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RI-ENERGYSET-3P-ESS-125-261

User Manual

E&OE. Please check critical parameters at time of order. ISSUE : 20260041

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Content

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Notice

This manual contains important safety instructions, installation, electrical connections, commissioning, maintenance, and troubleshooting of the equipment.

Save the manual!

This manual must be stored carefully and be available at all times.

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1. About this manual

1.1 Applicability

Please read the product manual carefully before installation, operation, or maintenance. This manual contains important safety instructions and installation instructions that must be followed during the installation and maintenance of the equipment.

1.2 Target Group

The instructions in this document can only be performed by qualified persons who must have the following skills:

- Have certain electronic, electrical wiring, and mechanical expertise, and be familiar with electrical and mechanical schematic diagrams.
- Be familiar with the composition and working principle of the PCS; be familiar with the design and working principle of the PCS and its front and back level equipment.
- Have received professional training related to electrical equipment installation and commissioning.
- Understand how the product works and how to operate the product.
- Have emergency response capabilities for dangerous or unexpected situations during installation or trial operation.
- Be familiar with the relevant standards and codes of the country where the project is located.
- Understand and follow this manual and all safety information.

1.3 Symbols Used

Symbols used have the following meaning:

DANGER 'Danger' indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
WARNING 'Warning' indicates a hazard with a medium level of risk that, if not avoided, will result in death or serious injury.
CAUTION 'Caution' indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.
NOTICE 'Notice' indicates a situation that, if not avoided, could result in equipment or property damage, or provides tips that are valuable for the optimal operation of your product.

1.4 Designation in the Document

AC	Alternating Current
ATS	Automatic Transfer Switch
BMS	Battery Management System
DC	Direct Current
FU	Fuse

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GEN	Generator
EMS	Energy Management System
LC	Liquid Cooling Unit
MSD	Manual Service Disconnect
PCS	Power Conversion System
PDU	Power Distribution Unit
PV	Photovoltaic
PVS	Smart Photovoltaic Controller
STS	Static Transfer Switch
SOC	State of Charge
TOU	Time of Use
WLAN	Wireless Local Area Network

2. Safety

2.1 General Safety

The energy storage system should be used in an environment that meets the requirements of the design specifications. Failure to follow proper usage guidelines may result in equipment malfunction, component damage, personal injury, property damage, and other issues. Please note that the energy storage system's quality assurance does not cover any such problems. The installation, operation, and maintenance of equipment must comply with local laws, regulations, and standards. The safety precautions in the manual are intended only as a supplement to local laws, regulations, and norms. The company shall not be liable in the event of any of the following circumstances:-

- The installation and use environment exceeds the provisions of relevant international, national, and regional standards.
- Does not operate under the conditions of use described in this manual.
- Disassemble, alter the product, or modify the software code without authorization.
- Failure to follow the product's operating instructions, safety warnings, and documentation.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquakes, fires, storms, floods, mudslides, etc.).
- Damage caused by storage conditions not meeting the requirements of the product documentation.
- Damage to the hardware or data of the device due to customer negligence, incorrect operation, or intentional damage.
- System damage due to third-party or customer reasons, including relocation and installation systems that do not meet the requirements of this manual, and damage caused by adjustments, alterations, or removal of identifying marks that do not meet the needs of this manual.
- Defects, malfunctions, or damages resulting from acts, events, omissions, or accidents beyond the seller's reasonable control, including power or electrical failures, theft, war, riot, civil commotion, terrorism, intentional or malicious damage, etc.
- The installation and various operations of the integrated hybrid inverter must comply with the relevant standards and regulations of the country/region where the project is located.
- The battery cabinet is equipped with an automatic fire extinguishing system, and the fire switch should not be triggered unless it is an emergency.

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2.2 Important Safety Instructions

DANGER

The equipment has a high voltage, and irregular operation may cause electric shock or fire, resulting in death, personal injury, or property damage. Please follow the operation sequence and safety precautions given in this manual and other related documents, and standardise the operation:

- Please check that the cable connection is fastened before the device is powered on. Inspect the machine for damage, such as holes, dents, or other signs of possible damage inside. Check that the internal parts of the equipment are kept the same, and it is forbidden to change the structure and installation order of the equipment without authorisation.
- It is forbidden to clean the electrical parts inside the equipment with water. If you find liquid entering the device, press the emergency stop immediately and notify the site management.
- It is forbidden to carry out installation, wiring, maintenance, and replacement operations with electricity. Contact should be measured before touching any conductor surface or terminal point voltage, and confirm that the protective ground wire of the equipment or parts to be serviced is reliably grounded to confirm that there is no risk of electric shock.
- Do not approach the equipment except those operating the equipment. If the device has not been installed or confirmed by a professional. Do not power up the device. When powering up for the first time or making the main circuit live, at least two personnel must be on site.

WARNING

◆ Battery pack Leakage

If the battery packs leak electrolytes, contact with the leaking liquid or gas should be avoided. The electrolyte is corrosive, and the contact may cause skin irritation and chemical burns. If one is exposed to the leaked substance, follow these actions:-

- Inhalation: Evacuate the contaminated area, and seek medical help immediately.
- Eye contact: Rinse eyes with flowing water for 15 minutes and seek medical help immediately.
- Skin contact: Wash the affected area thoroughly with soap and water and seek medical help immediately.
- Ingestion: Induce vomiting and seek medical help immediately.

◆ The battery packs and their components should be protected from damage when transporting and handling.

- Do not impact, pull, drag, or step on the battery packs.
- Do not insert unrelated objects into any part of the battery packs.
- Do not throw the battery pack into a fire.
- Do not soak the battery packs in water or seawater.
- Do not be exposed to strong oxidisers.
- Do not short-circuit the battery packs.
- The battery packs cannot be stored at high temperatures (more than 50°C).
- The battery packs cannot be stored directly in the sun.
- The battery packs cannot be stored in a high-humidity environment. Do not use the battery packs if they are defective, cracked, broken, or otherwise damaged, or fail to operate.
- Do not attempt to open, disassemble, repair, tamper with, or modify the battery packs. The battery packs are not user-serviceable.
- Do not use cleaning solvents to clean the battery packs.

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CAUTION

◆ Risk of injury due to the weight of the battery pack may result if the battery pack is lifted incorrectly or dropped while being transported or installed.

- Transport and lift the battery pack carefully. Take the weight of the battery pack into account.
- Wear suitable personal protective equipment for all work on the energy storage system.

◆ If the battery has not been installed within 6 months of shipment from the factory, the battery must be recharged until the State of Charge (SOC) is greater than 50% for maintenance.

NOTICE

◆ Fire-fighting Measures

The battery packs may catch fire if they are exposed to heat. Please ensure an ABC or carbon dioxide extinguisher is located nearby. Water cannot be used to extinguish the fire. Full protective clothing and a self-contained breathing apparatus are required for the fire-fighters to extinguish the fire.

◆ Damage to the energy storage system due to under-voltages

If the energy storage system does not start up, please contact Rayleigh Instruments after-sales service within 48 hours. Otherwise, the battery could be permanently damaged.

◆ Electrical installation and maintenance must be carried out by competent electricians according to local regulations.

2.3 Explanation of Symbols

Symbols on Label:

Symbol	Explanation
	Do not disconnect or disassemble by untrained personnel.
	Do not short-circuit.
	Do not expose the battery to open flame, heat, or sparks, as there is a risk of fire or explosion.
	Keep the battery packs away from children.
	Before operating the equipment, please read the product manual in detail.
	Beware of high voltages! The equipment operates under high voltage. Ensure the device is powered off before performing any operations.
	The battery contains corrosive electrolytes. Please avoid contact with leaked substances.

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Symbol	Explanation
	WEEE designation Do not dispose of the system together with household waste, but in accordance with the disposal regulations for electronic waste applicable at the installation site.
	CE Marking
	Beware of high voltages! Wait 5 minutes after powering off to ensure complete discharge before operation.
	Don't work on the equipment until it is isolated from the battery, mains supply, and on-site PV modules.
	Beware of hot surfaces! The equipment can be hot during operation. Avoid touching during operation.
	Danger! Risk of electric shock!
	Keep away from fire!
	Keep away from explosives!
	Keep away from corrosive substances!

2.4 Electrical Safety

2.4.1 Wiring Requirements

- Please select the cable that meets the requirements of local laws and regulations. The same type of cables should be tied together, different types of cables should be placed separately, and mutual winding or cross-laying should be prohibited. If
- wiring is incomplete or left for a short time during the wiring process, block the cable port and close the cabinet door to avoid the entry of small animals.
- The cables used in the energy storage system must be firmly connected and well insulated, and the specifications must meet the requirements. The position of the cable through the conduit or the wire hole must be protected to avoid the cable being damaged by sharp edges, burrs, etc.
- After completion of the cable connection, make sure the cable bracket and cable clamp are securely fixed. The cable in the backfill soil area ensures that it is closely fitted to the ground to prevent deformation or damage caused by the force of the cable when the soil is backfilled.
- The use of cables in high-temperature environments may cause aging and damage to the insulation layer and between the cable and the heating device or the periphery of the heat source area.

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- In order to ensure the safety of construction, all cables should be installed above 0°C. When handling cables, especially in low-temperature environments, they should be handled with care.

2.4.2 Grounding Requirements

- It is prohibited to destroy the grounding conductor. The grounding body of the equipment should be permanently connected to the protective grounding grid. Before operating the equipment, the electrical connection of the equipment should be checked to ensure that the equipment is reliably grounded.
- The grounding impedance of the equipment meets the requirements of national standard IEC62477-1 and local electrical standards.
- It is prohibited to operate the equipment when the grounding conductor is not installed. When installing the equipment that needs to be grounded, the protective ground wire must be installed first; when the equipment is removed, the protective ground wire must be finally released.
- If a ground fault occurs in the integrated hybrid inverter, there may be fatal high voltage in the parts that are not initially charged. Dangerous if accidentally touched! Before the operation, please ensure that there is no ground fault in the system, and also take relevant protective measures.

2.4.3 Maintenance Requirements

- Before connecting or removing a cable, the protective switch for the corresponding circuit must be disconnected.
- Use a multimeter at the correct voltage level to ensure that the device has been completely powered off.
- If there is a charged body nearby, please use an insulation board or an insulation belt to block or wrap it.
- After the grounding wire is used to reliably connect the circuit to be repaired with the grounding circuit, the operation
- and maintenance is complete.
- When maintaining or overhauling the DC/DC modular system, at least two operators must be on site. The maintenance or
- overhaul operations can be performed only when the equipment has been safely disconnected, and the power conversion system has discharged for 10 minutes.

WARNING

Before connecting the cable, it is necessary to confirm that the line label identification is correct before connecting.
If the device has multiple inputs, all inputs of the device should be disconnected, and the device can be operated after it is fully powered down.
After the overhaul is completed, the grounding wire between the overhaul circuit and the grounding circuit is disassembled.

2.4.4 Mechanical Safety

- The bottom apron must be removed when forklifting without wooden boxes. Lift-off and landing should be taken lightly to avoid impact or vibration.
- In the process of transportation, the center of gravity of the box should fall in the middle of the two forks on the forklift. Prohibit long-distance handling or inversion, or tilting.
- When transporting equipment, it may block the operator's line of sight due to the large volume of the equipment, and may be is necessary to arrange auxiliary personnel to assist with the operation.
- In order to ensure the safety of drilling outside the equipment, an appropriate position should be selected before drilling to ensure that it will not cause short circuits and other effects.

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- In the process of drilling, the equipment should be protected to prevent debris from falling into the equipment, and any debris should be removed after drilling.
- When handling equipment manually, wear protective gloves, safety-shoes, and other relevant safety protective equipment. Carefully move the device during the equipment handling process to avoid impact or drop. Avoid scratching the surface of
- the equipment and damaging parts or cables.

2.4.5 Battery Safety

Rayleigh Instruments shall not be liable for any damage to the batteries provided by Rayleigh Instruments due to the following:-

- Customer reasons: the battery is not charged and accepted in time, resulting in overdue storage, capacity loss, or irreversible damage.
- Due to improper operation, or not in accordance with the requirements of the battery, caused by mechanical damage, leakage, rupture, etc.
- The customer or third party did not inform Rayleigh Instruments to change the battery usage scenario. Including but not limited to self-connecting the battery to an additional load, mixing with other brands of batteries, mixing with batteries with different rated capacities, etc. with different rated capacities, etc.
- The direct damage to the battery is caused by the operating environment of the field equipment or the external power parameters that cannot meet the requirements of the normal operating environment. Including the actual operating temperature of the battery is too high or too low, the power grid is bad, and the power outage is frequent.
- Customers do not correctly set the battery operation management parameters or perform improper maintenance, resulting in frequent over-discharge of the battery, customer on-site expansion, or long-term inability to charge fully.
- The customer did not carry out the correct maintenance of the battery according to the operating manual of the supporting equipment, including but not limited to not checking whether the battery terminal screw is tightened regularly.
- The battery was stolen and lost.
- Battery beyond the warranty period.

Battery exception handling measures:

- If electrolyte leakage or abnormal odor occurs, avoid contact with the leaked liquid or gas. Non-professionals, please do not approach; please contact the professionals immediately.
- The electrolyte is corrosive, and contact may cause skin irritation and chemical burns. If you come into contact with the battery electrolyte, you need to immediately clean the contact area with lots of water and soap and immediately seek medical help.
- If the battery drops (whether with packaging material or not), it is prohibited to continue to use it. If the appearance is not obviously deformed or damaged and there is no obvious smell, smoke, or fire, under the premise of ensuring safety, the battery is transferred to an open and safe place for one hour for post-treatment, and contact the Rayleigh Instruments technical service engineer.
- When the battery has an obvious odour, damage, smoke, and fire after falling, personnel should be evacuated immediately and alerted in time. Professionals use fire protection facilities to extinguish a fire under the condition of ensuring safety.

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2.4.6 Maintenance and Replacement

WARNING

When installing, maintaining and overhauling the equipment, make sure that:

- The energy storage battery has been completely disconnected.
- Clear warning signs at the point of disconnection to ensure no accidental reconnection.

- It is forbidden to open the cabinet door in the weather of rain, snow, lightning, dust, fog, and so on.
- Before the parts are taken out of the cabinet, please make sure that the other pieces on the cabinet are not loose.
- During the maintenance of the equipment, insulating materials should be used to cover the live parts nearby.
- Before the fan is powered off and stops rotating, any item is prohibited from contacting the running fan (such as fingers, components, screws, etc.). Please do not power on the device before troubleshooting.
- During the live inspection of the system, attention should be paid to the danger warning signs on the equipment to avoid standing at the cabinet door.
- Devices other than battery packs must wait for about 15 minutes after powering down to ensure that the device is powerless before operating the machine.
- After the power components of the energy storage system are replaced, or the wiring is changed, manual wiring detection is required to avoid the abnormal completion of the system operation.
- If any battery packs are damaged, they must be replaced with new ones. Please ensure that the voltage of the replacement battery pack is the same as that of the other battery packs.
- After the relevant operations of maintenance and replacement, the cabinet door should be locked in time, and the key should be properly kept.

2.4.7 Arc Protection

WARNING

In order to avoid unnecessary casualties and equipment damage, the product must be operated strictly according to the description in this manual. If the operation is improper, it may cause an arc hazard and may even cause fire, explosion, and other risks. The company will not be liable for accidents such as arcs, fires, explosions, and other accidents caused by failure to follow the signs or product manual.

Improper handling, as described below, may cause arcing, fire, explosion, and other hazards inside the machine. In an accident, it must be handled by qualified professionals. If not handled properly, existing accidents may cause a broader range of malfunctions or accidents.

- Plug and unplug the DC side high-voltage cables of each device under power.
- Touch potentially live cable ends that are not insulated.
- Touch copper Busbars, terminals, or other parts inside the machine that may be live.
- Power cable connections are loose.
- Parts such as screws were accidentally dropped into the power module.
- Improper operation by untrained and unqualified operators, etc.

Before working on the equipment, the area of operation must be pre-assessed for arc risk. If there is a risk of arcing:

- Operators must have received relevant safety training in advance.
- Try to assess the area where shock may occur.

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- Wear appropriate protective clothing before working in areas of potential electric shock.

3. Introduction

3.1 Block diagram

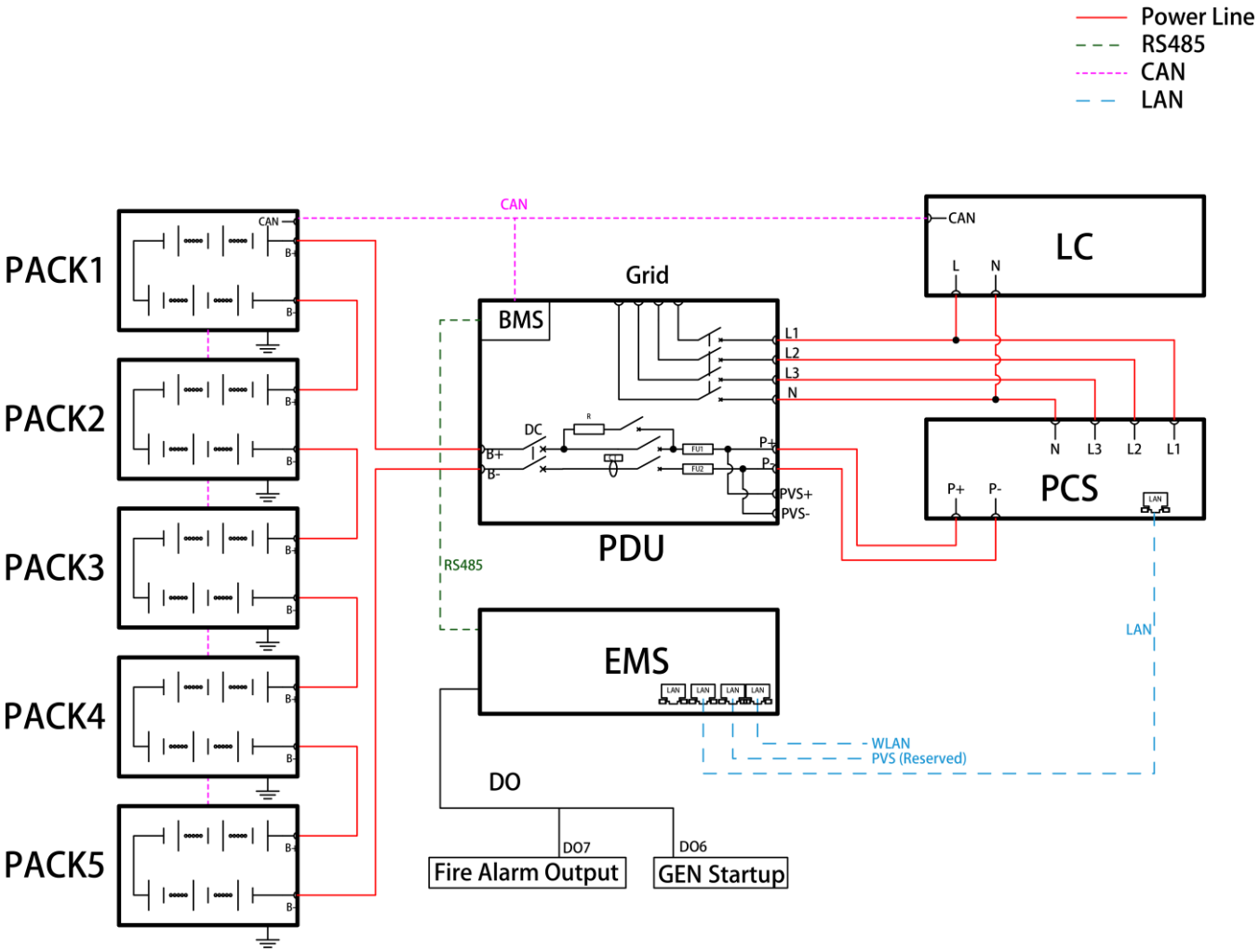

Figure 3-1 Block diagram of the RI-ENERGYSET-3P-ESS-125-261

3.2 Product Overview

The RI-ENERGYSET-3P-ESS-125-261 is a highly integrated, all-in-one outdoor energy storage system designed for commercial and industrial (C&I) applications. It incorporates Battery Packs, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) , and Liquid Cooling (LC). The equipment is also equipped with an environmental monitoring system, including temperature sensors, smoke sensors, and water immersion systems, to monitor the safe operation of the system comprehensively.

The liquid-cooled pack utilizes 314Ah battery cells with high energy density. The 125kW PCS adopts a three-level T-type topology, outputs three-phase four-wire power, and supports 100% unbalanced load.

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Model name: RI-ENERGYSET-3P-ESS-125-261

Capacity of battery: 261kWh

Energy Storage System

3.3 Appearance Introduction

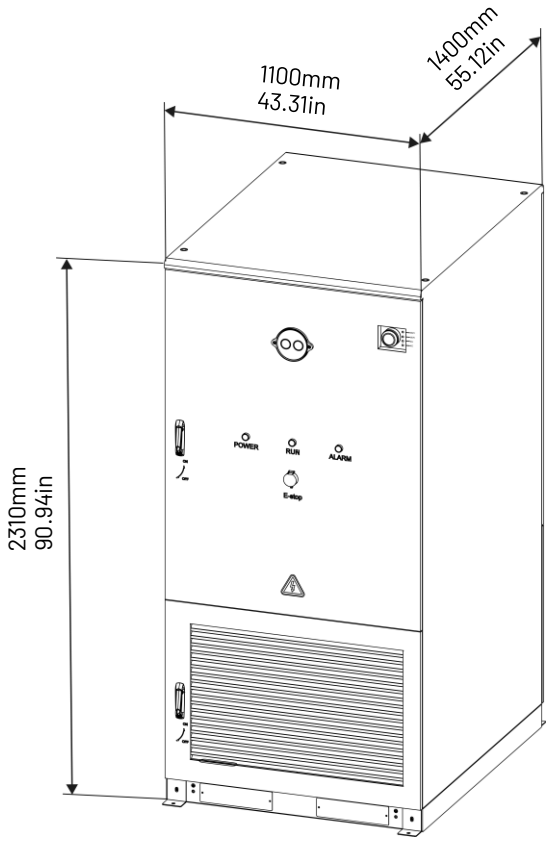

Figure 3-2 Dimensions of the RI-ENERGYSET-3P-ESS-125-261

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3.4 Application Scenarios

1. On-grid :

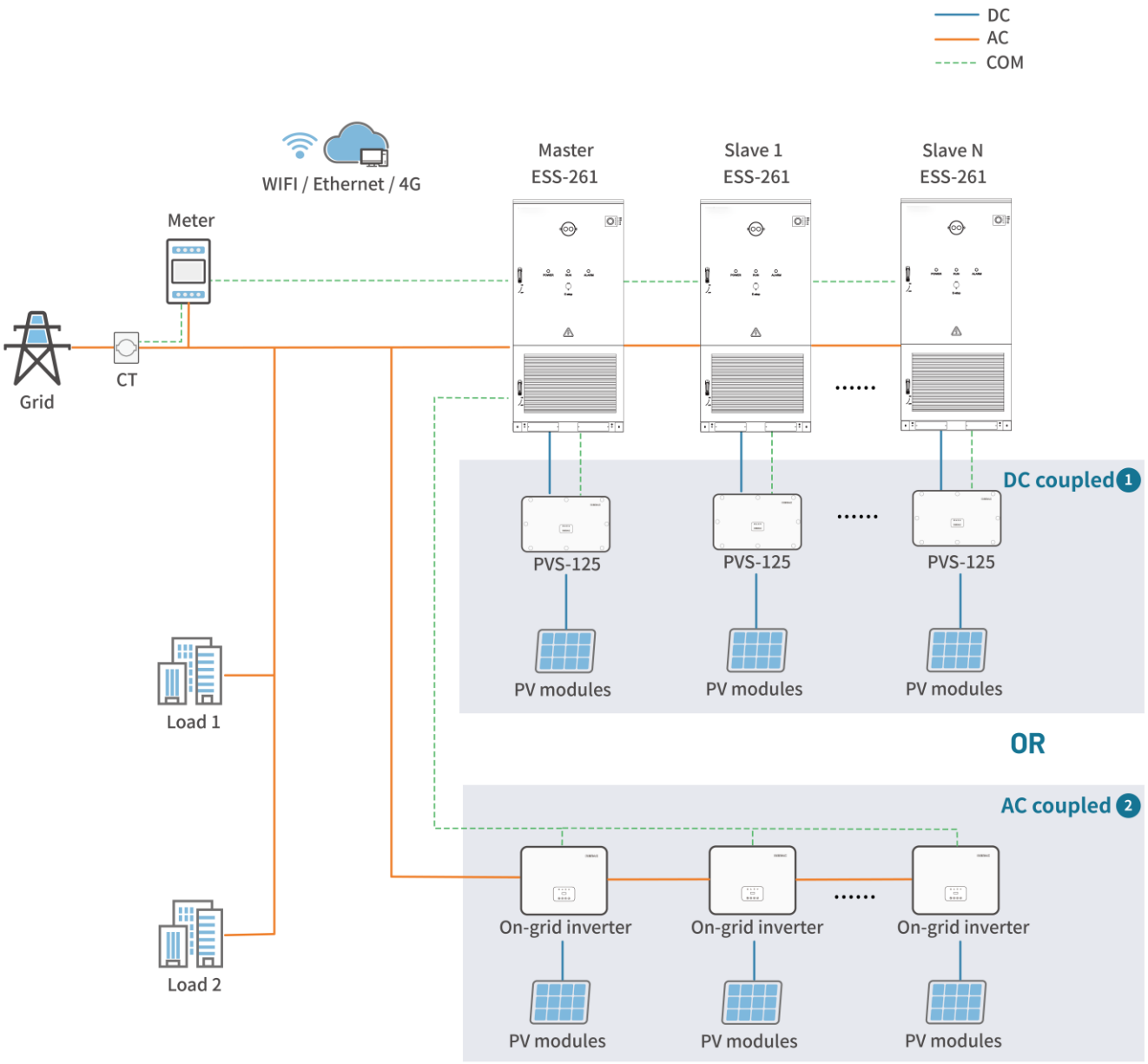

Figure 3-3 DC Coupled + AC Coupled

NOTE: If you need to connect a PV system, you can choose either configuration ① or ②. As shown in the table below.

No.	PV Access Method	Applicable Scenarios
①	DC Coupled	For new installations, DC coupled configuration is preferred. The number of PVS-125 and RI-ENERGYSET-3P-125-261 in this scenario is the same.
②	AC Coupled	For existing PV plants, AC coupled configuration is preferred. The number of On-grid inverters and RI-ENERGYSET-3P-ESS-125-261 in this scenario is not the same.

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2. Off-grid :

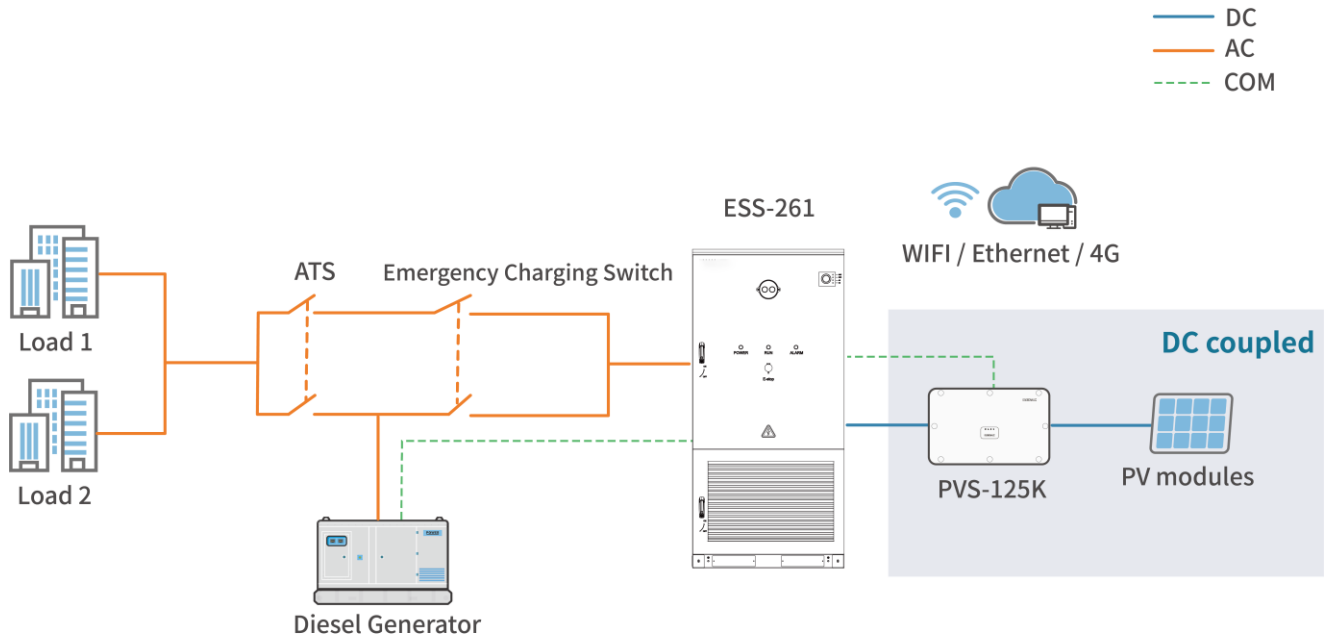

Figure 3-4

NOTE: If you need to connect a PV system in Off-grid scenario, we recommend adopting a DC coupled configuration.

3. On/Off-Grid Switching:

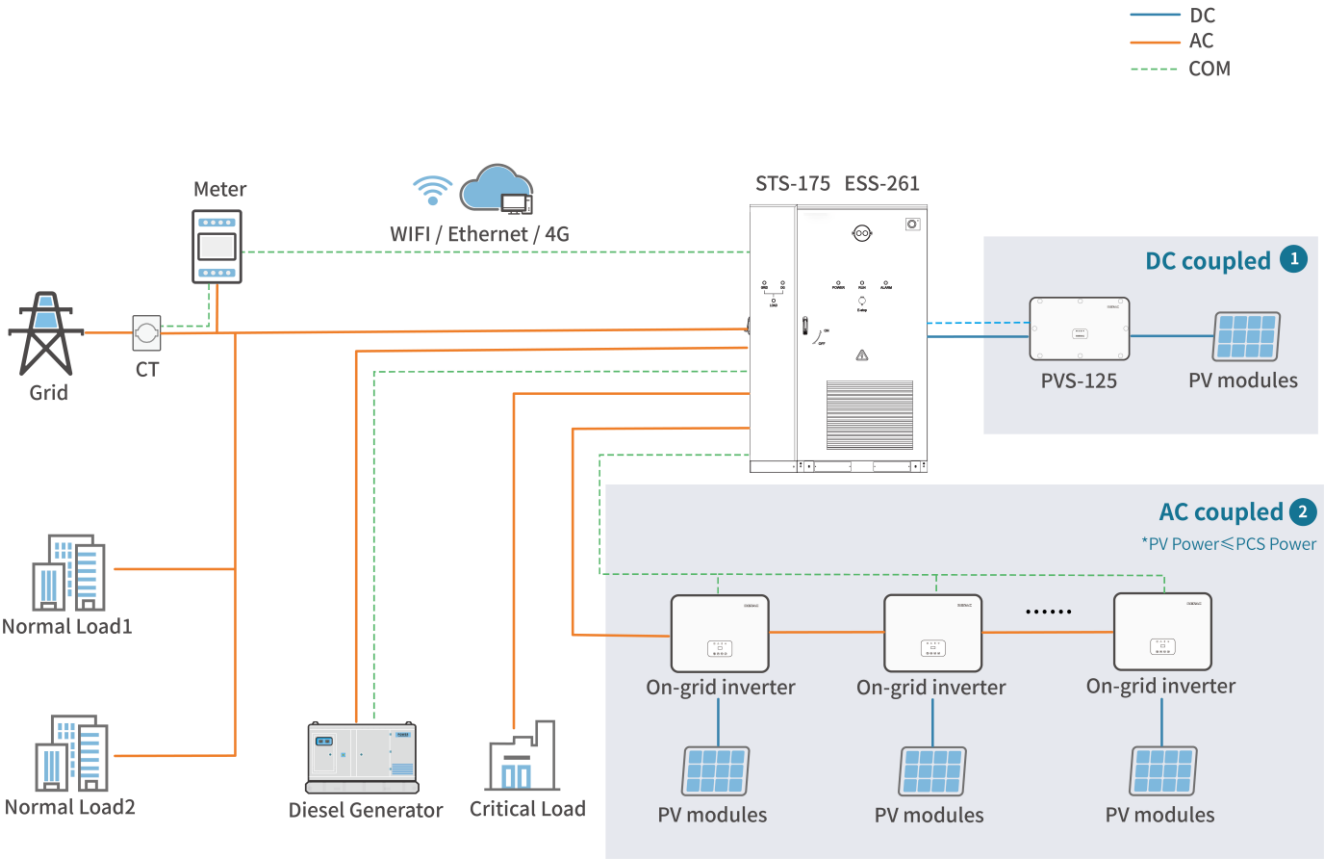

Figure 3-5 DC Coupled + AC Coupled

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NOTE:

1. For more information regarding On/Off-grid switching, please refer to the STS user manual.
2. If you need to connect a PV system, you can choose either configuration ① or②. As shown in the table below.

No.	PV Access Method (Optional)	Applicable Scenarios
①	DC Coupled	For new installations, DC coupled configuration is preferred. The number of PVS-125 and RI-ENERGYSET-3P-ESS-125-261 in this scenario is the same.
②	AC Coupled	For existing PV plants, AC coupled configuration is preferred. The number of On-grid inverters and RI-ENERGYSET-3P-ESS-125-261 in this scenario is not the same. The PV power must not be greater than the PVS power.

3.5 Technical Data

Model	RI-ENERGYSET-3P-ESS-125-261
Battery	
Battery Technology	LFP (LiFePO4)
Nominal Energy of Module [kWh]	52
Module Configuration	1P52S
Number of Modules	5
Nominal Energy [kWh]	261
Nominal Voltage [V]	832
Voltage Range [V]	650 ~ 949
Max. Charging / Discharging Current [A]	200
System	
Rated AC Power [kW]	125
Max. AC Apparent Power [kVA]	138
Rated AC Voltage [V]	400, 3L / N / PE
AC Voltage Range [V]	400 ± 10%
Rated Frequency [Hz]	50
Max. AC Current [A]	200
Adjustable Power Factor [cos φ]	0.99 (-1~1)
THDi (@Rated Output) [On-grid]	< 3%
THDv (@Linear Load) [Off-grid]	< 3%
System Efficiency	88%
Protection	
Battery Reverse Polarity Protection	Integrated
AC Overcurrent Protection	Integrated
AC Short-circuit Protection	Integrated
AC Overvoltage Protection	Integrated
DC Surge Protection	Integrated (Type II)
AC Surge Protection	Integrated (Type II)
Emergency Stop	Integrated
General Data	
Ambient Temperature Range [℃]	-25 ~ +55

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Relative Humidity	5 ~ 95%
Operation Altitude [m]	4000 (> 2000 Derating)
Cooling	Liquid
User interface	WEB + APP
Communication	WiFi / 4G / Ethernet
Communication protocol	Modbus RTU, Modbus TCP
Weight [kg]	2650
Dimensions (W * H * D) [mm]	1100 * 2310 * 1400
Topology	Transformerless
Ingress Protection	IP54 (Pack IP67)
Fire Protection	Pack / Cluster: Aerosol, Water Interface Reserved
Certification	
Grid Regulation	IEC 61727, IEC 62116, EN50549-1, EN 50549-PL
Safety Regulation	CE-LVD, CE-EMC, UN38.3

3.6 Components Introduction

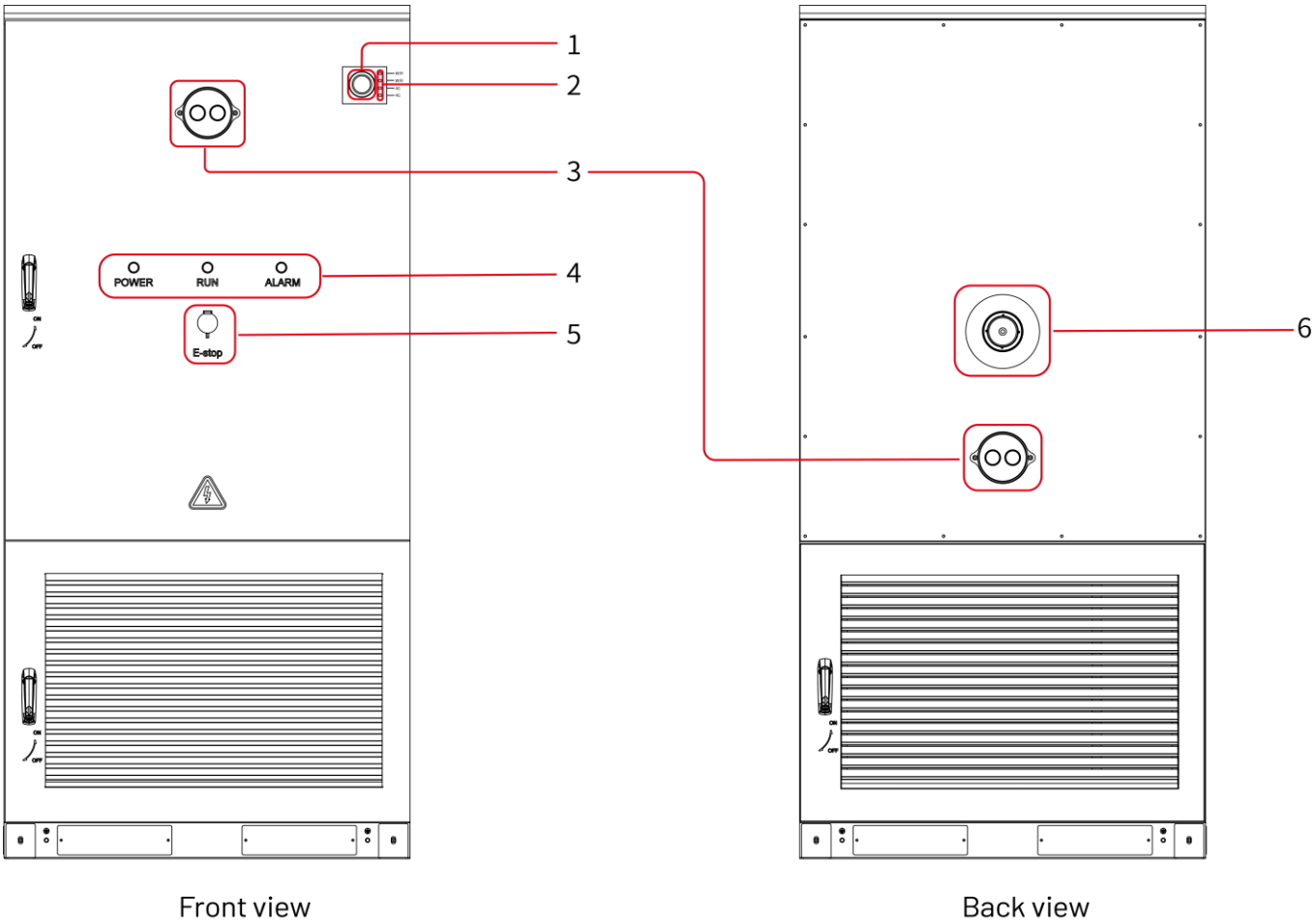

Figure 3-6 Components of the RI-ENERGYSET-3P-ESS-125-261 (Door closed)

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No.	Model	Description	Quantity
1	Audible-visual alarm	Used to alert you when abnormal conditions occur, such as temperature or smoke.	1
2	Signal receiver ports	Used to connect WiFi/4G signal receivers.	4
3	Pressure Relief Valve	Used for passive release of internal overpressure gas to ensure safe system operation. The gas release pressure condition is 4.5 ± 1 kPa.	2
4	Signal lights	Used to display power, run and alarm light.	3
5	Emergency stop	Used to stop the system from running when an emergency occurs.	1
6	Fire hose coupling	Used to engage with a quick-attack fire hose coupling for rapid hose attachment.	1

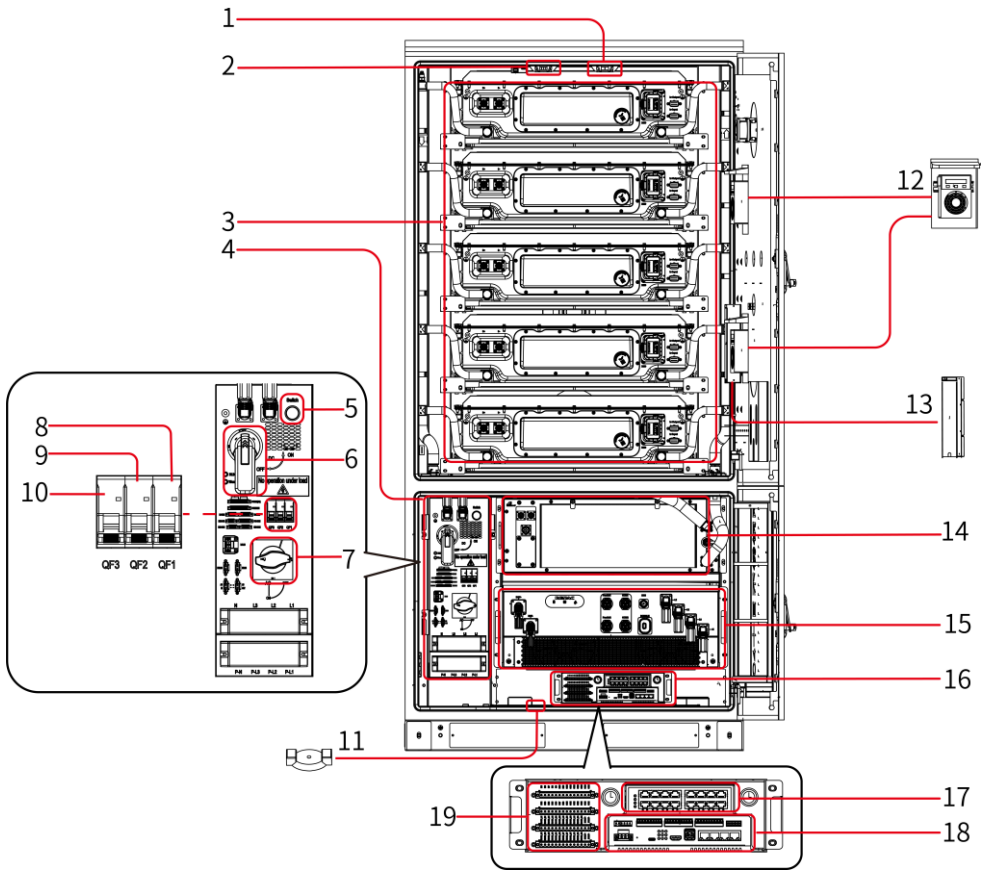

Figure 3-7 Components of the RI-ENERGYSET-3P-ESS-125-261 (Door open—Front view)

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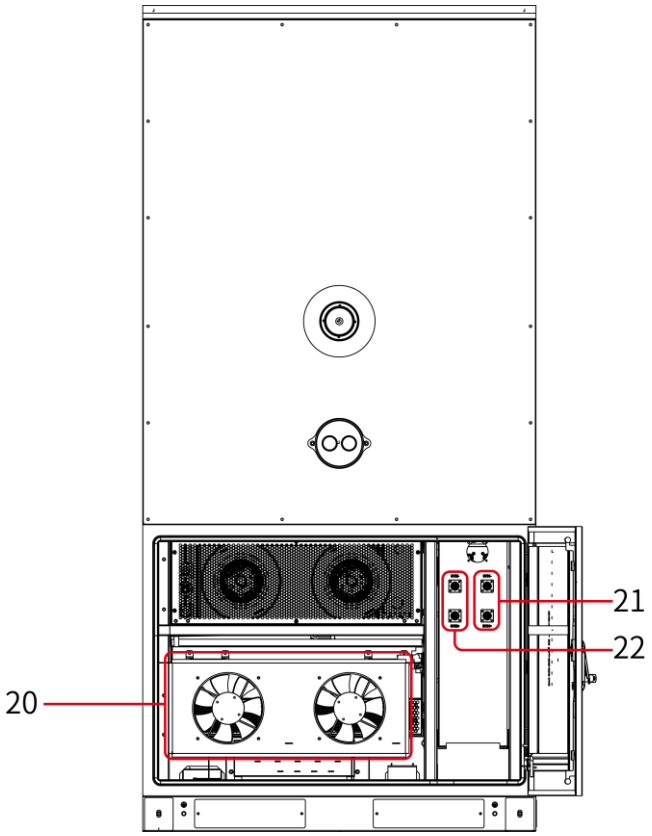

Figure 3-8 Components of the RI-ENERGYSET-3P-ESS-125-261 (Open the door—Back view)

No.	Model	Description	Quantity
1	Temperature sensor	Used for real-time monitoring of the temperature inside the cabinet.	1
2	Smoke sensor	Used to determine whether smoke or fire has occurred inside the cabinet.	1
3	Battery pack	Used to store and release power. Each battery has an energy capacity of 52.2 kWh.	5
4	PDU	Used to control battery charging and discharging, perform overall processing of information transmitted from the battery pack, and communicate with the EMS and liquid cooling machine.	1
5	Switch	Used to start the system when the external grid power is lost.	1
6	DC switch	A switch for controlling DC power.	1
7	AC switch	A switch for controlling AC power.	1
8	QF1	A switch for controlling the liquid-cooled unit.	1
9	QF2	A switch for controlling the fans.	1
10	QF3	A switch for controlling the smart dehumidification system.	1
11	Water sensor	Used to determine whether there is a risk of water accumulation inside the cabinet.	1
12	Dehumidifier	Used for dehumidifying inside the equipment.	1
13	Fire-fighting system	If a fire or other emergency occurs, it can suppress the fire, protect the system, and ensure personal safety. If the temperature inside the outdoor cabinet reaches 170℃, the fire detector tube will rupture automatically, and the Aerosol fire-fighting device can be released into the outdoor cabinet to extinguish the fire.	1
14	Liquid cooler	Used to maintain a stable battery system temperature.	1
15	PCS	The PCS is the core energy conversion component in commercial and industrial	1

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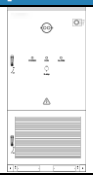
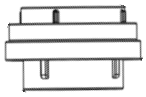
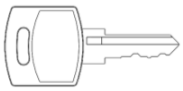
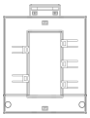
No.	Model	Description	Quantity
		energy storage cabinets, enabling bidirectional conversion between DC and AC power.	
16	EMS control box	An intelligent terminal device that integrates the functions of data acquisition, processing, control, and communication.	1
17	Switching Hub	A switch for communication expansion	1
18	EMS	Used for energy management, strategic control, and monitoring of fault anomalies in the operation of energy storage systems.	1
19	Communication Ports	Used to connect communication cables	1
20	Cooling fan	Used for machine heat dissipation.	1
21	PCS connector	Used to connect to PCS	1
22	PVS connector	Used to connect to PVS	1

4. Unpacking and Storage

4.1 Unpacking

Please check your package in two steps:

1. Check outside: Before opening, ensure it is intact—not damaged, torn, or wet. If damaged, please contact the Rayleigh Instruments.
2. Check Inside: On opening, compare all items with the packing list/figure. Report any missing or damaged parts to Rayleigh Instruments.

No.	Appearance	Model	Quantity
1		RI-ENERGYSET-3P-ESS-125-261	1
2		Firefighting water inlet	1
3		Manual service disconnect	5
4		Key	6
5		Smart meter	1
6		CT (Optional)	1

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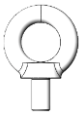
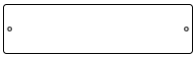
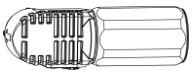
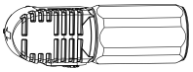
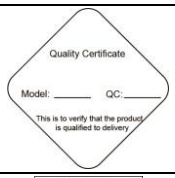
No.	Appearance	Model	Quantity
7		Lifting components	4
8		Base fork pocket cover	4
9		Hexagon Socket Head Cap Screw	8
10		Expansion screw	4
11		PVS connector (+)	1
12		PVS connector (-)	1
13		PCS communication connector	4
14		WIFI signal receivers.	2
15		4G signal receivers.	2
16		User manual	1
17		Quality Certificate	1
18		Factory report	1

4.2 Storage Environment

If it isn't installed immediately after the delivery work is successfully completed, please store the equipment properly according to the description in this section.

- Do not store the equipment in a place that is susceptible to condensation or rainwater ingress.
  The equipment should be stored in an indoor environment, such as a large warehouse or workshop.
- If the battery packs are going to be kept for more than 30 days, adjust the SOC to 40%-60% and dis-/charge them once every six months. Continuous storage is not recommended for more than 3 months.
- If it must be stored outdoors due to on-site conditions, the equipment must be raised. The specific elevation height should be reasonably determined according to the site's geological and meteorological conditions. If the ambient temperature is too low, heating should be provided for the internal equipment of the equipment

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- Storage environment temperature: -30°C~60°C (less than one month); recommended long-term storage temperature: 20°C~30°C; storage relative humidity: 0~95%, non-condensing. The storage ground must be flat, free of water, no bumps or undulations.
- Effective measures must be taken to prevent rainwater, sand, and dust ingress to the equipment. The air inlets and outlets of the equipment must be effectively protected.
- DO NOT place the batteries into or near a fire due to risk of explosion. Excessive ambient temperatures (exceeding 150°C) might also cause a fire to the Battery pack.
- Inspect at least once every half month to check whether the cabinet and internal equipment are in good condition.

5. Installations

5.1 Installation Environment

- The level of the installation location should be above the highest historical water level in the area. The distance to airports, buried waste disposal sites, river banks, or dams should be greater than 2km.
- Select a well-ventilated area. Do not block the ventilation openings and heat dissipation system while the equipment is in operation to prevent fire from high temperatures.
- Installation space is sufficient to ensure that the surrounding equipment will not be affected by the heat generated by the product; the installation location ensures sufficient space for external wiring, easy access to transport, and a reliable fire suppression system.
- Keep the installation location away from sources of ignition, and do not place flammable or explosive materials around the equipment.
- If the equipment is installed in a place with lush vegetation, in addition to routine weeding, the ground below the equipment needs to be hardened to prevent weeds from growing.
- Do not install the energy storage system outdoors in salt-affected areas to prevent equipment corrosion and fire. Salt-affected areas are defined as areas within 2km of the coast or affected by sea breezes.
- The energy storage system must be equipped with protective measures such as fences and walls, and safety warning signs must be erected for isolation to avoid the entry of unauthorized personnel during the operation of the equipment, which may lead to personal injury or property damage.
- The equipment is installed in the area away from the liquid; should not be installed in the water pipe, air outlet, and other easy-to-produce condensation below the location; should not be installed in the air conditioning port, vents, machine room outlet windows, and other easy to leak below the area, to prevent the liquid from entering the internal caused by the short circuit of the equipment.

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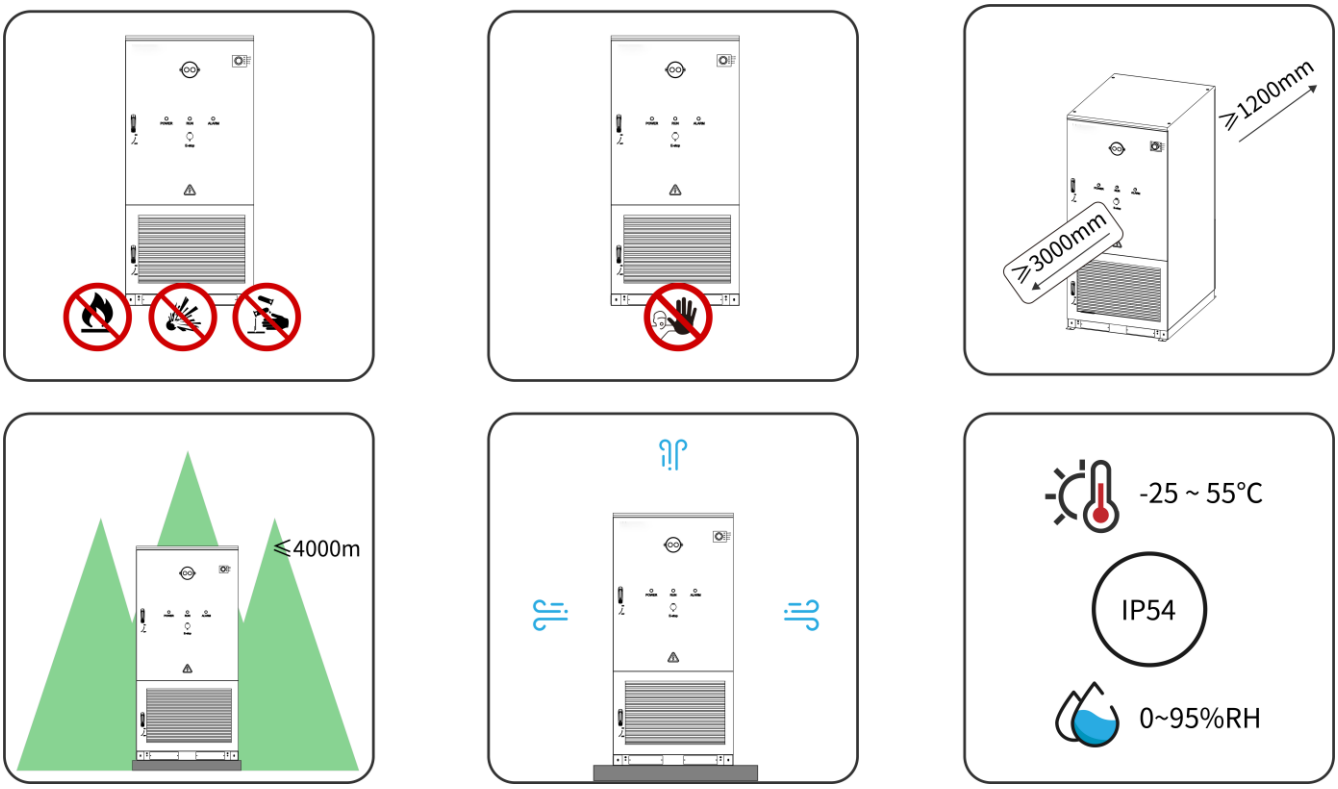

Figure 5-1 Installation environment

At least the following requirements should be met when constructing the foundation:

- The bottom of the foundation pit for building the foundation must be compacted and filled.
- The foundation should be sufficient to provide adequate load-bearing support for the energy storage system.
- Elevate the energy storage system to prevent rainwater from eroding the base and interior. It is suggested that the foundation should be about 200mm higher than the horizontal ground of the installation site.
- It is necessary to construct corresponding drainage measures in combination with local geological conditions.
- Construct concrete foundations of sufficient cross-sectional area and height. The construction party shall determine the foundation height according to the site geology.
- Cable routing should be considered when constructing the foundation.
- The maintenance platform should be built around the foundation to provide convenience for later maintenance.
- Both ends of all pre-buried pipes are temporarily sealed to prevent impurities from entering; otherwise, it will be inconvenient to route later.

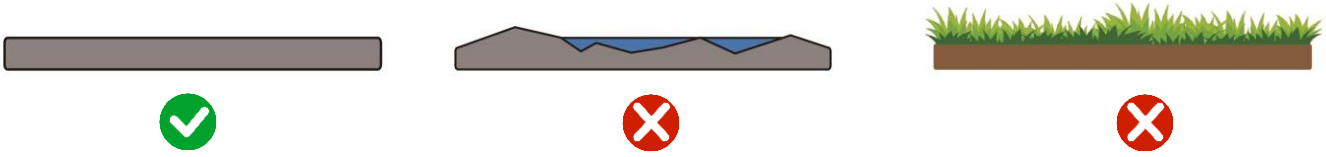

Figure 5-2 Foundation requirements

- Ensure the equipment is placed horizontally, and not tilted, laid sideways, or inverted.

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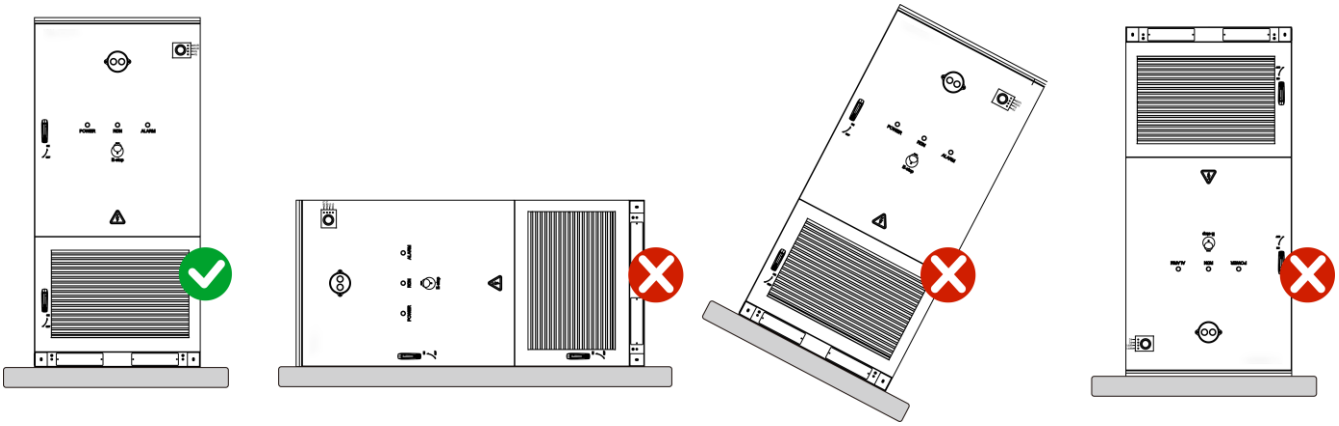

Figure 5-3

WARNING

Throughout the entire mechanical installation process, operators must comply with the relevant standards and requirements of the project location.

Foundation requirements:

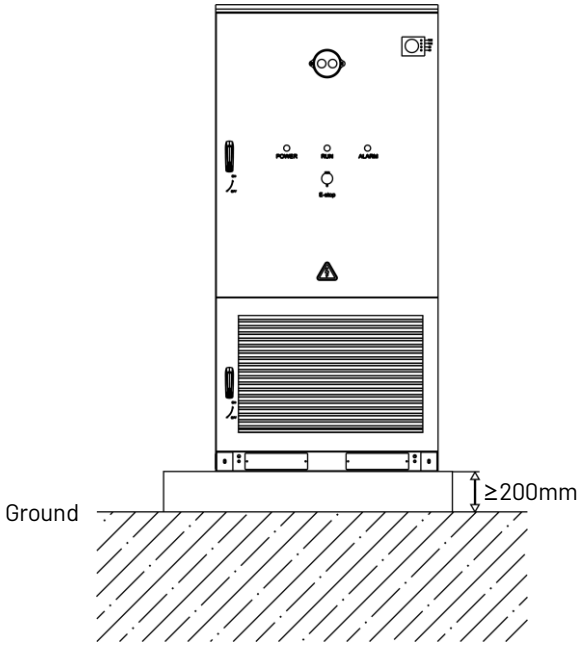

Figure 5-4 Front view of foundation

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Rayleigh Instruments Limited
Raytel House, Cutlers Road, South Woodham Ferrers, Chelmsford, Essex CM3 5WA. UK

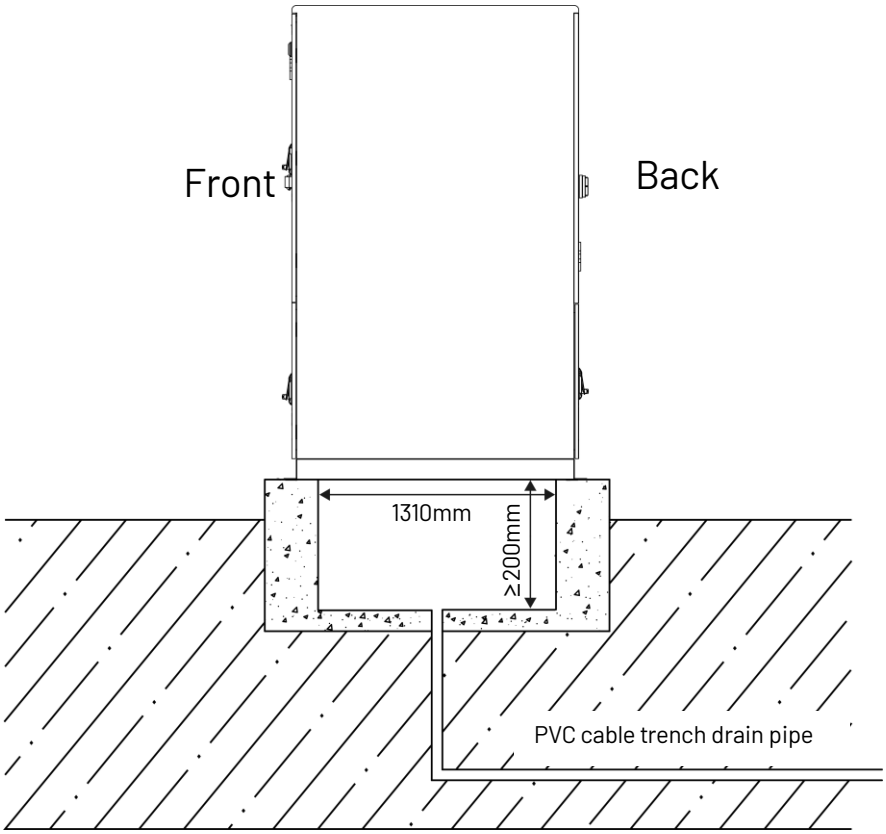

Figure 5-5 Side view of foundation

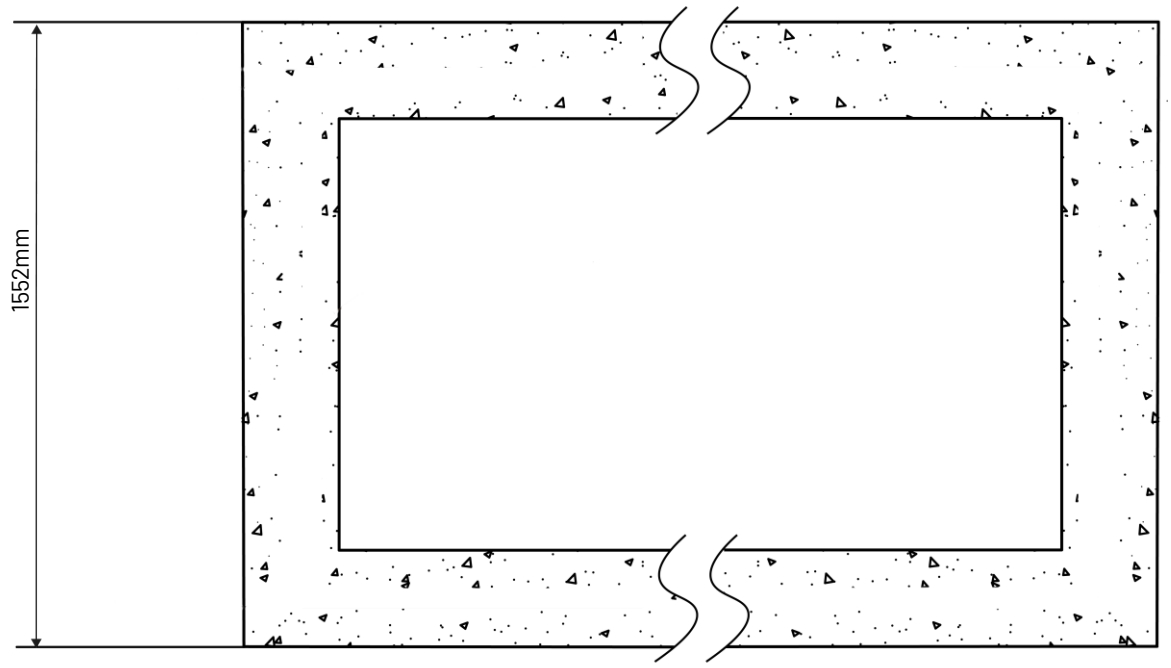

Figure 5-6 Top view of foundation

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CAUTION

This foundation layout is for reference only. The final construction design must be finalized by a qualified engineer based on actual site conditions.

5.2 Product transport

Forklift transport:

- When transporting the equipment with a forklift, ensure the forklift has adequate lifting capacity. The equipment's center of gravity must be positioned between the forklift legs to prevent injury and equipment damage.
- Forklift truck loading capacity needs to be ≥3.5t.
- Recommended forklift arm length ≥1.4m.
- Recommended forklift arm thickness < 100mm.
- Recommended forklift fork width < 250mm
- All handling of the equipment—including transportation, moving, and setting down, must be performed in a slow, steady, and controlled manner. When using a forklift truck to transport equipment, it is important that it is operated by a professional operator.

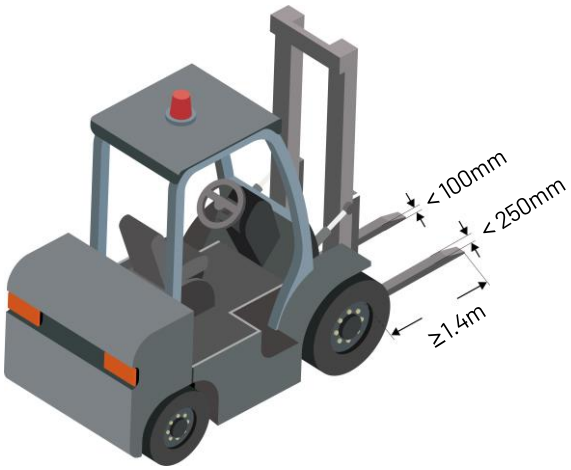

Figure 5-7 Recommended forklift arm sizes

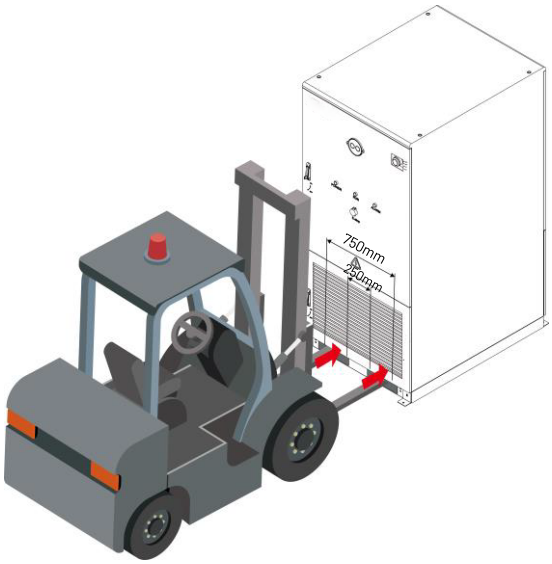

Figure 5-8 Moving with a forklift

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WARNING

Forklift transport only from that side of the battery cabinet (pictured).

Lifting transport:

- When using lifting equipment to transport, ensure that the energy storage system is lifted into the air using a sling with a hook or U-hook.
- The load-bearing capacity of the lifting equipment shall be ≥3.5t;
- The entire lifting process should be carried out slowly; pay attention to observing the balance state of the box, and do not move too fast.
- During the entire lifting process, no one is allowed to stand underneath the energy storage system or the crane.

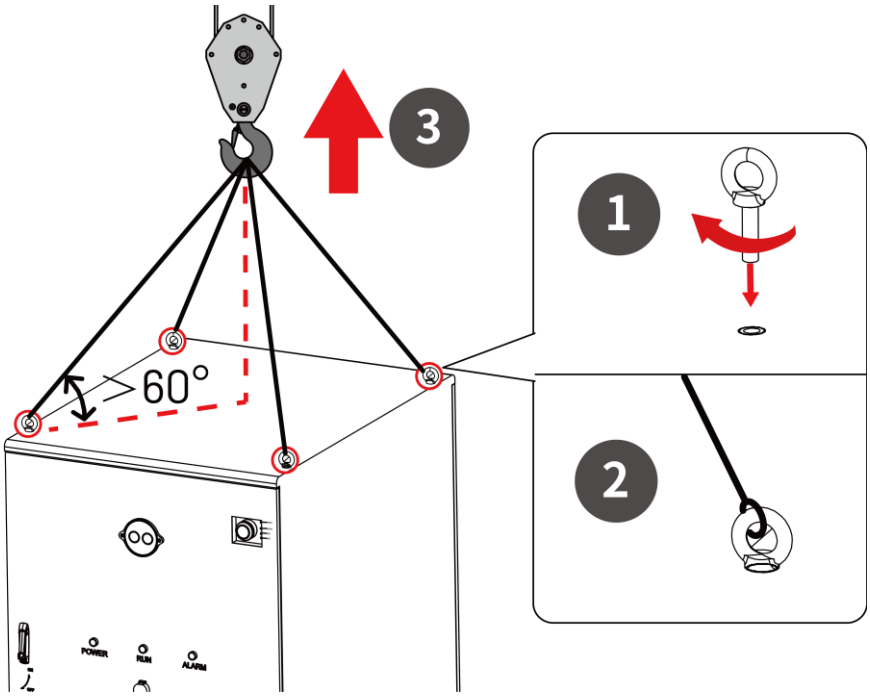
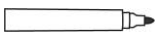
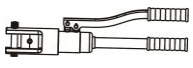
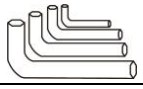


Figure 5-9 Lifting with a crane

5.3 Preparation for Installation

(1) Installation tools:

No.	Tool	Model	No.	Tool	Model
1		Spirit level	7		Marker
2		Wire stripper	8		Rubber hammer
3		Hydraulic pliers	9		Hex key

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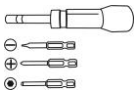
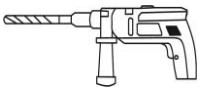
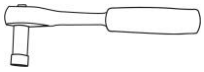
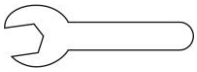
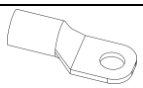
No.	Tool	Model	No.	Tool	Model
4		Heat gun	10		Torque screwdriver
5		Hammer drill	11		Multimeter
6		Socket spanner	12		Spanner

(2) Protective tools:

No.	Tool	Model	No.	Tool	Model
1		Dust mask	4		Insulated shoes
2		Goggles	5		Safety helmet
3		Insulated gloves			

(3) Cables and other tools:

No.	Tool	Model	Description
1		4*70 mm^2+1*35 mm^2	Grid input / Load input
2		RVSP 2*0.5 mm^2	Meter communication
3		Deutsch Terminal (70 mm^2 & 35 mm^2)	Wiring connector

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5.4 Mechanical Installation

1. Drill 4 holes with a diameter of 15 mm and a depth of 99 to 101 mm in the foundation and install expansion bolts.

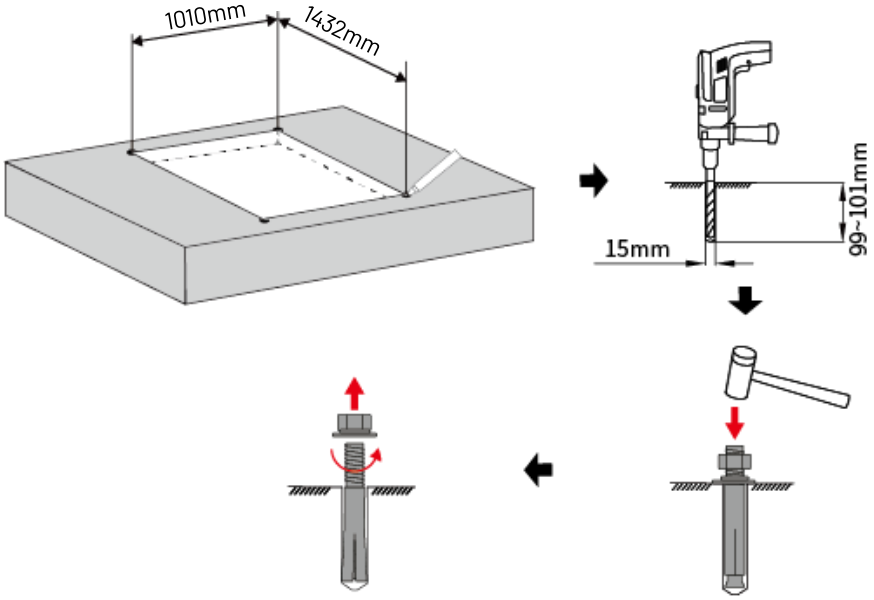

Figure 5-10

2. Transport the equipment to the designated location by forklift or crane.

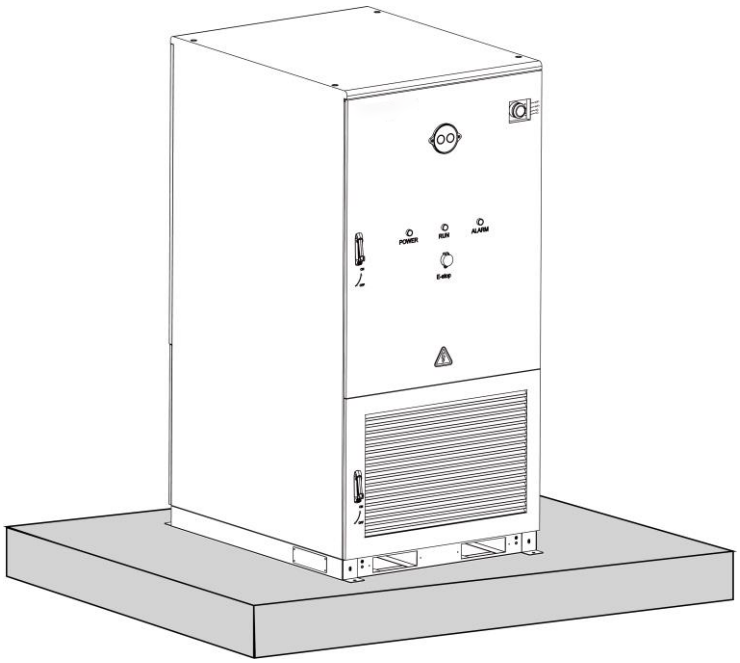

Figure 5-11

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3. Use a socket wrench to tighten the expansion bolts and secure the equipment to the ground.

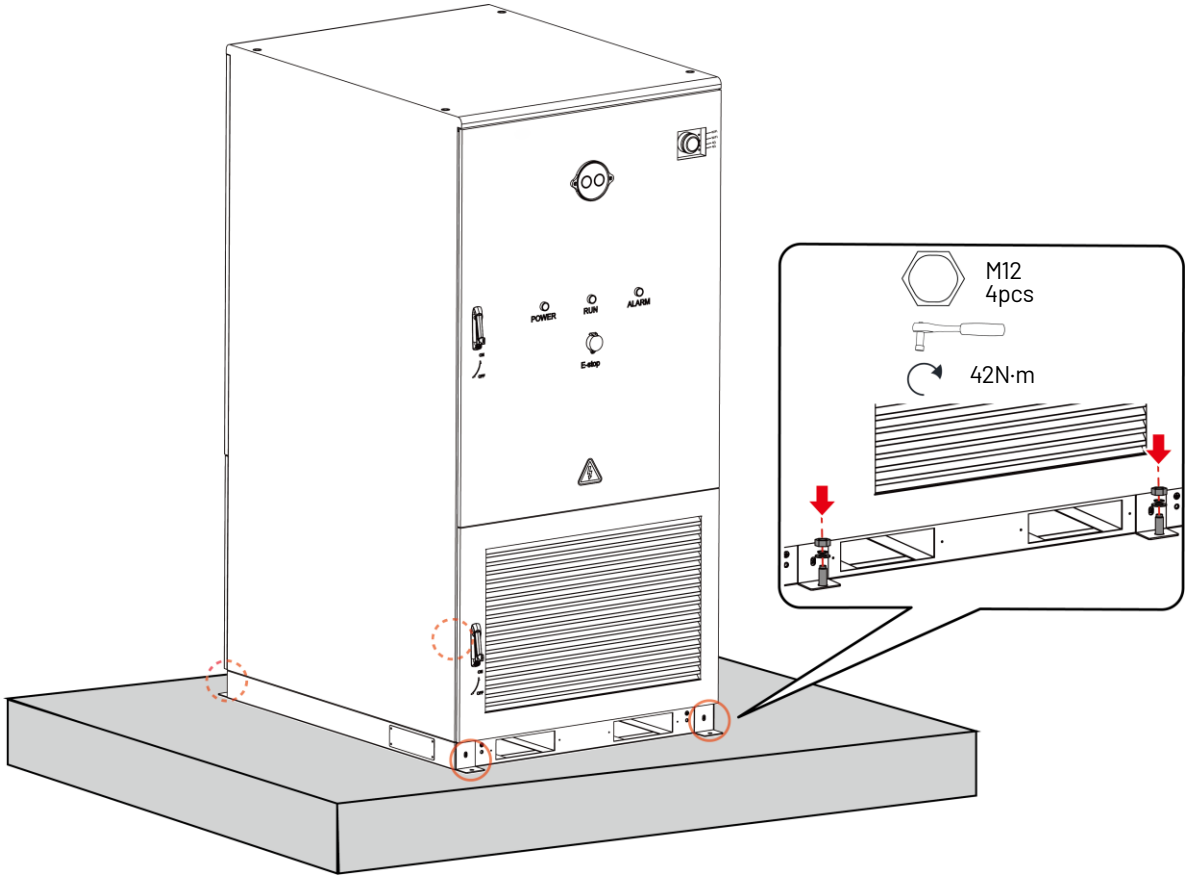

Figure 5-12

4. Install the two anti-rodent panels on the battery cabinet.

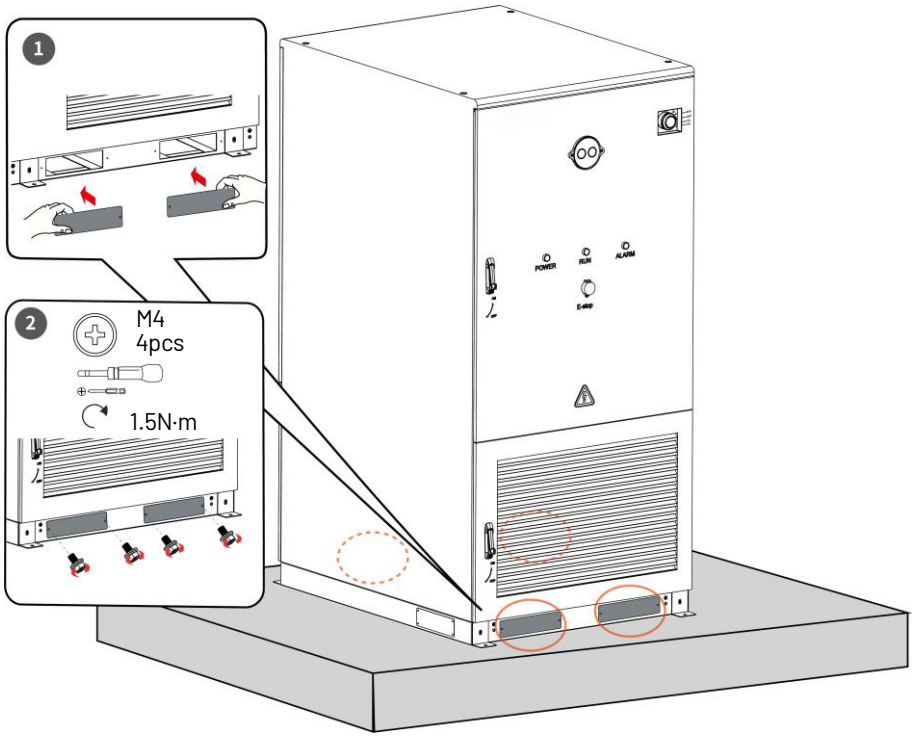

Figure 5-13

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5.5 Electrical Connection

DANGER

Danger of high voltage! Danger of electric shock!

- Do not touch live parts!
- Please ensure that the AC and DC sides are not charged before installation.

Do not place the energy storage system on the surface of combustible materials.

WARNING

When performing an electrical installation, refer to the following recommendations:

- Check that all switches in the equipment are disconnected before wiring. Ensure that the equipment is not energized.
- Disconnect the grid switch before wiring and ensure the cable is not energized.
- To determine the correct phase sequence of the cable, you can add yellow, green, red, and black different colors of insulation sheath or marking to distinguish to prevent the phase sequence error.
- Cable terminals and copper row connections need to be compressed; screws should be selected to the right length so as not to affect the insulation and tightening.
- Lay communication and power cables as separately as possible, making sure that the cable insulation is not damaged during the laying process.
- The grounding cable must be reliably connected to the grounding copper row, and the cross-sectional area of the cable must meet the design requirements.
- All AC cables should be connected to the appropriate phase sequence after entering the device through the access holes on the bottom.
- After the wiring is completed, use fireproof mud to seal the leaks to prevent external insects and rodents from entering and damaging the equipment or cables.
- During electrical connection, bolts must be tightened strictly according to the torque described in this manual. Failure to observe the torque requirements may result in fire at the connection!

NOTICE

During the whole process of electrical connection, as well as all other operations on equipment such as PCS, the following five safety rules must be observed:

When the energy storage system is disconnected, ensure that it cannot be accidentally energized;

Disconnect all device's internal power supply.

Ensure that the energy storage system is completely de-energized when using a multimeter.

Make the necessary grounding.

Insulate and cover potentially live parts adjacent to the operating part with insulating cloth.

5.5.1 Grounding connection

WARNING

The equipment needs to be reliably grounded, with at least two grounding points, distributed diagonally.

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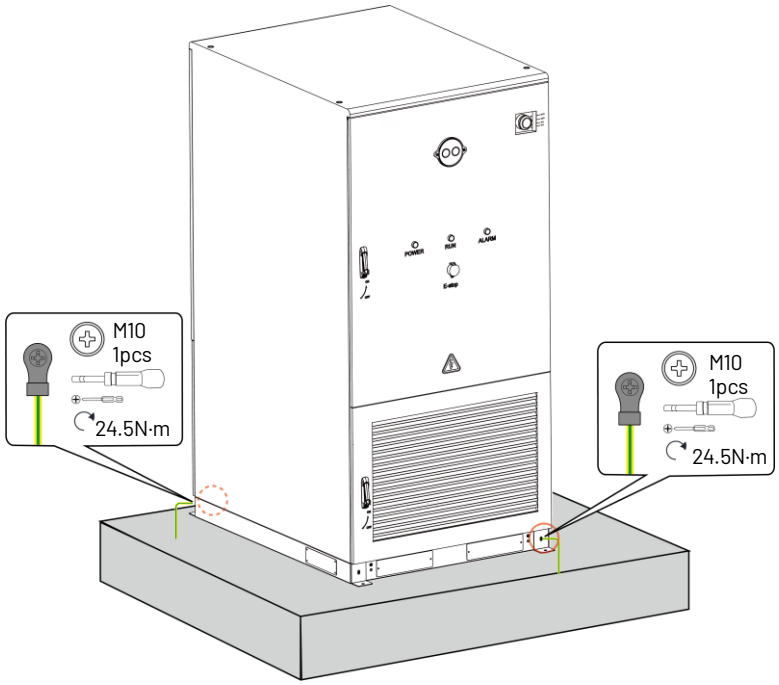

Figure 5-14

5.5.2 Installation Procedure

1. Open the cabinet door before performing any the electrical wiring. All cabinet doors operate in the same manner.

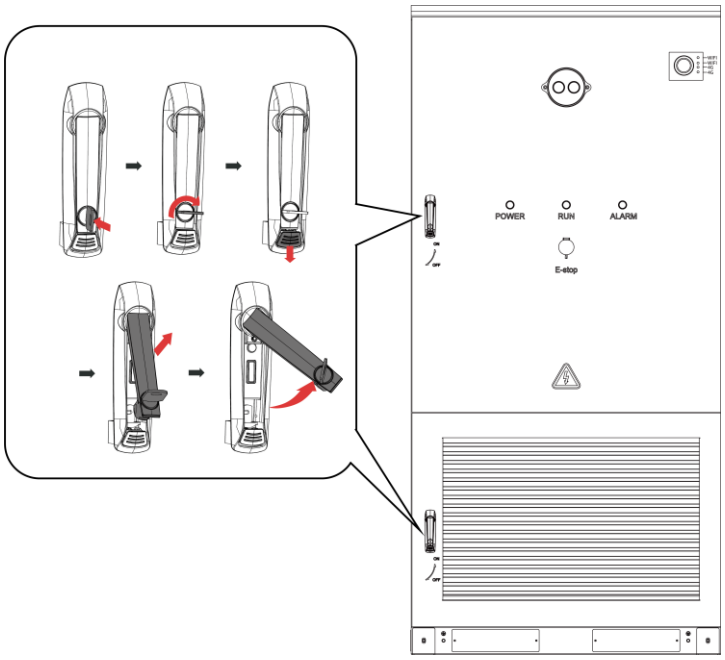

Figure 5-15

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2. Remove the front cover panel of the distribution unit to facilitate cable routing.

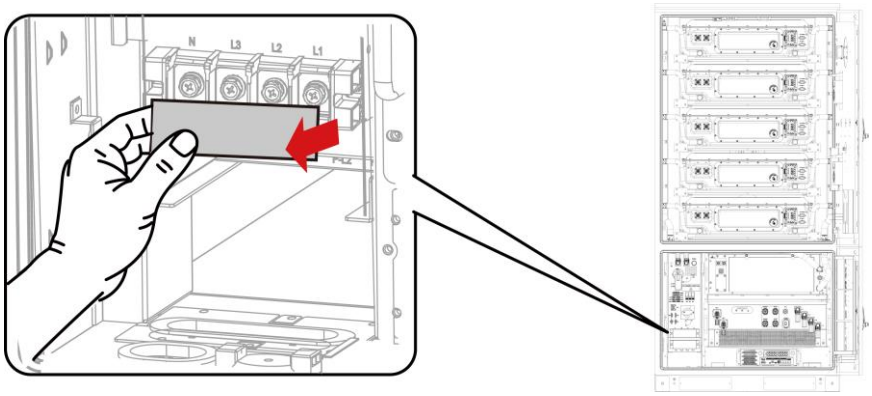

Figure 5-16

3. AC connection

3.1 Remove the corresponding screws.

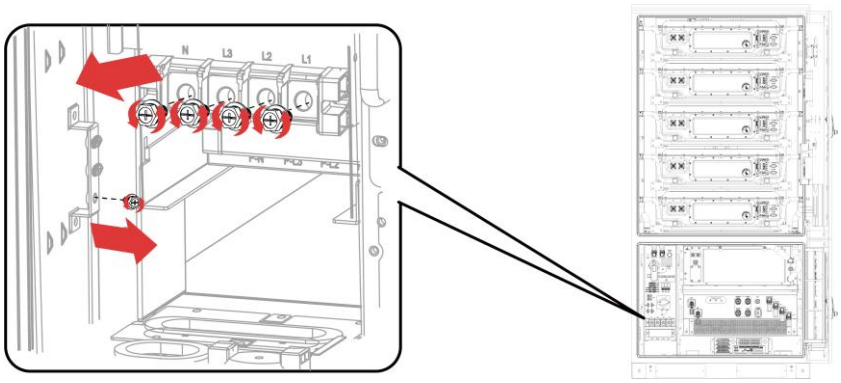

Figure 5-17

3.2 Prepare the required cables and OT terminal, then perform crimp to fabricate the AC output cable.

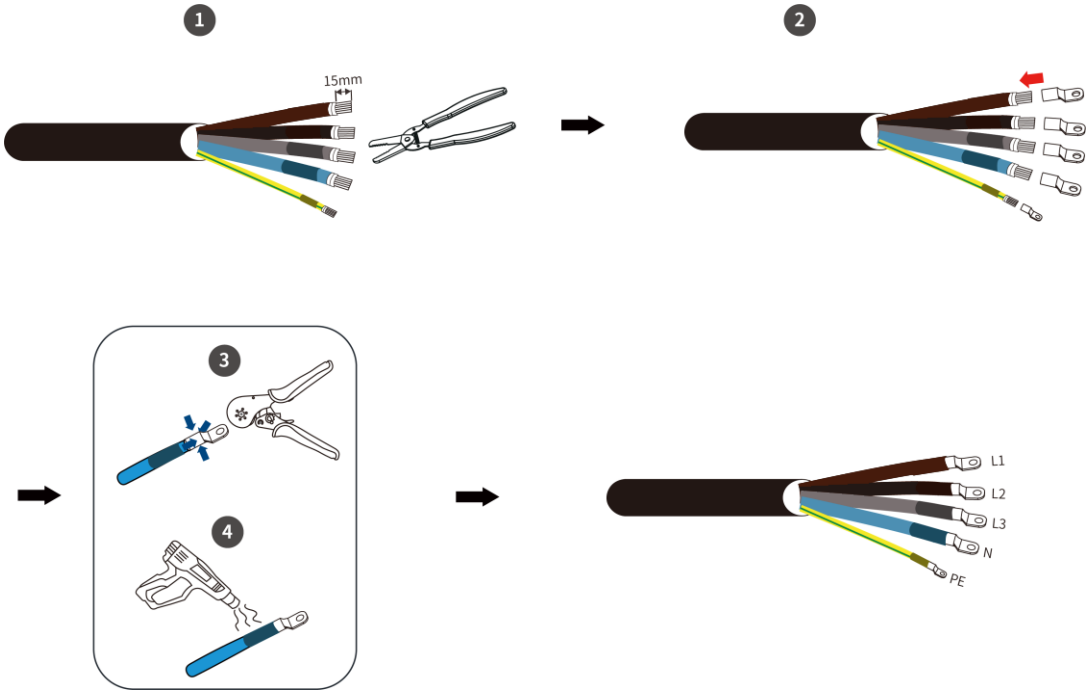

Figure 5-18

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3.3 Connect the L1, L2, L3, N, and PE cables according to the cables' position and order shown in the diagram below.

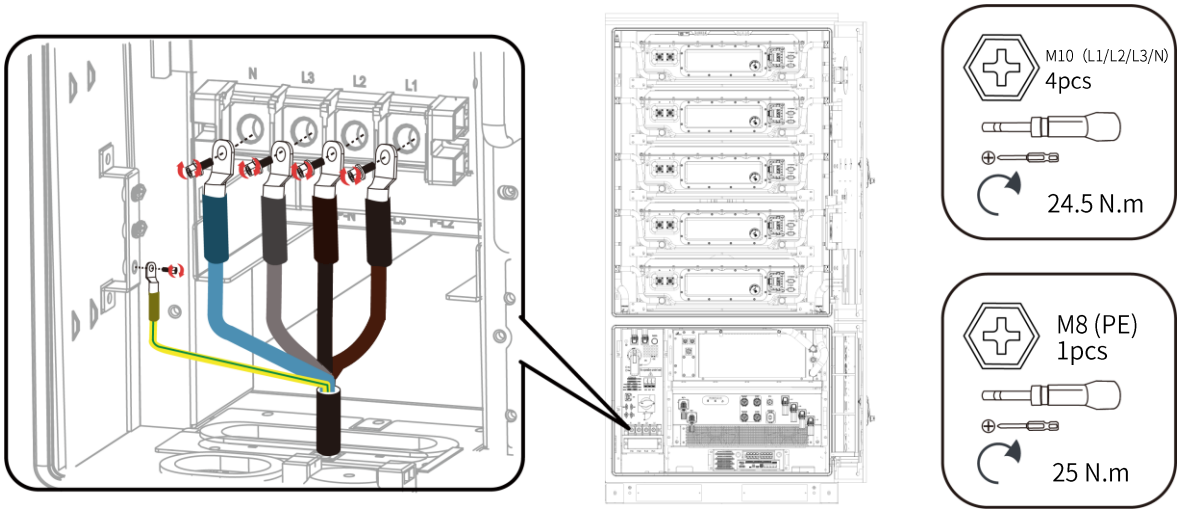

Figure 5-19

3.4 Install the front cover panel of the distribution unit.

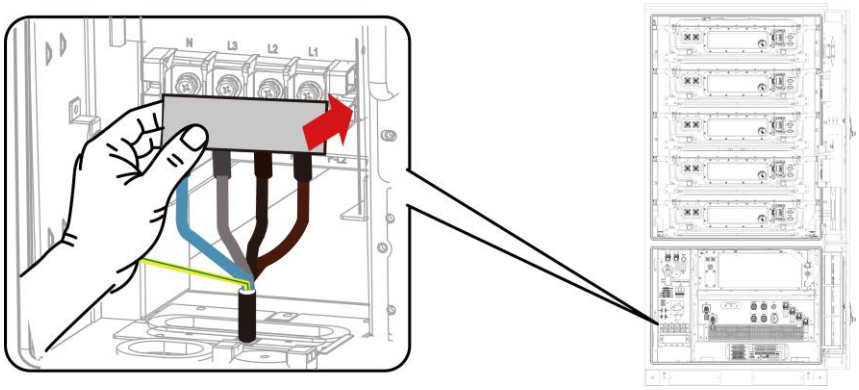

Figure 5-20

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4. On-Grid connection

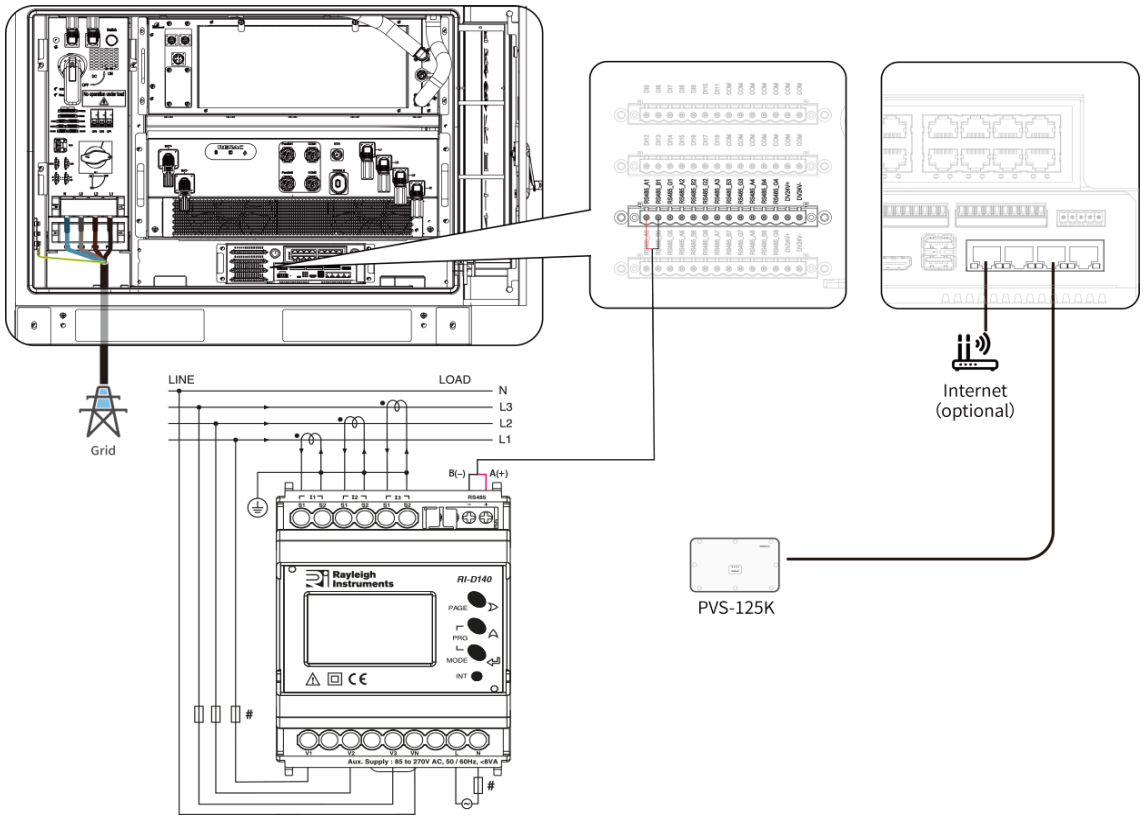

Figure 5-21 On-Grid wiring connection

NOTE:

1) For PVS communication cable connections, please refer to the PVS user manual.

2) The fuse is rated at 4A.

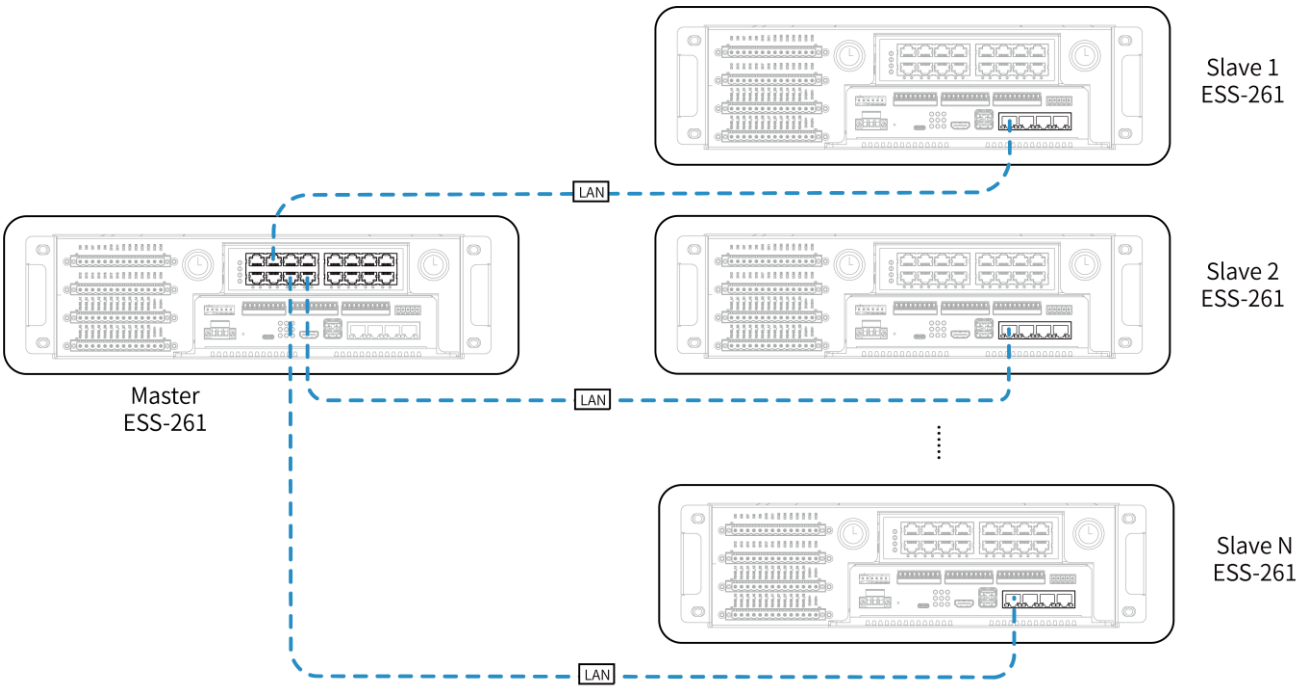

Figure 5-22 Parallel communication connection

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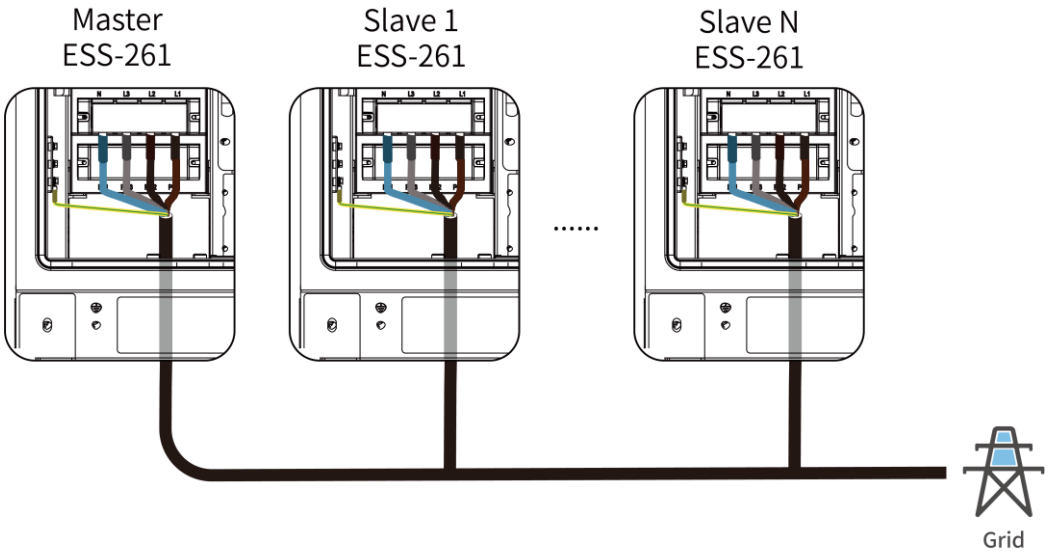

Figure 5-23 Grid connection

CT is not standard and has to be purchased by the customer. Recommended models are shown in the table below:

Model	Ratio (A)	Overall Dimensions (W * H * D) (mm)	Perforation Dimensions (mm)	Accuracy class
RI-CTS058	400 / 5	115 * 145 * 51	50.1 * 80	0.5
	600 / 5			
	800 / 5			
RI-CTS088	1200 / 5	145 * 153.8 * 51	80.5 * 80.5	0.5
RI-CTS816	1000 / 5	186 * 250 * 51.4	81 * 160.5	0.5
	4000 / 5			
	6000 / 5			

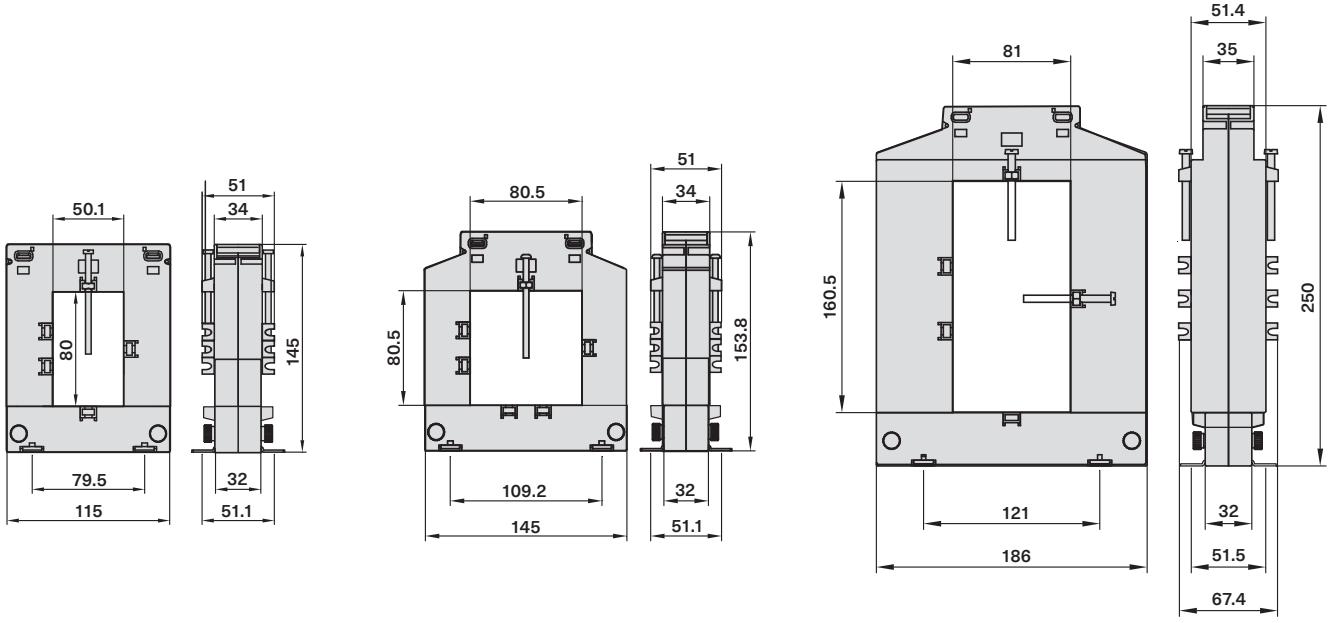

Figure 5-24

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5. Off-Grid wiring connection

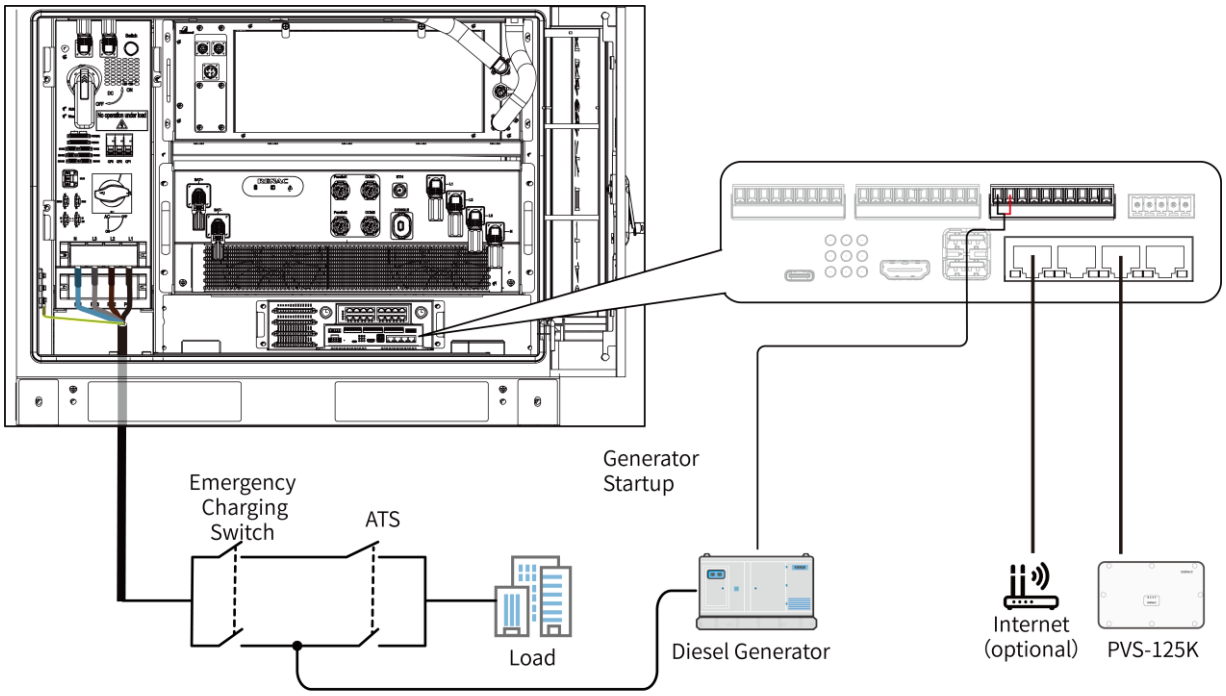

Figure 5-25

NOTE:

1) For On/Off-grid communication cable connections, please refer to the STS user manual.

2) For PVS communication cable connections, please refer to the PVS user manual.

6. Install the MSD on every battery pack.

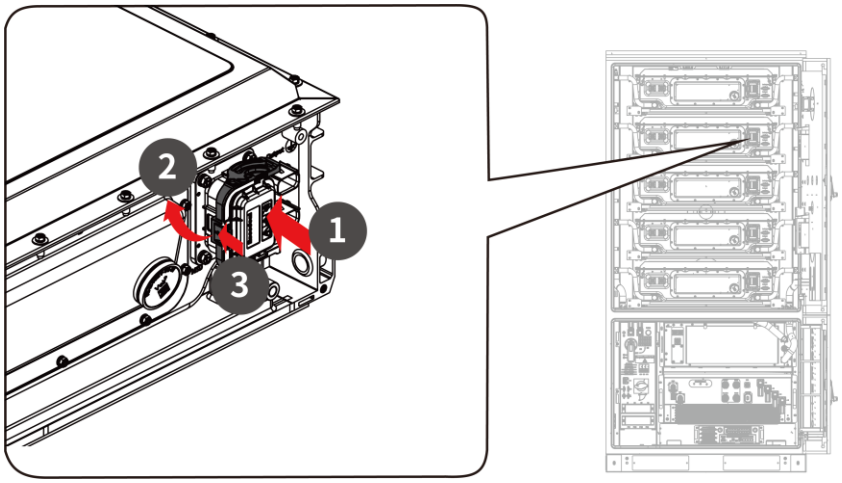

Figure 5-26

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7. Install all the 4 WIFI/4G signal receivers.

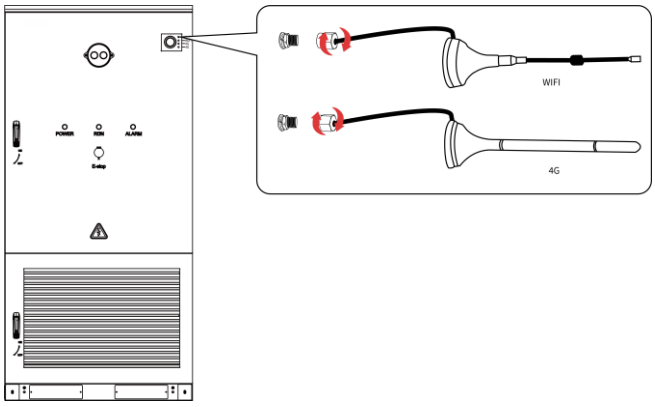

Figure 5-27

6. Commissioning

6.1 Indicator Status

Indicator	Status	Description
POWER	ON	The power indicator light will turn yellow when the system is connected to electricity.
RUN	ON	The run indicator light will turn green when the system is operating normally.
ALARM	ON	The alarm indicator light will turn red when the system has faults. (Check EMS for specific fault information.)

6.2 Check before Powering On

Before powering on the RI-ENERGYSET-3P-ESS-125-261, please make sure that the product has been installed following the specifications, and carry out a comprehensive and detailed inspection of the system to ensure that all indicators are in line with the requirements before powering on the system.

(1) Exterior Inspection:

- The RI-ENERGYSET-3P-ESS-125-261 is in good condition, with no damage, no rust, and no paint loss. If there is any paint loss, please carry out a paint refinishing operation.
- The RI-ENERGYSET-3P-ESS-125-261 labels are clearly visible, and damaged labels should be replaced promptly.

(2) Ground check:

- Box with a grounding point and grounded firmly, the box grounding conductor is reliably connected to the box grounding Busbar.

(3) Cable check:

- The cable protection is well-wrapped with no visible damage.
- The terminals are made following specifications and are connected firmly and reliably.
- Each cable is clearly labelled at both ends. The cable runs meets safe principle of separation standards for high and low power cabling and should be installed without excessive bending, or strain on mounting points.
- Check the cable mounting bolts are secure, the cable cannot be pulled out without loosening, and that holes have been blocked where the cable crosses.

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(4) Copper row check:

- There is no obvious crack or deformation of the copper Busbars, the screws are tight at the lap joints, the scribe marking is not misplaced and there is no debris on the copper rows.

(5) Component check:

- The DC breaker and AC breaker are all in the open position.

6.3 Power On

6.3.1 On-grid solution power on

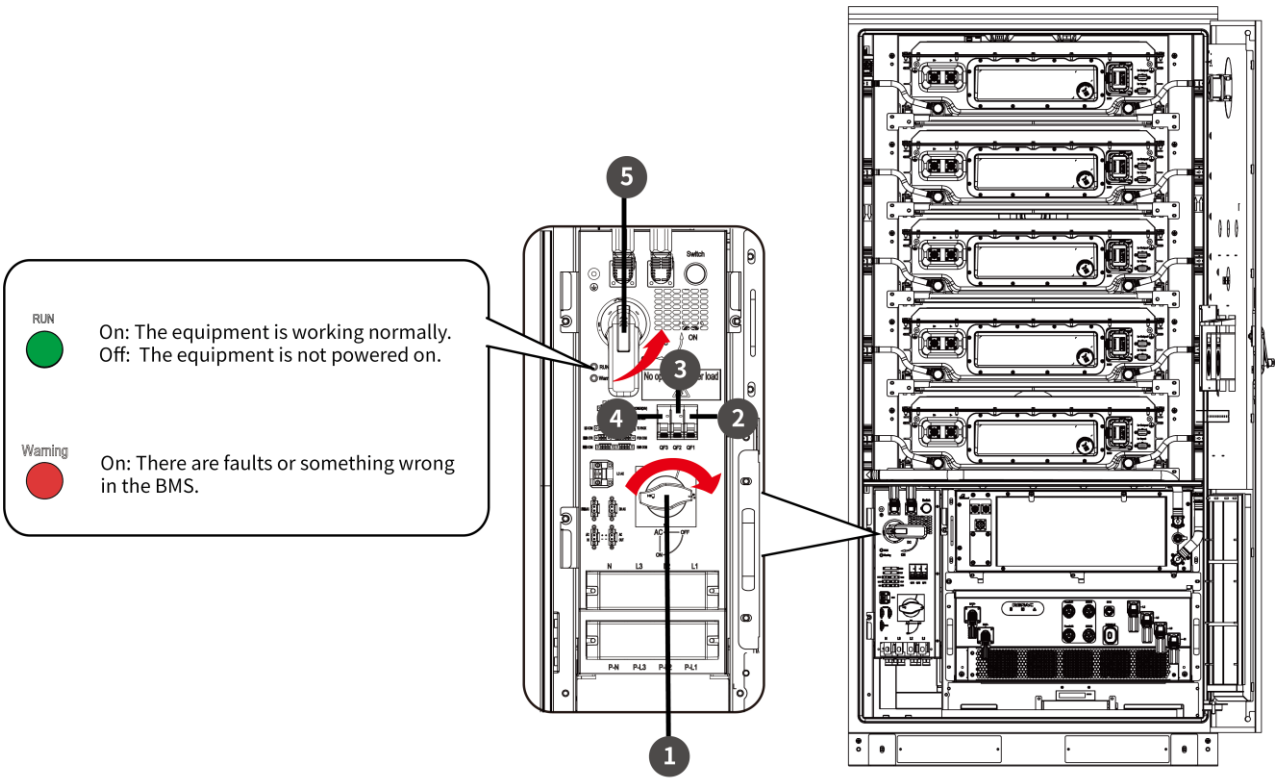

Figure 6-1

1) Turn on the AC breaker.
2) Turn on the QF1 breaker.
3) Turn on the QF2 breaker. The power indicator illuminates.

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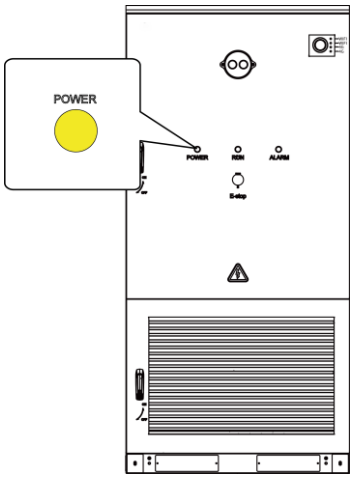

Figure 6-2

4) Turn on the QF3 breaker. If the current ambient humidity is not high enough to activate the Smart Dehumidification System, this step can be ignored.

5) Turn on the DC breaker. The PDU Run indicator illuminates.

6) For the initial startup, the operational mode and parameters must be configured in the EMS interface.

NOTICE

1. The power-on sequence in a multi-unit parallel operation is from the slave unit to the master unit.
2. The on-grid power-off procedure is the inverse of the power-on procedure.

6.3.2 Off-grid solution power on

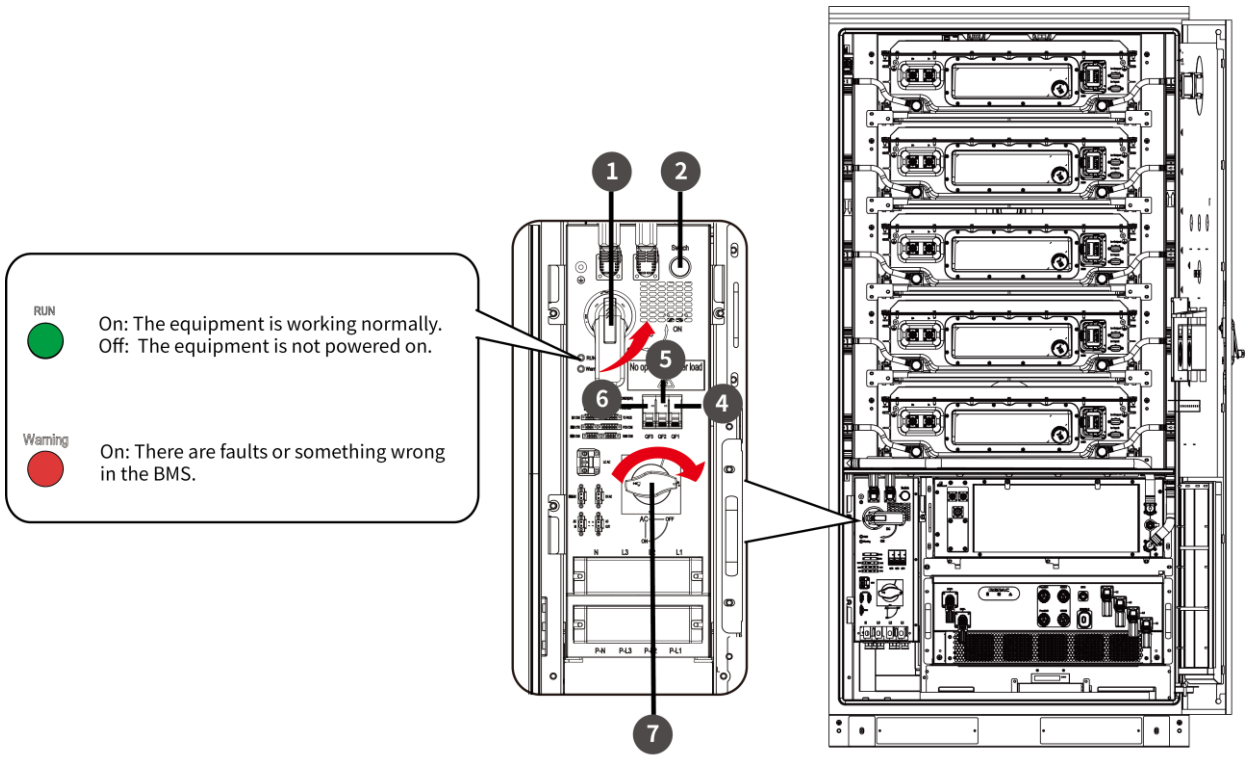

Figure 6-3

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1) Turn on the DC breaker. The PDU Run indicator illuminates.
2) Press the Switch button.
3) For the initial startup, the operational mode and parameters must be configured in the EMS interface.
4) Turn on the QF1 breaker.
5) Turn on the QF2 breaker. The power indicator illuminates.

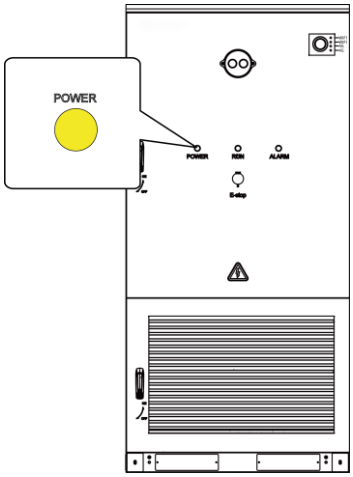

Figure 6-4

6) Turn on the QF3 breaker. If the current ambient humidity is not high enough to activate the Smart Dehumidification System, this step can be ignored.
7) Turn on the AC breaker.

> **NOTICE**
>
> The off-grid power-off procedure is the inverse of the power-on procedure.

6.4 Emergency Shut Down

When there is a malfunction of the product or a critical situation that requires an emergency shutdown, you can perform the following emergency shutdown operations:

1) Press the emergency shutdown button “Emergency stop”.
2) Reset the Emergency stop button after determining that the fault or hazard is cleared and operation is required

7. Operation and Handling

This chapter mainly introduces the EMS operation. Users can execute various operation commands through the HMI in the AC cabinet, conveniently browse the DC, AC, and system operation-related parameters and data, and obtain the current equipment status and real-time alarm information in a timely manner, which provides a reliable basis for troubleshooting. In addition, the HMI can also display the system software version information and upgrade the software of each component through the U disk.

7.1 Introduction of Menu Interface

There are seven submenus in the menu that can be selected for relevant setting operations: Detail; Strategy; Alarm; Log; History data; Statistics; Setting.

Open the EMS energy management system, the home page can display energy information and fault information. Click ‘Enter

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System' in the upper left corner to set up the system.

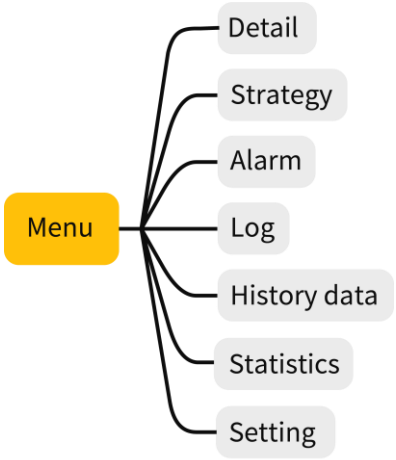

Figure 7-1

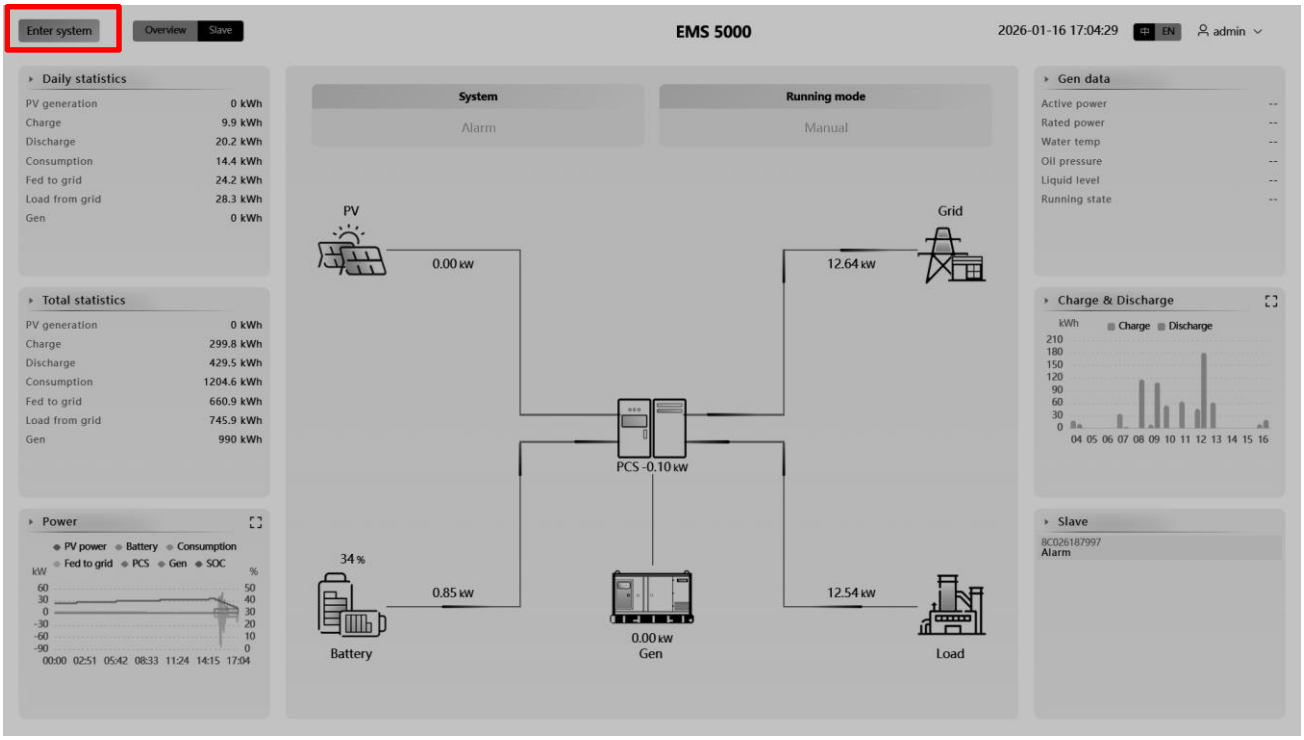

Figure 7-2

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(1) **Detail**: For displaying system operation status and partial parameter settings. There are six kinds of data that can be displayed: PCS data, PVS data, BMS data, STS data, Meter Data, and Generator Data.

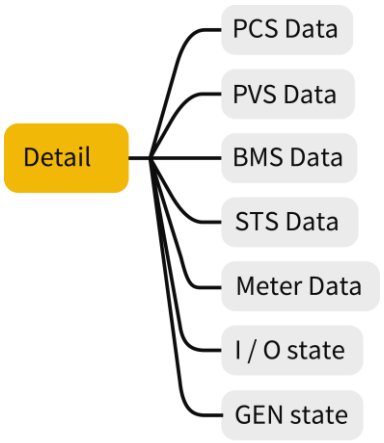

Figure 7-3

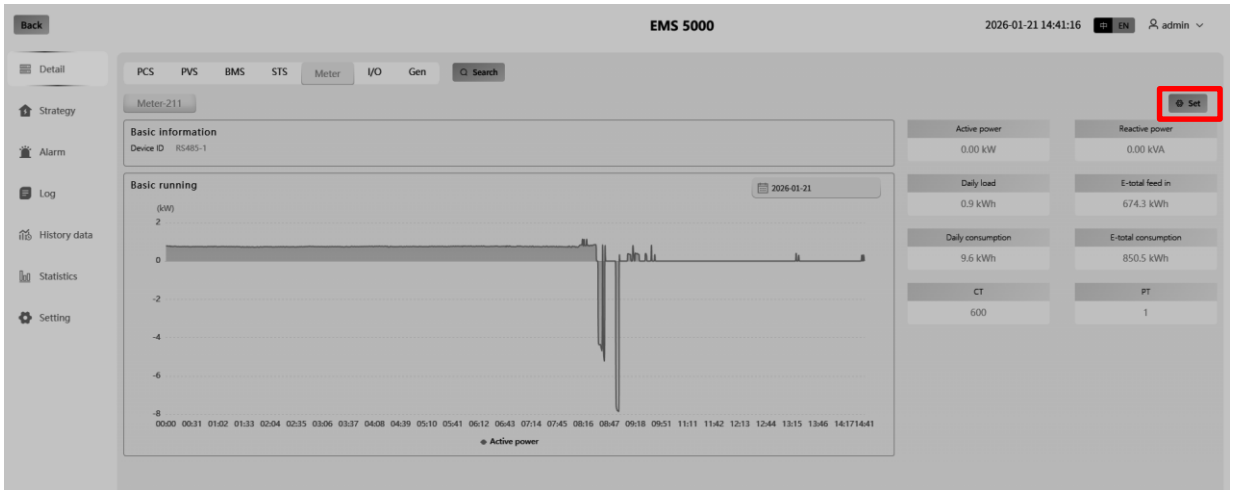

Figure 7-4

Figure 7-5 Meter setting

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(2) **Strategy**: The RI-ENERGYSET-3P-ESS-125-261 has three strategies for meeting the various needs of the user: Manual mode, Auto mode, and Agency mode.

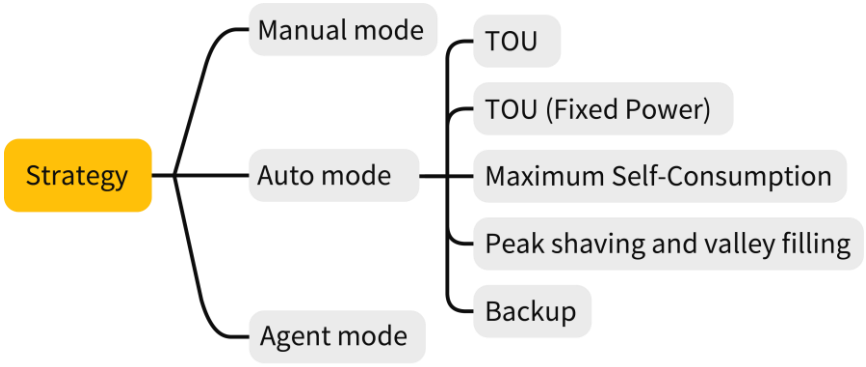

Figure 7-6

Manual mode: Users can set the output power manually in this mode. This mode is only used for post-installation debugging.

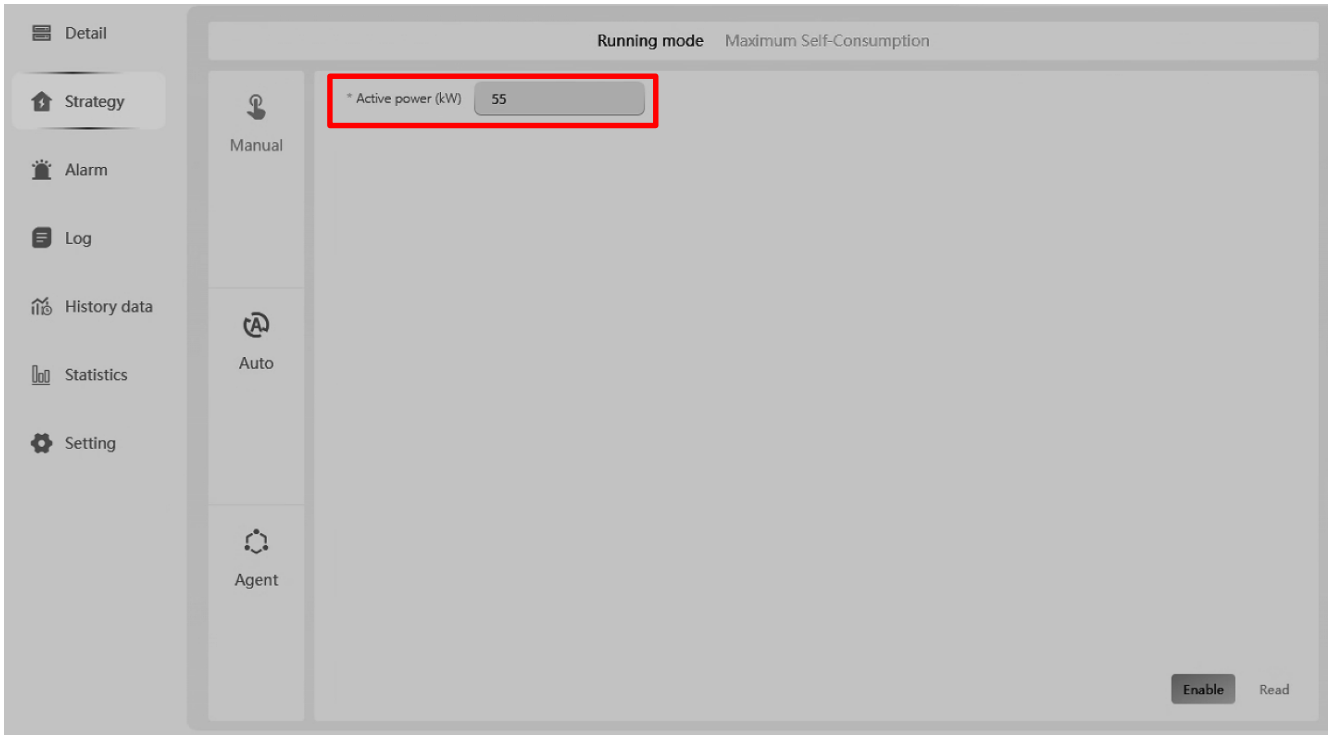

Figure 7-7

Auto mode: This mode allows you to set five different modes: TOU mode, TOU (fixed power), Maximum Self-Consumption mode, Peak Shaving and Valley Filling mode, and Backup mode.

- TOU mode: This mode is suitable for PV-storage or pure storage systems, in scenarios with significant peak-valley electricity price differences and the presence of meters. Users can set different time periods for charging or discharging the system and set the maximum charging and discharging power values.

In this mode, users can add configurations independently. Simply click 'New', enter a configuration name, and input parameters, then click 'Save' in the bottom-right corner. Check the box in the configuration item and click 'Enable' to activate the mode.

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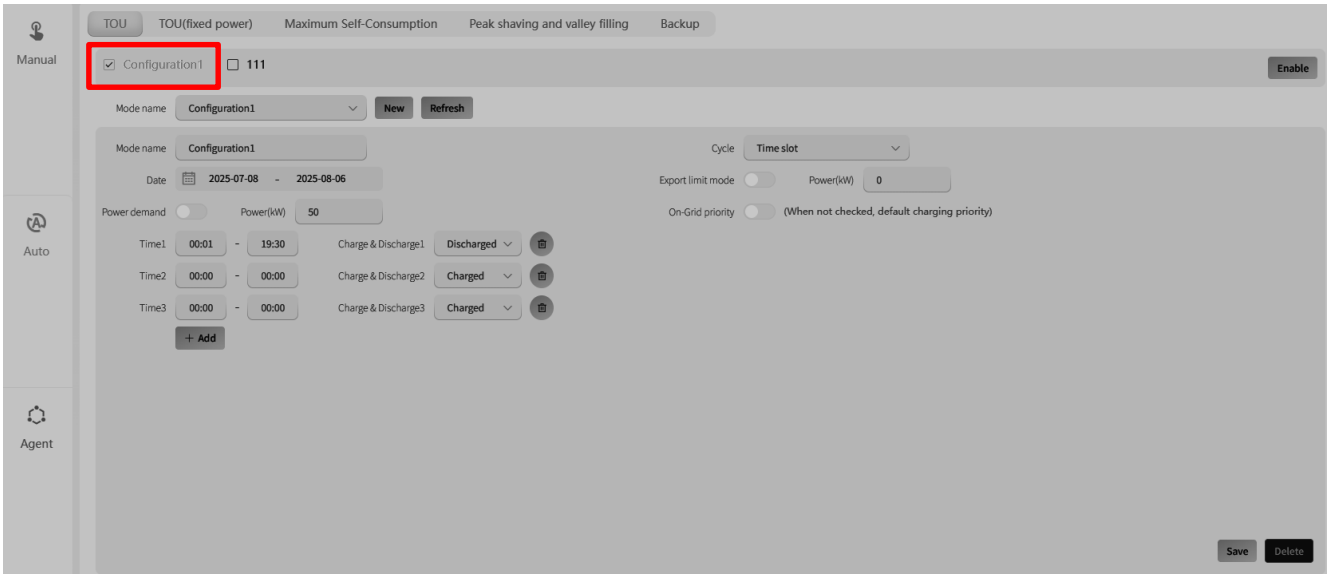

Figure 7-8

Charge/ discharge window	Charging priority	Injecting priority
Discharge	The energy storage system is discharged. PV power priority: Load -> Battery -> Grid Load consumption priority: PV power -> Battery -> Grid	Energy storage systems can be discharged. PV power priority: Load -> Grid -> Battery Load consumption priority: PV power -> Battery -> Grid
Charge	The energy storage system is charged only. PV power priority: Battery -> Load -> Grid Load consumption priority: PV power -> Grid	The energy storage system is charged only. PV power priority: Battery -> Load -> Grid Load consumption priority: PV power -> Grid
Neither	The energy storage system cannot be discharged, and charged from the grid. PV power priority: Load -> Battery -> Grid Load consumption priority: PV power -> Grid	The energy storage system cannot be discharged, and charged from the grid. PV power priority: Load -> Grid -> Battery Load consumption priority: PV power -> Grid

- TOU mode (fixed power): This mode is suitable for pure storage systems in scenarios with significant peak-valley electricity price differences and no meters. Users can set different charging and discharging time periods and set fixed charging and discharging power values. For example, charging during low tariff hours and discharging during high tariff hours.

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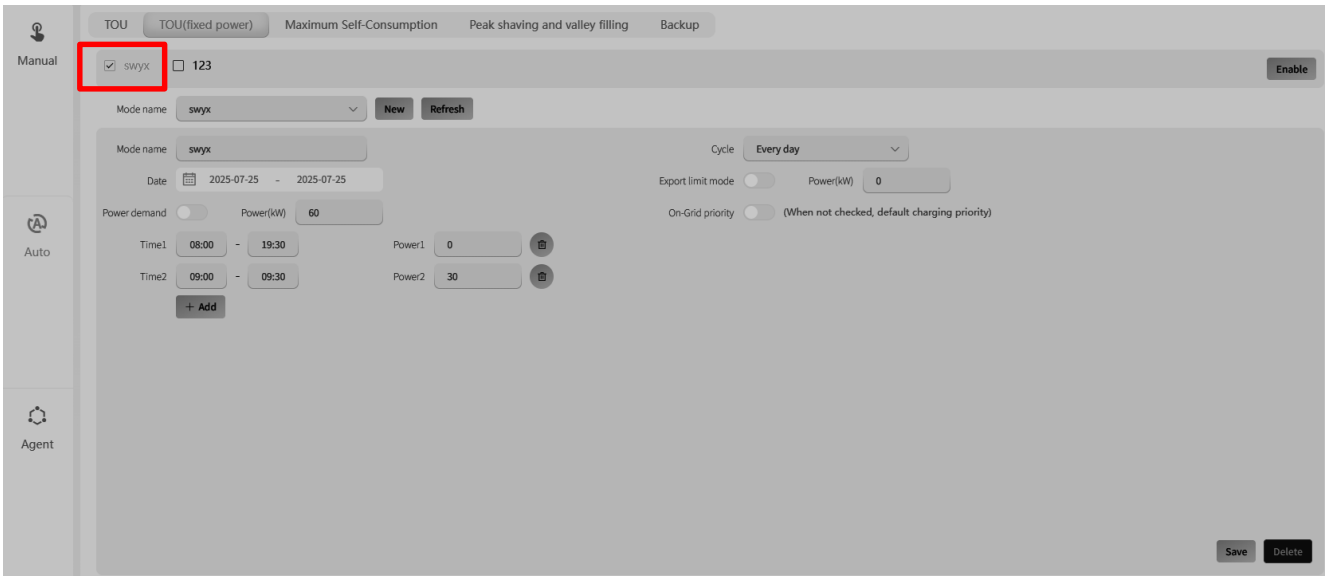

Figure 7-9

- Maximum Self-Consumption mode: This mode is applicable to the areas with low subsidies and high electricity prices. The PV power is prioritized for use by the load, the excess PV power is charged to the energy storage, and if the energy storage is full or fully charged, the excess PV power is fed into the grid. The grid cannot charge the storage, but it can supply power to the load.

  PV power priority: Load -> Battery -> Grid

  Load consumption priority: PV power -> Battery -> Grid

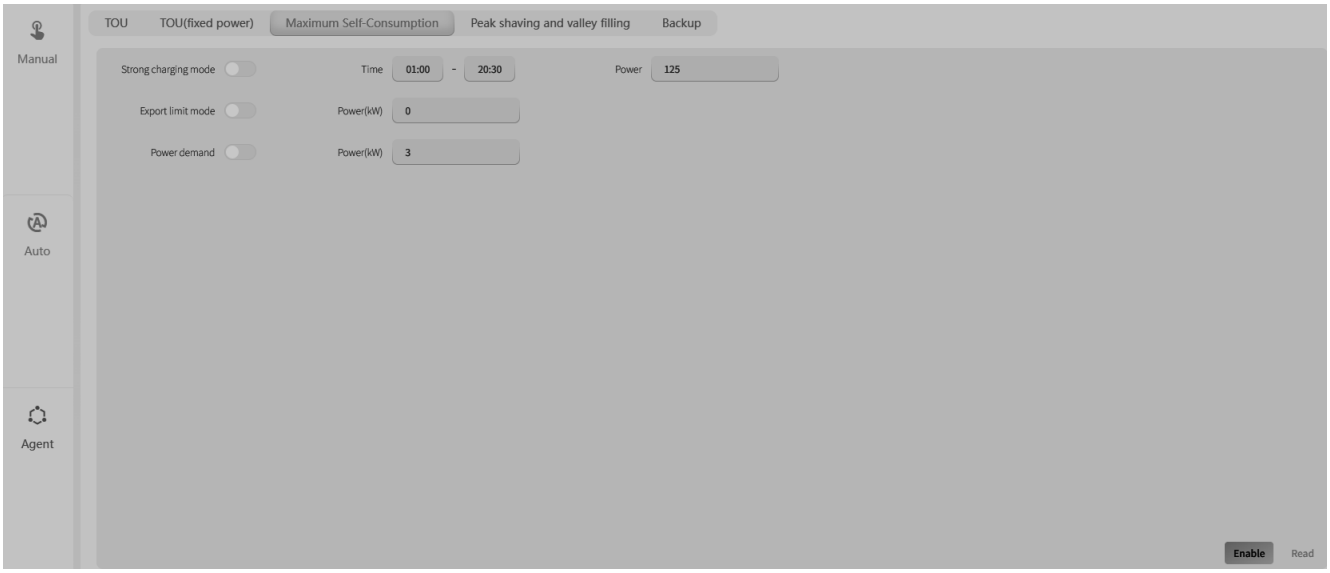

Figure 7-10

- Peak shaving and valley filling mode: This mode applies to the area where the grid system needs to balance the load. In this mode, the energy storage system ensures that the battery is charged during the valley period and discharged during the peak period. When the setting reaches a certain SOC value, the system starts to force charging for a set period of time.

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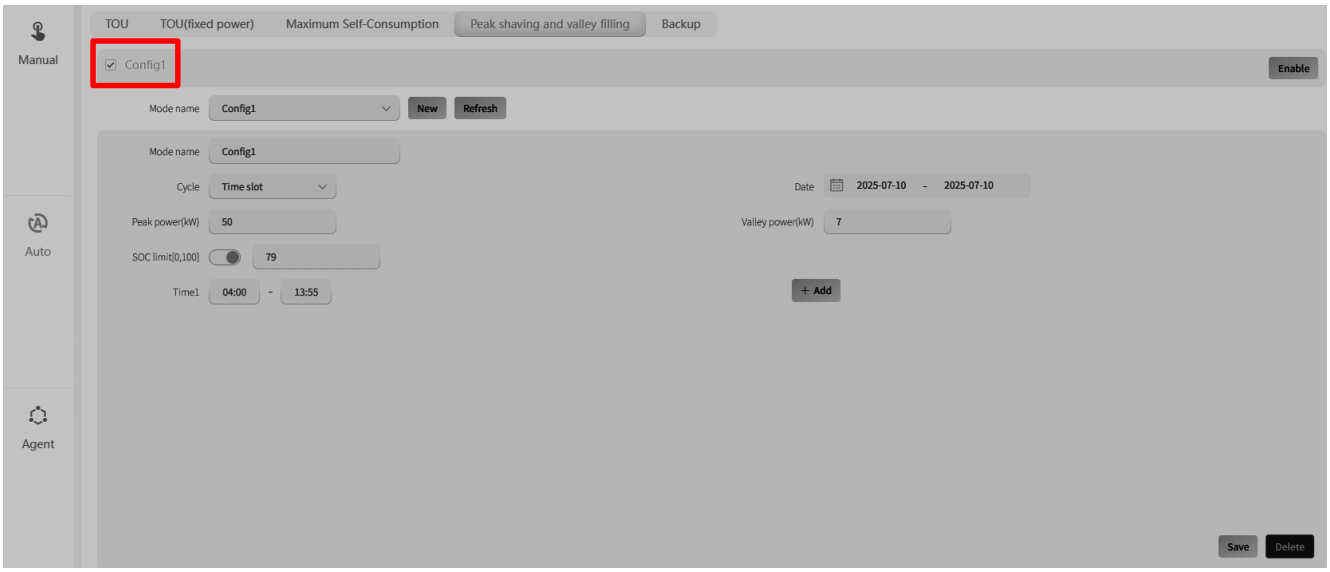

Figure 7-11

- Backup mode: It is suitable for areas with frequent power outages. When the grid is off, the battery is used as backup power to supply load. Under this mode, when the grid is on, the battery will be in a charging state during charge time and will not be discharged. When the grid is off, the battery will be discharged to supply load. The energy storage system will connect to the grid automatically when the grid restores.

  PV power priority: Battery -> Load -> Grid

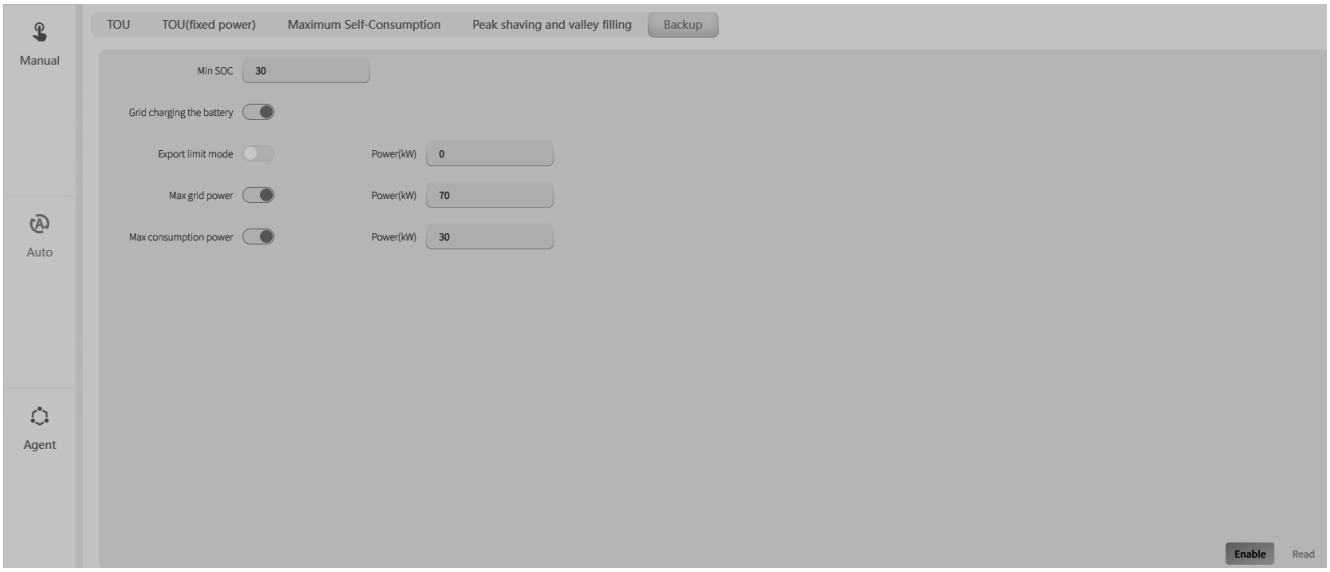

Figure 7-12

- Agent mode: In this mode, a third party manages the energy storage system on behalf of the customer.

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(3) **Alarm**: This interface is for machine fault detection and diagnostics.

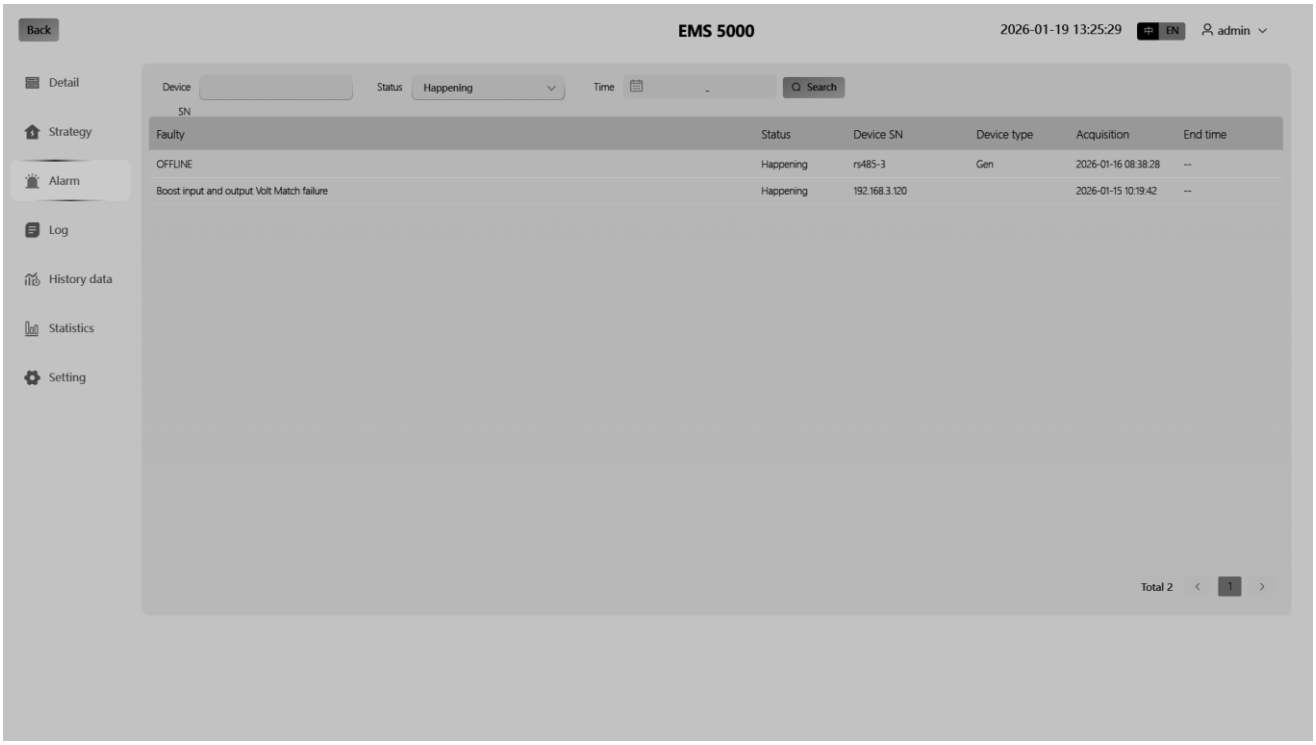

Figure 7-12

(4) **History data**: This interface allows you to query historical operational data information. The system stores data every minute and retains real-time operational information for one year, except for battery cell data.

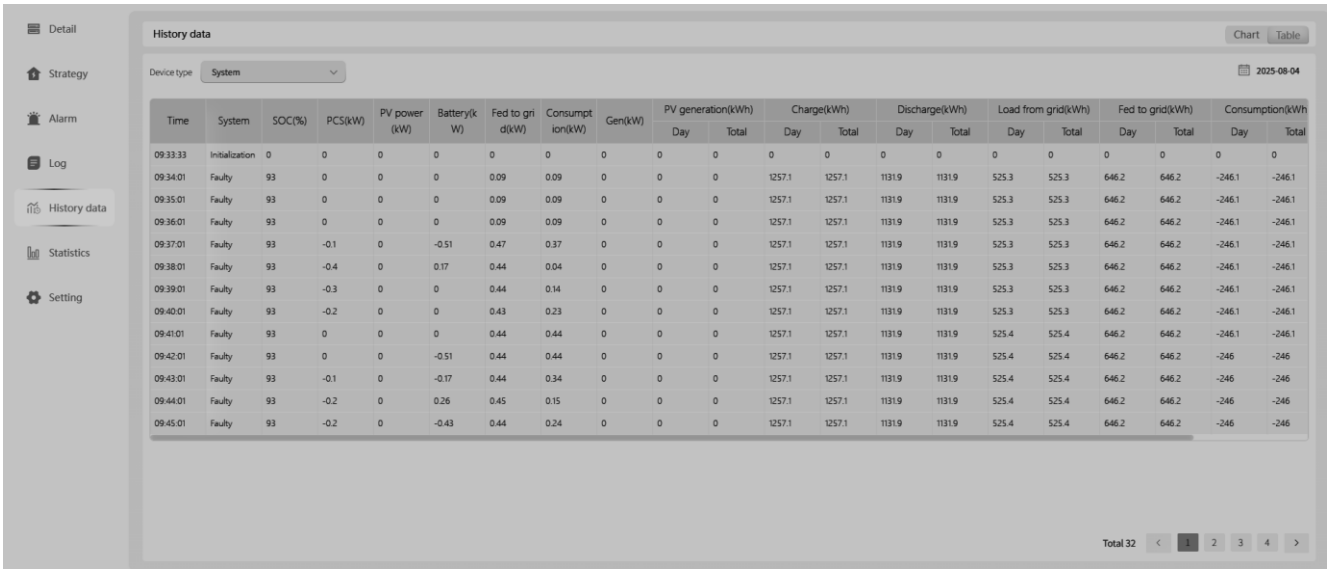

Figure 7-13

(5) **Setting**: System setting consists of three parts: firmware updates (Update), parameter settings (Setting), and device registration (Device).

- Users can insert a USB containing the firmware file into the USB port of the EMS, then select the type and ID, as well as the firmware file, to perform a local update.

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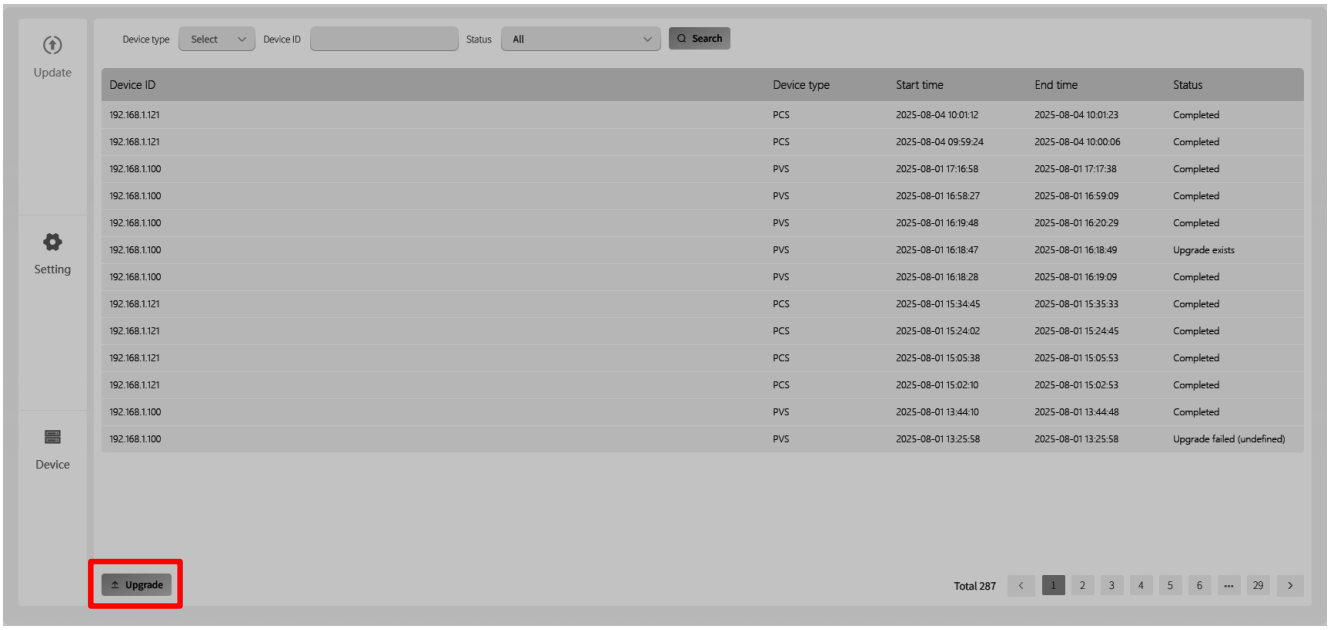

Figure 7-14

- Users can set the battery charge and discharge cut-off SOC, whether to use a diesel generator and a range of other system application settings. The system's one-button power-on/off function can also be set here.

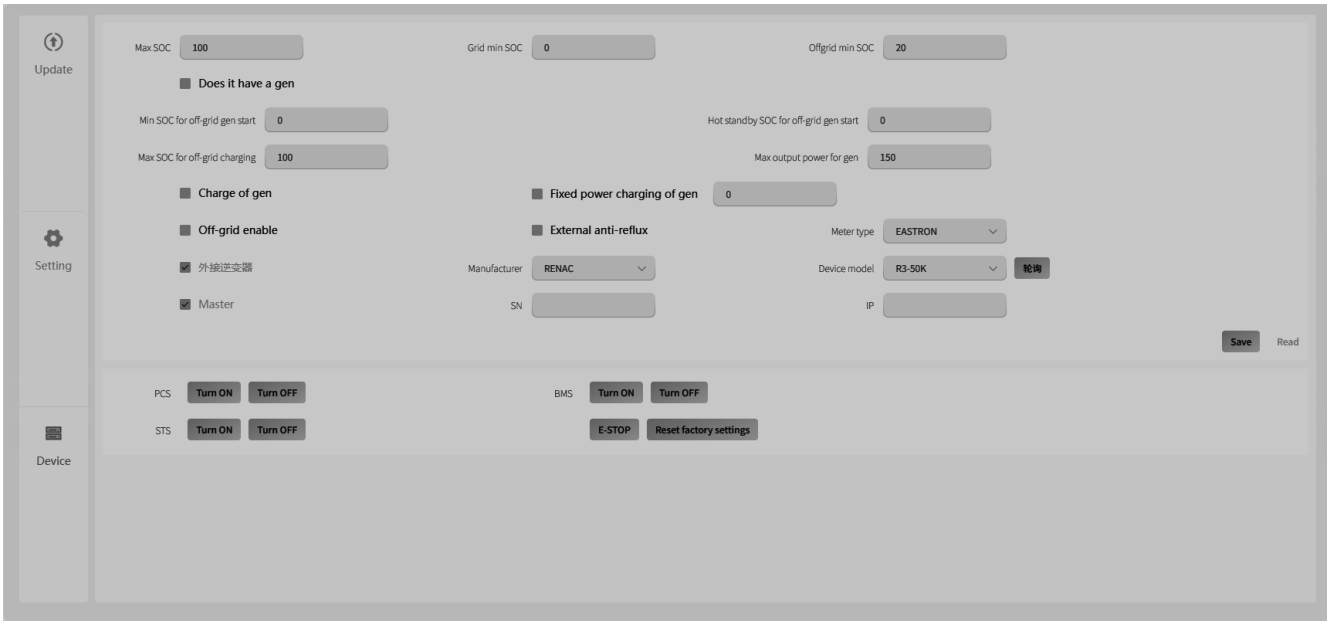

Figure 7-15

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- Users can query, add, or delete all device information in the system.

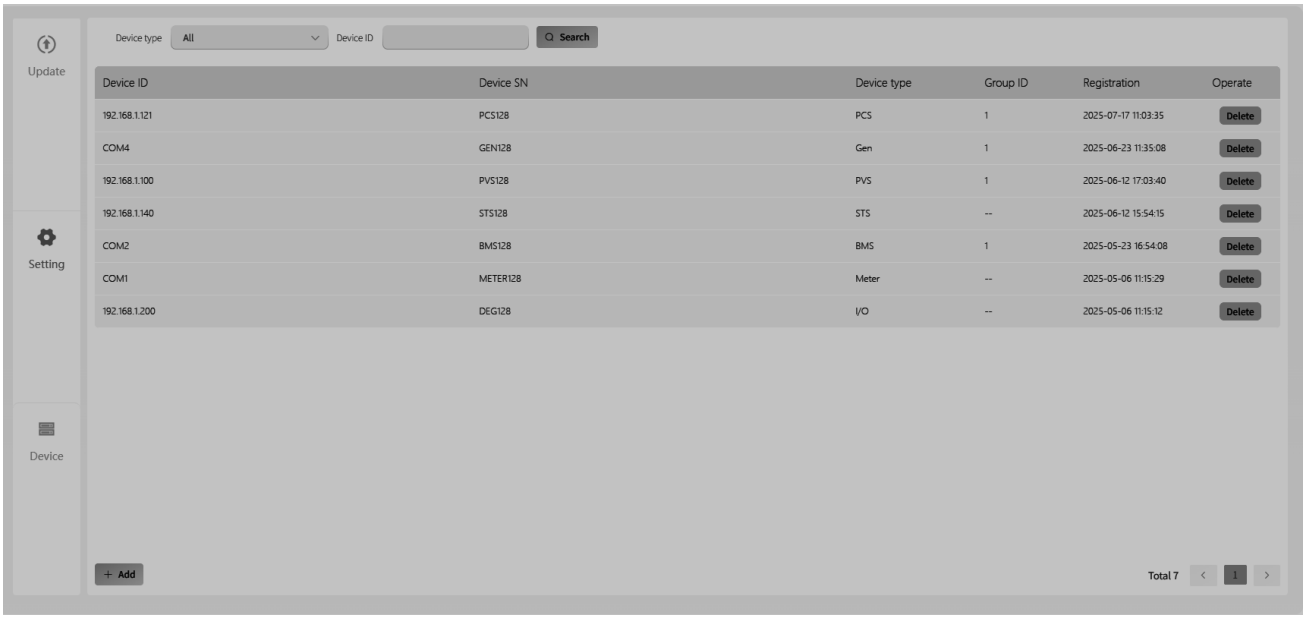

Figure 7-16

8. Routine Maintenance and Warranty

WARNING

There is a deadly high voltage inside the cabinet equipment of the integrated hybrid inverter, and there is a risk of fatal electric shock if accidentally touched.

The energy storage system must be switched off before maintenance, wait 10 minutes, and then open the cabinet door. It is important to ensure that the unit is fully de-energized internally before carrying out maintenance.

Only qualified and authorized personnel can perform maintenance and other operations.

8.1 Routine Maintenance

There are a number of potential problems that can occur during system operation due to ambient temperature, humidity, dust, vibration, and aging of the inverter's internal components. In order to enable the energy storage system to operate in a long-term and stable manner, it is necessary to arrange for regular inspections by maintenance personnel, according to Table 9-1, so as to identify and deal with problems in a timely manner. Quarterly maintenance is recommended for systems installed in sandy, dusty, salt-fogged, or heavy industrial parks, and semi-annual maintenance is recommended for energy storage systems in areas with favourable climatic conditions.

8.2 Warranty

Please refer to the Rayleigh Instruments Warranty Document for this device.

8.3 Fire-fighting Instructions

The energy storage system is equipped with a fire safety system that integrates advanced detection, suppression, and material technologies, enabling rapid response to fire incidents and achieving initial fire suppression. The fire safety system consists of two levels:-

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In the event of a fire in the energy storage system, the following measures are recommended for on-site personnel: Pack-level fire suppression and Cluster-level fire suppression.

If a thermal runaway fire occurs in a battery cell, the pack-level fire suppression can quickly detect the fire through a thermal wire and activate the fire suppression module to implement primary fire extinguishing. If the pack fire spreads, the cluster-level fire suppression can detect the fire through smoke sensors, triggering a smoke alarm. As the temperature rises rapidly, thermal sensors detect the fire and activate the fire suppression system to implement secondary fire extinguishing, while simultaneously outputting a feedback signal to the local controller to notify personnel for timely intervention.

In the event of a fire in an energy storage system, in addition to the initial fire-fighting measures taken by the equipment itself, it is recommended that on-site personnel take the following measures:-

- In the event of a fire, evacuate the building or equipment area and press the fire alarm. Call the fire alarm immediately, notify professional firefighters, and provide them with relevant product information (battery pack type, system capacity, etc.).
- In any case, re-entry into the area of the burning building or equipment, opening of the energy storage system door, and the approach of uninvolved persons are prohibited.
- After calling the fire services, on-site personnel remotely power down the system under conditions that will ensure their safety.
- Wait for professional fire-fighters to confirm that the fire is extinguished, and then let them handle the situation. It is forbidden to open the door of the energy storage system without authorization.

8.4 Dehumidifier Operation Guide

No.	Parameter Code	Parameter Name	Setting Range	Description
1	P1	Humidity Start-up Threshold	1~99%RH	Default setting: 75% RH Recommended range: 70% to 80% RH
2	P2	Humidity Shutdown Threshold	1~99%RH	Default setting: 60% RH Recommended range: 60% to 70% RH

1. Start Manual Dehumidification: Press the "▼" key once to activate manual dehumidification (the operation indicator will illuminate steadily). Press the "▼" key again to restore automatic control.
2. Adjust Parameters: From the standard humidity display interface, press the "🔧" key to access the parameter adjustment menu, where parameter codes appear on the left and corresponding values on the right. Use the "▲" and "▼" keys to modify parameters.

   Note: To save parameters, press and hold the "🔧" key until the '—' confirmation prompt appears. Changes will only take effect upon this confirmation.
3. Monitor internal temperature, fan current, and thermoelectric cooler current: Under normal humidity display mode, a single press of the '▲' key will switch the interface to show the fan current value and thermoelectric cooler current value. After 5 seconds, the display automatically transitions to the internal temperature reading, followed by a return to the default humidity display after another 5 seconds.

8.5 Disclaimer

In the following cases, we have the right not to carry out warranty repair services or replacement.

The product is out of warranty.

Users cannot provide proof of purchase of the product.

Damage caused during transport, loading, and unloading.

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Damage caused by incorrect installation, modification, or dismantling by unauthorized personnel.
Damage caused by operation under abnormal conditions of use or environment.
Failure or damage to the machine caused by the use of non-Rayleigh Instruments parts or software.
Failure or damage caused by fire, earthquake, flood, and other 'acts of god'.

9. Troubleshooting and maintenance

9.1 Troubleshooting

In the event of a fault, please follow the troubleshooting steps below.
If the troubleshooting methods do not resolve the issue, please contact Rayleigh Instruments technical support.
When contacting Rayleigh Instruments technical support, please collect the following information to facilitate a quick resolution.

- Energy storage system information, such as: serial number, software version, device installation time, fault occurrence time, fault occurrence frequency, etc.
- Equipment installation environment, such as weather conditions, etc.
  (Please provide provide photos, videos, and other files to assist in problem analysis).
- Utility grid condition.

Fault type	Fault prompt	Troubleshooting
BMS Fault	Cell Temp High	1. Check if the liquid cooling unit's heating function is operating normally. 2. During system operation, check if the temperature of any individual battery cell falls below the protection threshold. If so, please contact the dealer/our customer service center.
	Cell Temp Low	1. Check if the liquid cooling unit's heating function is operating normally. 2. During system operation, check if the temperature of any individual battery cell falls below the protection threshold. If so, please contact the dealer/our customer service center.
	Cell Volt High	Check whether the total battery voltage exceeds the protection threshold during system operation. If the voltage of any individual cell exceeds the threshold during charging, contact the dealer/our customer service center.
	Cell Volt Low	During system operation, monitor whether the total battery voltage falls below the protection threshold. If the voltage of any individual cell is below the threshold, contact the dealer/our customer service center.
	Chg Curr High	Check if the charging current exceeds the protection threshold during system operation. If the charging current surpasses the threshold during charging, contact the dealer/our customer service center.
BMS Fault	Dch Curr High	Check if the discharge current exceeds the protection threshold during system operation. If the discharge current surpasses the threshold during discharging, contact the dealer/our customer

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Fault type	Fault prompt	Troubleshooting
		service center.
	Rack Volt High	Check if the total system voltage exceeds the protection threshold during charging. If it surpasses the threshold, contact the dealer/our customer service center.
	Rack Volt Low	Check if the total system voltage is below the protection threshold. If it falls below the threshold, contact the dealer/our customer service center.
	Insulation Low	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Cell Temp Diff High	1. Check if the liquid cooling unit is operating normally. 2. During system operation, verify that the temperature differential within the battery cluster remains within the protection threshold. If the temperature differential of any individual module exceeds the threshold, contact the dealer/our customer service center.
	Cell Volt Diff High	1. Check if the liquid cooling unit is operating normally. 2. During system operation, monitor the temperature differential of individual cells. If any exceeds the protection threshold, contact the dealer/our customer service center.**
	SOC Low	Charging system: If the total voltage exceeds 650V and an alarm prevents contact, contact the dealer/our customer service center.
	Rack Volt mismatch	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	SOH Low	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	BMU comm lost	1. Check whether the communication port connector of the battery pack is properly connected or abnormal. 2. If the fault persists, contact the dealer/our customer service center.
	Rack Int_Volt sampling Err (HVon)	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Rack Int_Volt sampling Err (Hvoff)	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Rack Ext_Volt sampling Err	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
BMS Fault	Rack Insulation sampling Err (Hvon)	Power down the energy storage system, wait for 5 minutes, and

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Fault type	Fault prompt	Troubleshooting
		then restart it. If the fault persists, contact the dealer/our customer service center.
	Rack Insulation sampling Err (Hvoff)	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	SBCU EE_Save Err	1. Check whether the communication port connector of the battery pack is properly connected or shows any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	EMS Comm Lost	1. Check if the communication port connector of the battery pack is properly connected or if there is any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	CAB Lost	1. Check if the Hall communication interface in the high-voltage box is properly connected or abnormal. 2. Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Chiller Comm Lost	1. Check if the communication port connector of the liquid cooling unit is properly connected or abnormal. 2. Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	33772 Comm Lost	1. Check if the communication port connector of the battery pack is properly connected or abnormal. 2. Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Pos-Relay Open	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Neg-Relay Open	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Prechg-Relay Open	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Fire and Smoke alaem	1. Check whether the fire protection system or smoke detector has been triggered and troubleshoot accordingly. 2. If no trigger occurred and the fault persists, power down and restart the system, then wait 5 minutes before re-energizing. If the fault still persists, contact the dealer/our customer service center.

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Fault type	Fault prompt	Troubleshooting
BMS Fault	Flooding alarm	1. Check whether the water leak sensor has been triggered and resolve the issue. 2. If it is not triggered and the fault persists, power down and restart the system, then wait 5 minutes before re-energizing. If the fault remains, contact the dealer/our customer service center.
	Pos-Relay Weld	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Neg-Relay Weld	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Prechg-Relay Weld	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Relay Circuit Detection Err	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Ext-Short Circuit Err	1. Check for a short circuit in the circuit connection. If a short circuit is found, contact the dealer/our customer service center. 2. If no short circuit is detected, power down the energy storage system, wait 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Rack PreChg Err	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	SBCU Wake up lost	1. Check whether the communication port connector of the battery pack is properly connected or shows any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	Rack-Volt Configure Mismatch	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Chiller Malfunction	Check if the liquid cooling unit is faulty, and troubleshoot accordingly. If the fault persists after resolution, contact the dealer/our customer service center.
	Battery Thermal Runaway	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
BMS Fault	Pack Aerosol Trigger	Please contact the dealer/our customer service center.
	Switchgear Valve Open	Please contact the dealer/our customer service center.
	Switchgear QS open	Check whether the isolation switch inside the high-voltage box has failed. If the isolation switch has failed, contact the dealer/our

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Fault type	Fault prompt	Troubleshooting
		customer service center.
	Switchgear FU1 open	Check whether the fuse inside the high-voltage box is blown. If the fuse is blown, contact the dealer/our customer service center.
	Switchgear Temp High	Check whether the temperature of the high-voltage box exceeds the protection threshold during system operation. If the temperature exceeds the threshold, contact the dealer/our customer service center.
	Switchgear Relay Power Abnormal	Power down the energy storage system, wait for 5 minutes, and then restart it. If the fault persists, contact the dealer/our customer service center.
	Pack-HV-Connector Over-Temp	Check whether the temperature of the PACK high-voltage connector exceeds the protection threshold during system operation. If the temperature exceeds the threshold, contact the dealer/our customer service center.
	Neg-contactor Over-Temp	Check whether the temperature of the contactor exceeds the protection threshold during system operation. If the temperature exceeds the threshold, contact the dealer/our customer service center.
	Pos-contactor Over-Temp	Check whether the contactor temperature exceeds the protection threshold during system operation. If the temperature exceeds the threshold, contact the dealer/our customer service center.
PCS Fault	Total comm. Fault	1. Check if the communication port is properly connected or showing any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	Zero-Synchronous signal fault	1. Check if the communication port is properly connected or showing any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	Auxiliary board comm. Fault	1. Check if the communication port is properly connected or showing any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	EMS comm. Connection timeout	1. Check if the communication port is properly connected or showing any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
PCS Fault	BMS comm. Connection timeout	1. Check if the communication port is properly connected or showing any abnormality. 2. If the fault persists, contact the dealer/our customer service center.

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Fault type	Fault prompt	Troubleshooting
	GFCI over threshold fault	Turn off the AC output side switch and the DC input side switch, wait for 5 minutes, and then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Ambient overtemp. Fault	1. Check whether the ventilation at the inverter installation location is adequate and whether the ambient temperature exceeds the maximum permissible range. 2. If ventilation is poor or the ambient temperature is too high, improve the ventilation and heat dissipation conditions. 3. If both ventilation and ambient temperature are normal, contact the dealer/our customer service center.
	Total overtemp. Fault	1. Check whether the ventilation at the inverter installation site is sufficient and whether the ambient temperature exceeds the maximum allowable range. 2. If there is poor ventilation or the ambient temperature is too high, improve the ventilation and heat dissipation conditions. 3. If both ventilation and ambient temperature are normal, contact the dealer/our customer service center.
	Module over temperature 1	1. Check whether ventilation at the inverter installation location is adequate and whether the ambient temperature exceeds the maximum allowable range. 2. If ventilation is insufficient or the ambient temperature is too high, improve ventilation and heat dissipation conditions. 3. If both ventilation and ambient temperature are normal, contact the dealer/our customer service center.
	Module over temperature 2	1. Verify that the ventilation at the inverter installation location is adequate and that the ambient temperature remains within the maximum allowable range. 2. If ventilation is insufficient or the ambient temperature exceeds the limit, improve the ventilation and cooling conditions. 3. If both ventilation and ambient temperature are normal, contact the dealer/our customer service center.
	Module over temperature 3	1. Verify that the ventilation at the inverter installation location is adequate and that the ambient temperature remains within the maximum allowable range. 2. If ventilation is insufficient or the ambient temperature exceeds the limit, improve the ventilation and cooling conditions. 3. If both ventilation and ambient temperature are normal, contact the dealer/our customer service center.
PCS Fault	Temp. sensor 1 fault	Turn off the AC output side switch and the DC input side switch, wait for 5 minutes, and then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.

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Fault type	Fault prompt	Troubleshooting
	Temp. sensor 2 fault	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Temp. sensor 3 fault	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Module over current fault 1	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Module over current fault 2	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Module over current fault 3	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC input over voltage	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC input under voltage	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC input reverse connection	Check whether the DC input plug is incorrectly connected. If the fault persists, contact the dealer/our customer service center.
	DC input soft start failed	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC bus over voltage	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
PCS Fault	DC bus under voltage	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.

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Fault type	Fault prompt	Troubleshooting
	DC bus voltage unbalanced	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC insulation detect abnormal	1. Check the impedance between the battery cluster and the protective earth. If the impedance is low, disconnect the MSD of each battery pack and inspect the system's DC connectors for abnormalities. 2. If the impedance remains low, contact the dealer/our customer service center.
	Grid power down	1. If the grid returns to normal, manually restore operation or allow the energy storage system to restore automatically according to the configured restoration mode (default is automatic restoration). 2. Ensure that the grid voltage and frequency comply with the specifications.
	Grid-tied galvanic-break-device open circuit	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Grid-tied galvanic-break-device short circuit	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	AC bus over voltage	1. If it occurs occasionally, it may be due to a temporary grid anomaly. The inverter will resume normal operation automatically after detecting that the grid has returned to normal, with no manual intervention required. 2. If it occurs frequently, check whether the grid voltage is within the allowable range. If not, contact the local power operator. If it is within range, adjust the grid overvoltage protection point after obtaining approval from the local power operator. 3. If normal operation cannot be restored for an extended period, check whether the AC side circuit breaker and output cables are properly connected.
	AC bus under voltage	1. If it occurs occasionally, it may be due to a temporary grid anomaly. The inverter will resume normal operation automatically after detecting that the grid has returned to normal, with no manual intervention required. 2. If it occurs frequently, check whether the grid voltage is within the allowable range. If not, contact the local power operator. If it is within range, adjust the grid overvoltage protection point after obtaining approval from the local power operator. 3. If normal operation cannot be restored for an extended period,

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Fault type	Fault prompt	Troubleshooting
		check whether the AC side circuit breaker and output cables are properly connected.
PCS Fault	AC bus over frequency	1. If it occurs occasionally, it may be due to a temporary grid anomaly. The inverter will resume normal operation automatically after detecting that the grid has returned to normal, with no manual intervention required. 2. If it occurs frequently, check whether the grid voltage is within the allowable range. If not, contact the local power operator. If it is within range, adjust the grid overvoltage protection point after obtaining approval from the local power operator. 3. If normal operation cannot be restored for an extended period, check whether the AC side circuit breaker and output cables are properly connected.
	AC bus under frequency	1. If it occurs occasionally, it may be due to a temporary grid anomaly. The inverter will resume normal operation automatically after detecting that the grid has returned to normal, with no manual intervention required. 2. If it occurs frequently, check whether the grid voltage is within the allowable range. If not, contact the local power operator. If it is within range, adjust the grid overvoltage protection point after obtaining approval from the local power operator. 3. If normal operation cannot be restored for an extended period, check whether the AC side circuit breaker and output cables are properly connected.
	AC bus phase reversed	1. Check whether the inverter and grid wiring are in the correct phase sequence. After proper wiring (e.g., swapping any two live wires), the fault will clear automatically. 2. If the wiring is correct and the fault persists, contact the dealer/our customer service center.
	PLL failed	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	Ac current dc component excess	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
PCS Fault	DC motor-driven switch close contactor fault	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC input side switch. If the fault persists, contact the dealer/our customer service center.
	DC motor-driven switch break contactor fault	Turn off the AC output side switch and the DC input side switch, wait 5 minutes, then turn on the AC output side switch and the DC

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Fault type	Fault prompt	Troubleshooting
		input side switch. If the fault persists, contact the dealer/our customer service center.
	ETHCommFail	1. Check if the communication port is properly connected or if there is any abnormality. 2. If the fault persists, contact the dealer/our customer service center.
	FanFault	Check whether the hardware is faulty. If the fault persists, contact the dealer/our customer service center.
Liquid cooler	Chiller Comm Lost	Power down and restart the system. If the fault persists, contact the dealer/our customer service center.
	Chiller Malfunction	Power down and restart the system. If the fault persists, contact the dealer/our customer service center.
Environment	Fire and Smoke alaem	1. If it occurs occasionally, it may be due to a temporary sensor anomaly. Restart and resume operation. 2. If it occurs frequently, contact the dealer/our customer service center.
	Flooding alarm	Power down and check whether the cabinet is flooded. If no flooding is found, contact the dealer/our customer service center.
	PACK Fire Alarm	Prepare firefighting measures and contact the dealer/our customer service center.
	Cluster-Level Fire Alarm	Prepare firefighting measures and contact the dealer/our customer service center.

9.2 Maintenance

DANGER

When performing operation and maintenance on the energy storage system, ensure the energy storage system is power off Operating live equipment may cause damage to the energy storage system or result in electric shock danger.

Maintenance content	Maintenance method	Maintenance cycle
System Appearance	Check whether the front and rear doors are obstructed, whether the indicator lights are normal, and whether the exterior is undamaged.	Once per year
WiFi/4G	Check whether the antenna is detached and functioning properly.	Once per year
Switch	Check the MSD switch, molded case switch, air switch, and emergency stop switch by turning each on/off five times consecutively to verify normal function.	Once per year

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Maintenance content	Maintenance method	Maintenance cycle
Electrical Connection	Check whether electrical connections are loose and whether cable exteriors show any damage.	Once per year
Dust Filter	Check whether the air inlets/outlets of the cabinet, liquid cooling unit, and PCS are obstructed by foreign objects or dust. Clean the filter cotton regularly.	Once per quarter
Hydraulic System of Liquid Cooling Unit	Check whether the pressure of the liquid cooling unit is within the normal range and regularly replenish the coolant.	Once every 6 months
Liquid Cooling	Check whether dust is blocking the air intake.	Once per quarter
Dynamic Environment Management	Check whether the water leakage sensor, smoke detector, and temperature sensor are functioning normally.	Once every 6 months
PCS Testing	Charging/Discharging Test, Off-Grid Operation Test, Initialization Test, System Shutdown Test, Remote Testing.	After initial installation or maintenance, as required.
EMS Testing	Tests under Different Operating Conditions	After initial installation or maintenance, as required.
Fans	Check whether dust is blocking the air intake.	Once per quarter

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