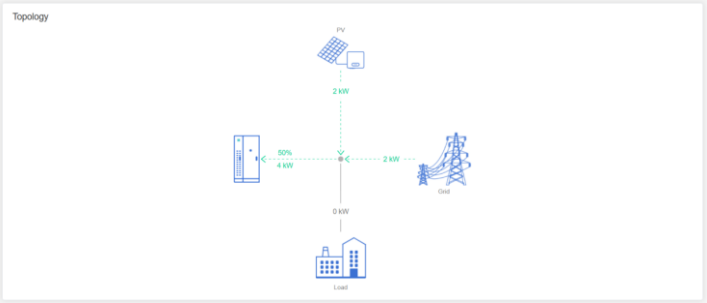
This section provides examples of topology display under different system configurations and operational states. The listed examples are for reference only and do not cover all possible configuration and status combinations.

- Single Energy Storage Cabinet

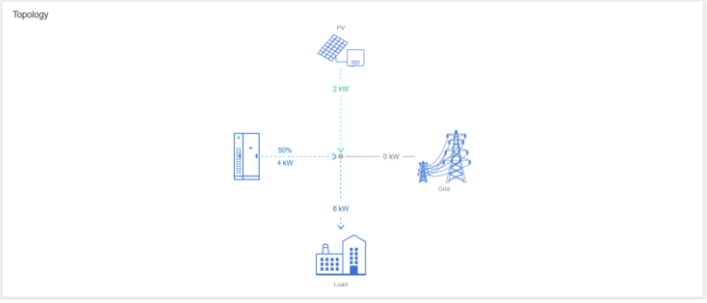
No charge, no discharge



Charging



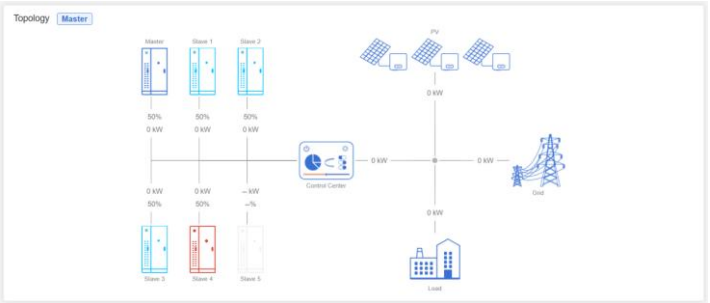
Discharging



- Parallel Cabinet Master Unit

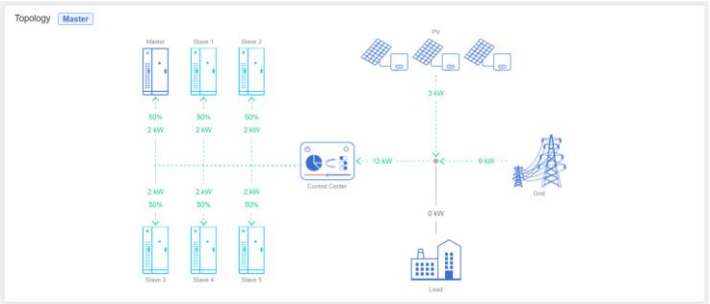
Clicking on the respective energy storage cabinet icon will enter the home page of the corresponding energy storage cabinet. Clicking on the control center will navigate to the management page under the parallel cabinet master unit.

No charge, no discharge

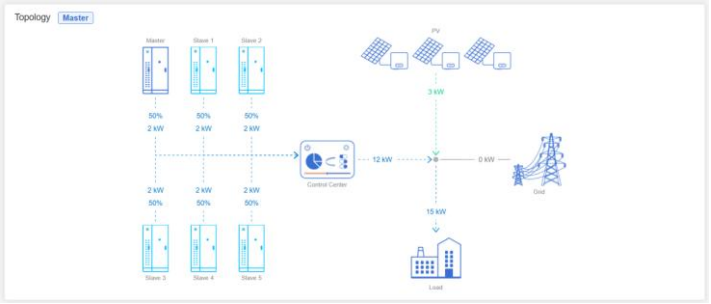


As shown in the figure above, this scenario involves six energy storage cabinets in parallel, grid-connected mode, with the PCC meter enabled and three photovoltaic meters configured. Slave unit 4 is in a fault state, and slave unit 5 is offline.

Charging

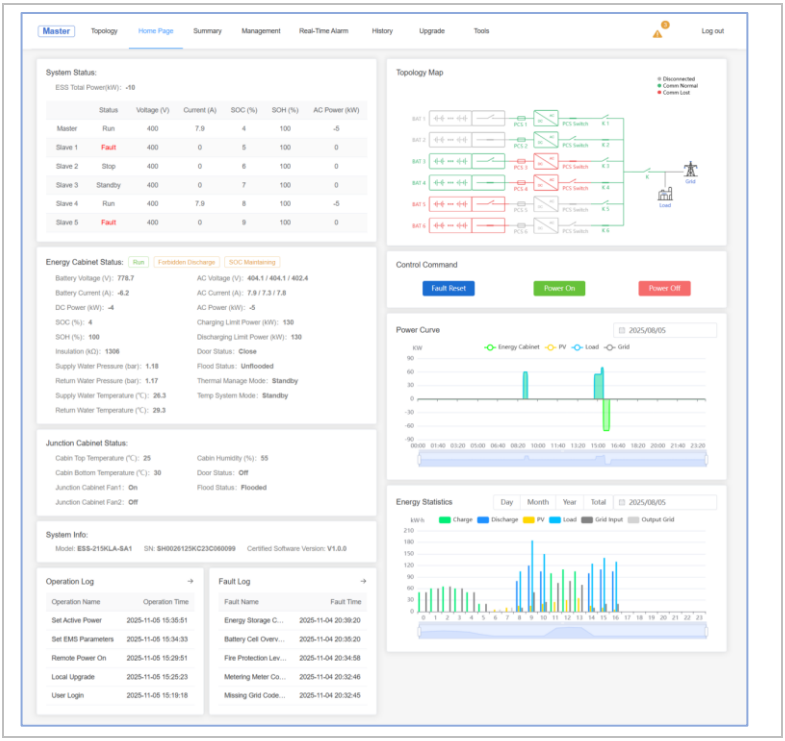


Discharging



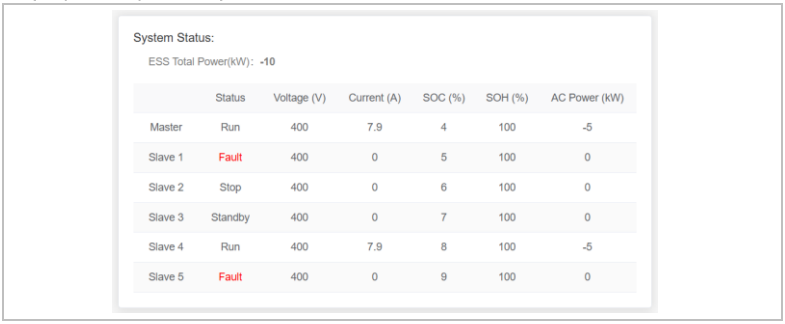
9.5 Homepage

9.5.1 Overview



9.5.2 System status

Displayed only in the parallel cabinet master station scenario.

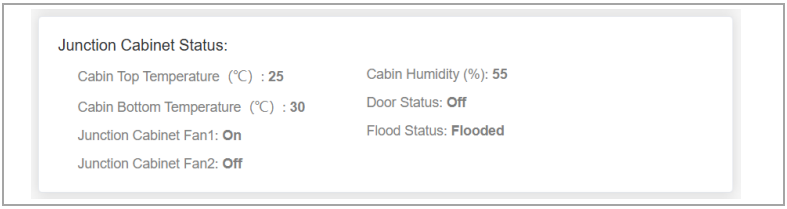


9.5.3 Energy storage cabinet status

Displays the current system status of the energy storage cabinet, charge/discharge prohibition status, SOC maintenance status, real-time data, and real-time status.

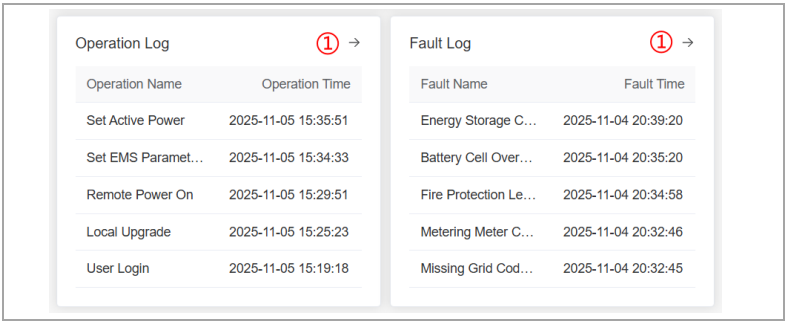
9.5.4 Junction cabinet status

Displayed only when the junction cabinet is enabled.



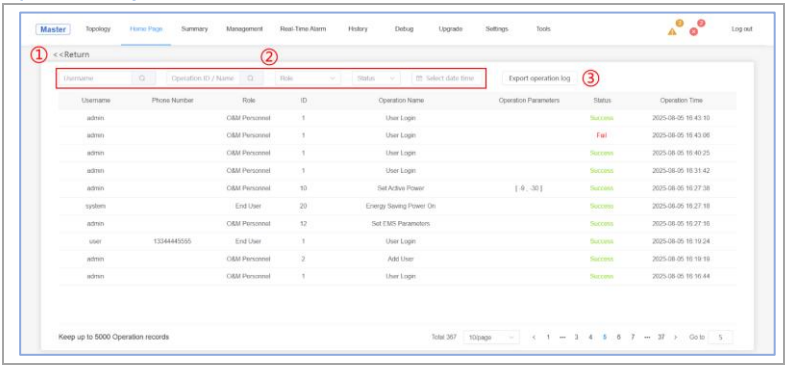
9.5.5 System Information

9.5.6 Operation/Fault logs



The latest 5 operation/fault logs are displayed on the homepage. Clicking the → as shown in ① will navigate to the corresponding details page.

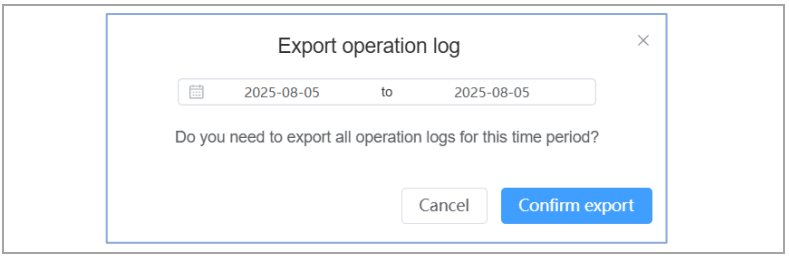
Operation log details



① Return to Homepage

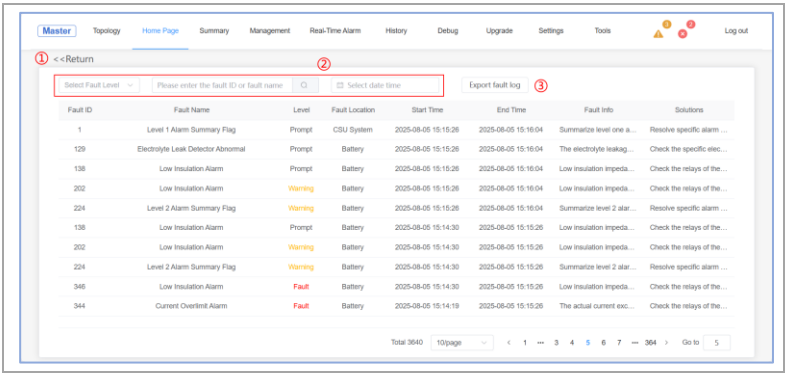
② Filter criteria, including username/operation ID/operation name/role permission/operation status/operation time

③ Log export



Fault log details

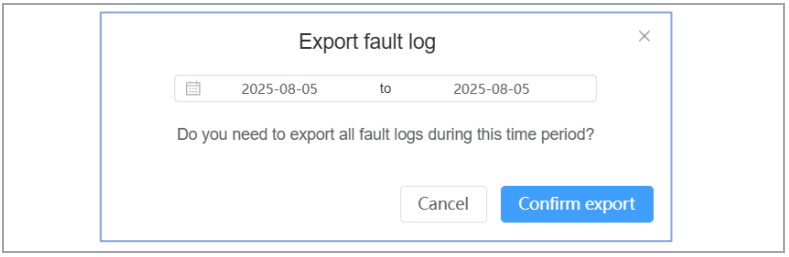
The recorded log levels are categorized by severity: Tip, Alarm, Fault.



① Return to Homepage

② Filter criteria, including fault level/fault ID/fault name/fault time

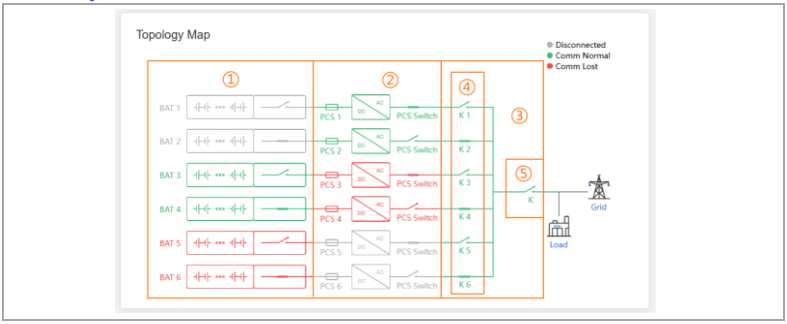
③ Log export



9.5.7 Electrical and communication topology

Displayed only in the single energy storage cabinet scenario and the parallel cabinet master station scenario.

Enabled junction cabinet



① Battery cluster communication status and battery cluster switch status

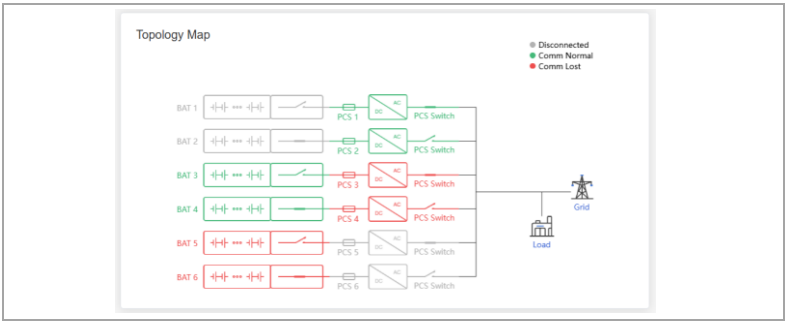
② PCS communication status and PCS switch status

③ Combiner cabinet communication status

④ Combiner cabinet sub-switch status

⑤ Combiner cabinet main switch status

Disabled Combiner Cabinet



Compared to the enabled combiner cabinet situation, the communication and switch status displays for the combiner cabinet are removed.

9.5.8 Control commands

9.5.9 Power curve

Can be queried by day.

Single Energy Storage Cabinet Scenario & Parallel Cabinet Master Station Scenario

Displays energy storage cabinet, photovoltaic, load, and grid.

Parallel Cabinet Slave Station Scenario

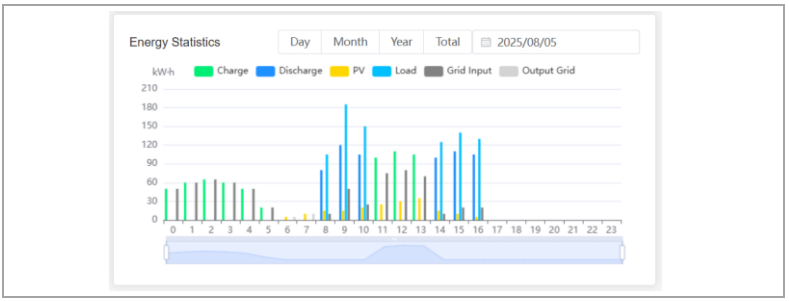
Displays energy storage cabinet.

9.5.10 Energy statistics

Can be queried and displayed by Day/Month/Year/Total.

Single Energy Storage Cabinet Scenario & Parallel Cabinet Master Station Scenario

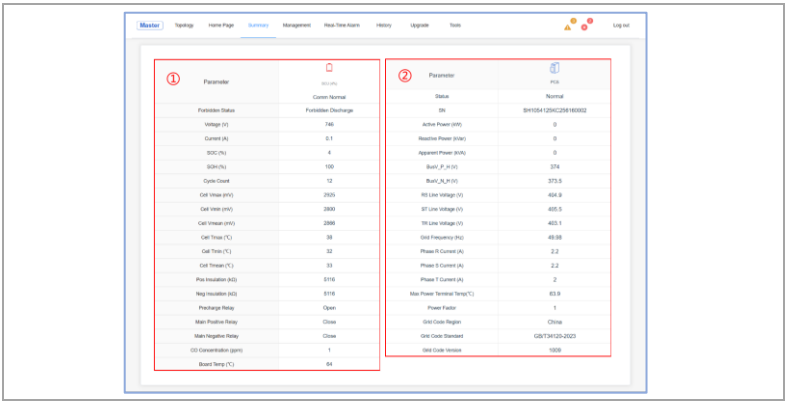
Displays charging, discharging, photovoltaic, load, grid input, and output grid.



Parallel Cabinet Slave Station Scenario

Displays charging and discharging.

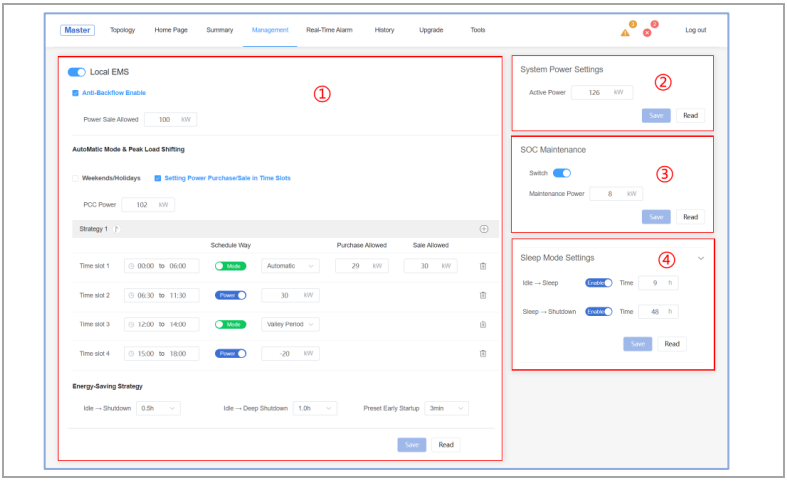
9.6 Summary data



① Battery Parameters

② PCS Parameters

9.7 Management



① Local EMS Configuration

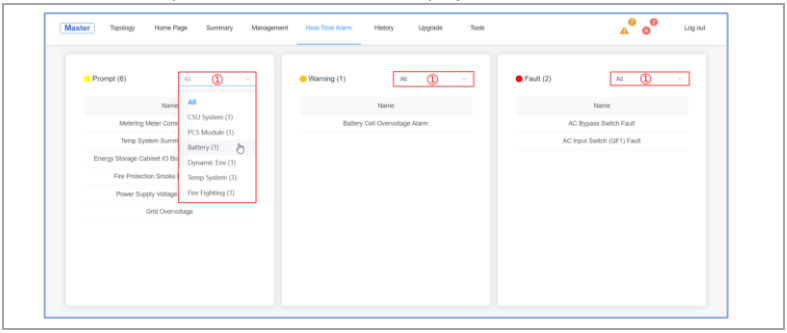
② System Power Settings

③ SOC Maintenance

④ Sleep Mode Settings

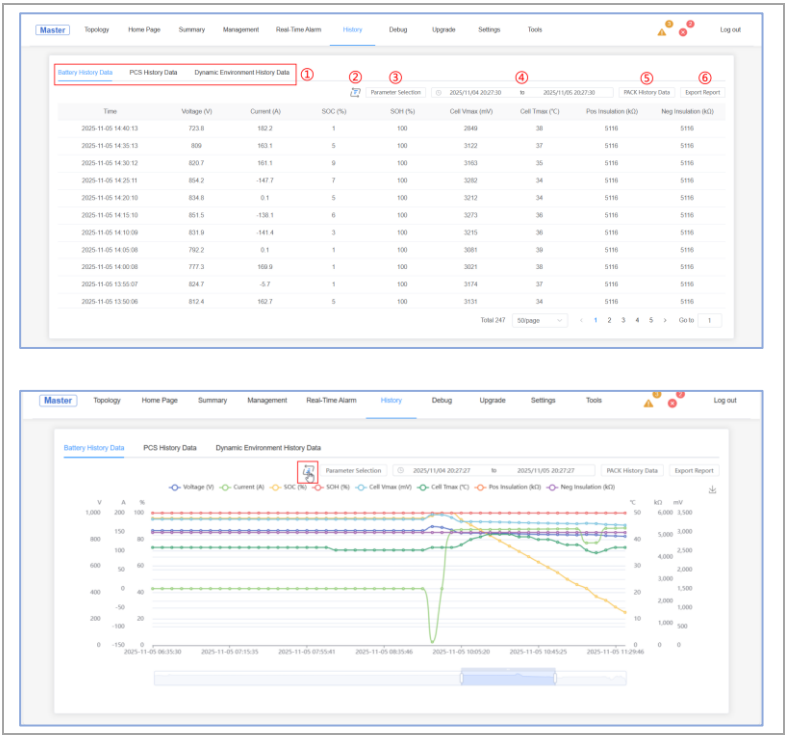
9.8 Real-time alarms

This page is divided into three levels based on severity: Tip, Alarm, and Fault. Each level corresponds to a section of the page.



① Fault location filter under the current level

9.9 Historical data



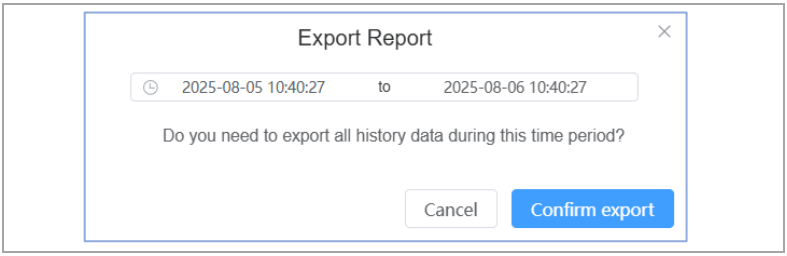
① Label switch options

② Toggle between table/graph display button

③ Parameter selection

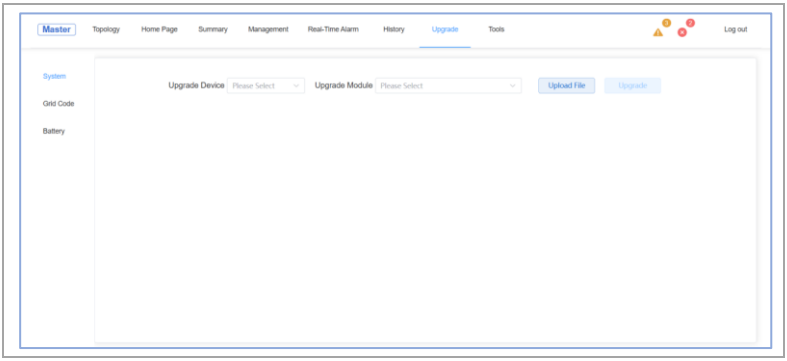
④ Time selection

⑤ Export historical data button



9.10 Upgrade

9.10.1 Overview



As shown in the figure, this is the overview of the upgrade page. You can select system upgrade, safety regulation upgrade, and battery upgrade from the left menu. Below, each module will be introduced in detail.

9.10.2 System upgrade

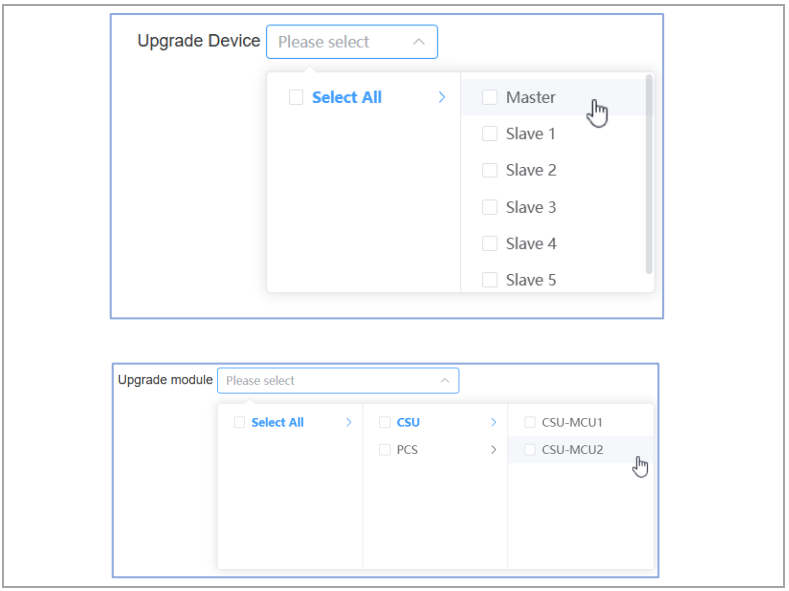
① Upgrade device – Only available under the parallel cabinet master station

② Upgrade module

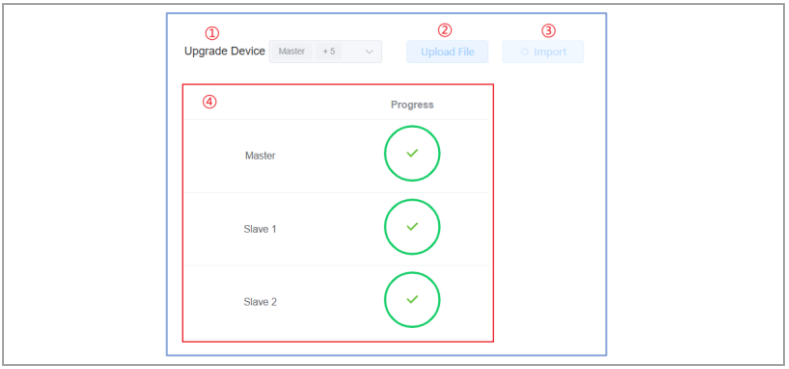
③ Upload file button

④ Upgrade button

⑤ Upgrade progress display



9.10.3 Safety regulation upgrade



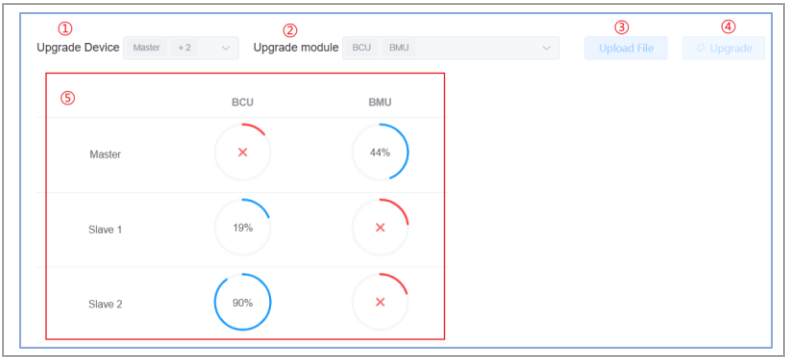
① Upgrade device – Only available under the parallel cabinet master station

② Upload file button

③ Import button

④ Upgrade progress display

9.10.4 Battery upgrade



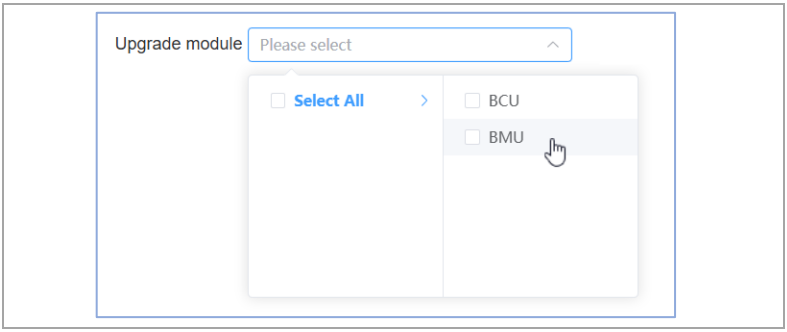
① Upgrade device – Only available under the parallel cabinet master station

② Upgrade module

③ Upload file button

④ Upgrade button

⑤ Upgrade progress display



10 Contact information

If you have any questions about this product, please contact us.

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Version 1.0

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